

20-0075 Repair BEQ FC530

CONTRACT N40085-20-B-0075

NAVFAC SPECIFICATION
NO. 05-20-0075

Repair BEQ - FC530

AT THE

MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA

JACKSONVILLE, NORTH CAROLINA

DESIGN BY:

The Walker Group Architecture, Inc.
New Bern, North Carolina

A/E Contract: N40085-15-D-0857

SPECIFICATION PREPARED BY:

The Walker Group Architecture, Inc.

Date: October 1, 2021

SPECIFICATION APPROVED BY:

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05-20-0075

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LIST OF DRAWINGS

Contract drawings are as follows:

NAVFAC DWG NO.	SHEET NO.	TITLE
60035726	G-101	TITLE SHEET, SITE MAP,
60035727	G-102	INDEX SHEET
60035728	G1001	LIFE SAFETY CODE ANALYSIS
60035729	GI002	LIFE SAFETY SITE PLAN
60035730	GI101	LIFE SAFETY FLOOR PLANS
60035731	H-101	LEAD AND ASBESTOS PLAN
60035732	C-001	CIVIL NOTES AND LEGENDS
60035733	CD101	SITE PLAN - EXISTING CONDITIONS AND DEMOLITION
60035734	CS101	SITE LAYOUT PLAN
60035735	CG101	SITE GRADING PLAN
60035736	CU101	SITE UTILITY PLAN
60035737	CS501	DETAILS
60035738	CS502	DETAILS
60035739	CG501	DETAILS
60035740	CG502	DETAILS
60035741	CU501	DETAILS
60035742	S-001	STRUCTURAL GENERAL NOTES
60035743	S-101	FIRST AND SECOND FLOOR STRUCTURAL PLANS
60035744	S-102	THIRD FLOOR STRUCTURAL PLANS
60035745	S-501	TYPICAL DETAILS
60035746	D-101	DEMOLITION FLOOR PLAN
60035747	D-102	DEMOLITION REFLECTED CEILING PLAN
60035748	D-103	DEMOLITION ROOF AND ATTIC PLAN
60035749	D-201	DEMOLITION ELEVATIONS
60035750	D-301	DEMOLITION BUILDING SECTIONS
60035751	D-401	DEMOLITION ENLARGED FLOOR PLANS
60035752	D-402	DEMOLITION ENLARGED REFLECTED CEILING PLANS
60035753	D-403	DEMOLITION ENLARGED FLOOR PLANS
60035754	D-404	DEMOLITION ENLARGED REFLECTED CEILING PLANS
60035755	D-405	DEMOLITION ENLARGED SAW-CUT PLANS
60035756	D-406	DEMOLITION ENLARGED SAW-CUT PLANS
60035757	A-101	CONSTRUCTION FLOOR PLAN
60035758	A-102	CONSTRUCTION REFLECTED CEILING PLAN
60035759	A-103	CONSTRUCTION ROOF AND ATTIC PLAN
60035760	A-201	CONSTRUCTION ELEVATIONS
60035761	A-301	CONSTRUCTION BUILDING SECTION
60035762	A-401	CONSTRUCTION ENLARGED FLOOR PLANS
60035763	A-402	CONSTRUCTION ENLARGED REFLECTED CEILING PLANS
60035764	A-403	CONSTRUCTION ENLARGED PLANS AND DETAILS
60035765	A-404	CONSTRUCTION ENLARGED FLOOR PLAN
60035766	A-405	CONSTRUCTION ENLARGED REFLECTED CEILING PLANS
60035767	A-406	CONSTRUCTION INTERIOR ELEVATIONS
60035768	A-407	CONSTRUCTION INTERIOR ELEVATIONS
60035769	A-408	CONSTRUCTION INTERIOR SECTIONS
60035770	A-409	CONSTRUCTION ENLARGED SAW-CUT PLANS
60035771	A-410	CONSTRUCTION ENLARGED SAW-CUT PLANS

	NAVFAC DWG NO.	SHEET NO.	TITLE
60035772	A-501		CONSTRUCTION WALL SECTIONS AND DETAILS
60035773	A-502		CONSTRUCTION DETAILS
60035774	A-503		CONSTRUCTION DETAILS
60035775	A-504		CONSTRUCTION DETAILS
60035776	A-505		CONSTRUCTION DETAILS
60035777	A-601		SCHEDULES
60035778	A-602		DOOR AND WINDOW DETAILS
60035779	A-603		SIGNAGE PLANS
60035780	A-604		SIGNAGE PLANS AND DETAILS
60035781	A-605		SIGNAGE SCHEDULE
60035782	P-001		PLUMBING GENERAL NOTES, LEGEND & ABBREVIATIONS
60035783	PD101		OVERALL PLUMBING DEMOLITION PLAN - SANITARY WASTE
60035784	PD102		OVERALL PLUMBING DEMOLITION PLAN - DOMESTIC WATER
60035785	PD401		PLUMBING DEMOLITION ENLARGED PLANS - SANITARY WASTE
60035786	PD402		PLUMBING DEMOLITION ENLARGED PLANS - DOMESTIC WATER
60035787	PD403		PLUMBING DEMOLITION ENLARGED PLANS - SANITARY WASTE
60035788	PD404		PLUMBING DEMOLITION ENLARGED PLANS - DOMESTIC WATER
60035789	PD405		PLUMBING DEMOLITION FLOOR PLANS - MECHANICAL BUILDING
60035790	P-101		OVERALL PLUMBING CONSTRUCTION PLANS - SANITARY WASTE
60035791	P-102		OVERALL PLUMBING CONSTRUCTION PLANS - DOMESTIC WATER
60035792	P-401		PLUMBING CONSTRUCTION ENLARGED PLANS - SANITARY WASTE
60035793	P-402		PLUMBING CONSTRUCTION ENLARGED PLANS - DOMESTIC WATER
60035794	P-403		PLUMBING CONSTRUCTION ENLARGED PLAN - SANITARY WASTE
60035795	P-404		PLUMBING CONSTRUCTION ENLARGED PLAN - DOMESTIC WATER
60035796	P-405		PLUMBING CONSTRUCTION ENLARGED PLAN - MECHANICAL BUILDING
60035797	PL501		PLUMBING FIXTURE PLATES
60035798	PL502		PLUMBING DETAILS & SCHEDULES
60035799	PL503		PLUMBING SANITARY RISER DIAGRAMS
60035800	PL504		PLUMBING DOMESTIC WATER RISER DIAGRAMS
60035801	M-001		GENERAL NOTES, LEGEND, AND ABBREVIATIONS
60035802	MS101		MECHANICAL DEMOLITION SITE PLAN
60035803	MS102		MECHANICAL CONSTRUCTION SITE PLAN
60035804	MD101		MECHANICAL DEMOLITION FLOOR PLANS
60035805	MD102		MECHANICAL DEMOLITION ATTIC PLAN
60035806	MD401		MECHANICAL DEMOLITION ENLARGED PLANS
60035807	M-101		MECHANICAL CONSTRUCTION FLOOR PLANS
60035808	M-102		MECHANICAL CONSTRUCTION ATTIC PLAN
60035809	M-301		MECHANICAL ROOM ISOMETRIC VIEWS AND SECTIONS
60035810	M-401		MECHANICAL ENLARGED CONSTRUCTION FLOOR PLANS
60035811	M-402		MECHANICAL ENLARGED CONSTRUCTION FLOOR PLANS
60035812	M-403		MECHANICAL ENLARGED CONSTRUCTION FLOOR PLANS
60035813	MP401		MECHANICAL ENLARGED CONSTRUCTION FLOOR PLANS - PIPING

	NAVFAC DWG NO.	SHEET NO.	TITLE
60035814	M-501		MECHANICAL DETAILS
60035815	M-502		MECHANICAL DETAILS
60035816	M-503		MECHANICAL DETAILS
60035817	M-504		MECHANICAL DETAILS
60035818	M-601		MECHANICAL SCHEDULES
60035819	M-602		MECHANICAL SCHEDULES
60035820	M-701		MECHANICAL CONTROLS
60035821	M-702		MECHANICAL CONTROLS
60035822	M-703		MECHANICAL CONTROLS
60035823	M-704		MECHANICAL CONTROLS
60035824	E-001		ELECTRICAL GENERAL NOTES AND LEGEND
60035825	ES101		ELECTRICAL DEMOLITION SITE PLAN
60035826	ES102		ELECTRICAL CONSTRUCTION SITE PLAN
60035827	ED101		ELECTRICAL DEMOLITION FLOOR PLAN
60035828	ED102		ELECTRICAL DEMOLITION ROOF PLAN
60035829	ED401		ELECTRICAL DEMOLITION ENLARGED FLOOR PLANS
60035830	ED402		ELECTRICAL DEMOLITION ENLARGED FLOOR PLANS
60035831	ED403		ELECTRICAL DEMOLITION ENLARGED FLOOR PLANS
60035832	E-101		ELECTRICAL CONSTRUCTION FLOOR PLANS
60035833	E-102		ELECTRICAL CONSTRUCTION ROOF AND ATTIC PLANS
60035834	E-401		ELECTRICAL CONSTRUCTION ENLARGED FLOOR PLANS
60035835	E-402		ELECTRICAL CONSTRUCTION ENLARGED FLOOR PLANS
60035836	E-403		ELECTRICAL CONSTRUCTION ENLARGED FLOOR PLANS
60035837	E-501		ELECTRICAL DETAILS
60035838	E-502		ELECTRICAL DETAILS
60035839	E-601		ELECTRICAL DIAGRAMS AND SCHEDULES
60035840	E-602		ELECTRICAL DIAGRAMS AND SCHEDULES
60035841	E-603		ELECTRICAL PANELBOARD SCHEDULES
60035842	E-604		ELECTRICAL PANELBOARD SCHEDULES
60035843	E-605		ELECTRICAL PANELBOARD SCHEDULES
60035844	E-606		ELECTRICAL PANELBOARD SCHEDULES
60035845	E-901		PHOTOMETRIC FLOOR PLANS
60035846	E-902		PHOTOMETRIC FLOOR PLANS
60035847	T-001		TELECOMMUNICATIONS GENERAL NOTES, LEGEND, AND ABBREVIATIONS
60035848	T-002		TELECOMMUNICATIONS SITE PLAN
60035849	TD101		TELECOMMUNICATIONS DEMOLITION FLOOR PLANS
60035850	TD401		TELECOMMUNICATIONS DEMOLITION ENLARGED FLOOR PLANS
60035851	TD402		TELECOMMUNICATIONS DEMOLITION ENLARGED FLOOR PLANS
60035852	T-101		TELECOMMUNICATIONS CONSTRUCTION FLOOR PLAN
60035853	T-401		TELECOMMUNICATIONS CONSTRUCTION ENLARGED FLOOR PLANS
60035854	T-402		TELECOMMUNICATIONS CONSTRUCTION ENLARGED FLOOR PLANS
60035855	T-501		TELECOMMUNICATIONS DETAILS AND RISER DIAGRAM
60035856	FA001		FIRE ALARM GENERAL NOTES, LEGEND, AND ABBREVIATIONS
60035857	FAD101		FIRE ALARM DEMOLITION FLOOR PLANS
60035858	FAD401		FIRE ALARM DEMOLITION ENLARGED FLOOR PLANS
60035859	FAD402		FIRE ALARM DEMOLITION ENLARGED FLOOR PLANS
60035860	FA101		FIRE ALARM CONSTRUCTION FLOOR PLANS
60035861	FA401		FIRE ALARM CONSTRUCTION ENLARGED FLOOR PLANS

	NAVFAC DWG NO.	SHEET NO.	TITLE
60035862	FA402		FIRE ALARM CONSTRUCTION ENLARGED FLOOR PLANS
60035863	FA501		FIRE ALARM DETAILS AND RISER DIAGRAM
60035864	FX001		SPRINKLER GENERAL NOTES, LEGEND, AND ABBREVIATIONS
60035865	FD101		SPRINKLER DEMOLITION FLOOR PLANS
60035866	FX101		SPRINKLER CONSTRUCTION FLOOR PLANS

XXXXXXXX	G-101	TITLE SHEET, SITE MAP,
XXXXXXXX	G-102	INDEX SHEET
XXXXXXXX	G1001	CODE ANALYSIS
XXXXXXXX	G1002	LIFE SAFETY SITE PLAN
XXXXXXXX	G1101	LIFE SAFETY FLOOR PLANS
XXXXXXXX	H-101	LEAD AND ASBESTOS PLAN
XXXXXXXX	C-001	CIVIL NOTES AND LEGENDS
XXXXXXXX	CD101	SITE PLAN - EXISTING CONDITIONS AND DEMOLITION
XXXXXXXX	CS101	SITE PLAN - NEW WORK
XXXXXXXX	CG101	SITE GRADING PLAN

NAVFAC DWG NO.	SHEET NO.	TITLE
XXXXXXXX	CU101	SITE UTILITY PLAN
XXXXXXXX	CS501	DETAILS
XXXXXXXX	CS502	DETAILS
XXXXXXXX	CG501	DETAILS
XXXXXXXX	CG502	DETAILS
XXXXXXXX	CU501	DETAILS
XXXXXXXX	S-001	STRUCTURAL GENERAL NOTES
XXXXXXXX	S-101	FIRST AND SECOND FLOOR STRUCTURAL PLANS
XXXXXXXX	S-102	THIRD FLOOR STRUCTURAL PLANS
XXXXXXXX	S-501	TYPICAL DETAILS
XXXXXXXX	D-101	DEMOLITION FLOOR PLAN
XXXXXXXX	D-102	DEMOLITION REFLECTED CEILING PLAN
XXXXXXXX	D-103	DEMOLITION ROOF AND ATTIC PLAN
XXXXXXXX	D-201	DEMOLITION ELEVATIONS
XXXXXXXX	D-301	DEMOLITION BUILDING SECTIONS
XXXXXXXX	D-401	DEMOLITION ENLARGED FLOOR PLANS
XXXXXXXX	D-402	DEMOLITION ENLARGED REFLECTED CEILING PLANS
XXXXXXXX	D-403	DEMOLITION ENLARGED FLOOR PLANS
XXXXXXXX	D-404	DEMOLITION ENLARGED REFLECTED CEILING PLANS
XXXXXXXX	D-405	DEMOLITION ENLARGED SAW-CUT PLANS
XXXXXXXX	A-101	CONSTRUCTION FLOOR PLAN
XXXXXXXX	A-102	CONSTRUCTION REFLECTED CEILING PLAN
XXXXXXXX	A-103	CONSTRUCTION ROOF AND ATTIC PLAN
XXXXXXXX	A-201	CONSTRUCTION ELEVATIONS
XXXXXXXX	A-301	CONSTRUCTION BUILDING SECTION
XXXXXXXX	A-401	CONSTRUCTION ENLARGED FLOOR PLANS
XXXXXXXX	A-402	CONSTRUCTION ENLARGED REFLECTED CEILING PLANS
XXXXXXXX	A-403	CONSTRUCTION ENLARGED PLANS AND DETAILS
XXXXXXXX	A-404	CONSTRUCTION ENLARGED FLOOR PLAN
XXXXXXXX	A-405	CONSTRUCTION ENLARGED REFLECTED CEILING PLANS
XXXXXXXX	A-406	CONSTRUCTION INTERIOR ELEVATIONS
XXXXXXXX	A-407	CONSTRUCTION INTERIOR ELEVATIONS
XXXXXXXX	A-408	CONSTRUCTION INTERIOR SECTIONS
XXXXXXXX	A-409	CONSTRUCTION ENLARGED SAW-CUT PLANS
XXXXXXXX	A-501	CONSTRUCTION WALL SECTIONS AND DETAILS
XXXXXXXX	A-502	CONSTRUCTION DETAILS
XXXXXXXX	A-503	CONSTRUCTION DETAILS
XXXXXXXX	A-504	CONSTRUCTION DETAILS
XXXXXXXX	A-505	CONSTRUCTION DETAILS
XXXXXXXX	A-601	SCHEDULES
XXXXXXXX	A-602	DOOR AND WINDOW DETAILS
XXXXXXXX	A-603	SIGNAGE PLANS
XXXXXXXX	A-604	SIGNAGE PLANS AND DETAILS
XXXXXXXX	A-605	SIGNAGE SCHEDULE
XXXXXXXX	P-001	GENERAL NOTES, LEGEND & ABBREVIATIONS
XXXXXXXX	PD101	OVERALL PLUMBING DEMOLITION PLAN - SANITARY WASTE
XXXXXXXX	PD102	OVERALL PLUMBING DEMOLITION PLAN - DOMESTIC WATER
XXXXXXXX	PD401	PLUMBING DEMOLITION ENLARGED PLANS - SANITARY WASTE

NAVFAC DWG NO.	SHEET NO.	TITLE
XXXXXXXXXX	PD402	PLUMBING DEMOLITION ENLARGED PLANS - DOMESTIC WATER
XXXXXXXXXX	PD403	PLUMBING DEMOLITION ENLARGED PLANS - SANITARY WASTE
XXXXXXXXXX	PD404	PLUMBING DEMOLITION ENLARGED PLANS - DOMESTIC WATER
XXXXXXXXXX	PD405	PLUMBING DEMOLITION FLOOR PLANS - MECHANICAL BUILDING
XXXXXXXXXX	P-101	OVERALL PLUMBING CONSTRUCTION PLAN - SANITARY WASTE
XXXXXXXXXX	P-102	OVERALL PLUMBING CONSTRUCTION PLAN - DOMESTIC WATER
XXXXXXXXXX	P-401	PLUMBING CONSTRUCTION ENLARGED PLANS - SANITARY WASTE
XXXXXXXXXX	P-402	PLUMBING CONSTRUCTION ENLARGED PLANS - DOMESTIC WATER
XXXXXXXXXX	P-403	PLUMBING CONSTRUCTION ENLARGED PLAN - SANITARY WASTE
XXXXXXXXXX	P-404	PLUMBING CONSTRUCTION ENLARGED PLAN - DOMESTIC WATER
XXXXXXXXXX	P-405	PLUMBING CONSTRUCTION ENLARGED PLAN - MECHANICAL BUILDING
XXXXXXXXXX	PL501	PLUMBING FIXTURE PLATES
XXXXXXXXXX	PL502	PLUMBING DETAILS & SCHEDULES
XXXXXXXXXX	PL503	PLUMBING SANITARY RISER DIAGRAM
XXXXXXXXXX	PL504	PLUMBING SANITARY RISER DIAGRAMS
XXXXXXXXXX	M-001	GENERAL NOTES, LEGEND, AND ABBREVIATIONS
XXXXXXXXXX	MS101	MECHANICAL DEMOLITION SITE PLAN
XXXXXXXXXX	MS102	MECHANICAL CONSTRUCTION SITE PLAN
XXXXXXXXXX	MD101	MECHANICAL DEMOLITION FLOOR PLANS
XXXXXXXXXX	MD102	MECHANICAL DEMOLITION ATTIC PLAN
XXXXXXXXXX	MD401	MECHANICAL DEMOLITION ENLARGED PLANS
XXXXXXXXXX	M-101	MECHANICAL CONSTRUCTION FLOOR PLANS
XXXXXXXXXX	M-102	MECHANICAL CONSTRUCTION ATTIC PLAN
XXXXXXXXXX	M-301	MECHANICAL ROOM ISOMETRIC VIEWS AND SECTIONS
XXXXXXXXXX	M-401	MECHANICAL CONSTRUCTION FLOOR PLANS
XXXXXXXXXX	M-402	MECHANICAL CONSTRUCTION FLOOR PLANS
XXXXXXXXXX	M-403	MECHANICAL CONSTRUCTION FLOOR PLANS
XXXXXXXXXX	MP401	MECHANICAL ENLARGED CONSTRUCTION FLOOR PLANS - PIPING
XXXXXXXXXX	M-501	MECHANICAL DETAILS
XXXXXXXXXX	M-502	MECHANICAL DETAILS
XXXXXXXXXX	M-503	MECHANICAL DETAILS
XXXXXXXXXX	M-504	MECHANICAL DETAILS
XXXXXXXXXX	M-601	MECHANICAL SCHEDULES
XXXXXXXXXX	M-602	MECHANICAL SCHEDULES
XXXXXXXXXX	M-701	MECHANICAL CONTROLS
XXXXXXXXXX	M-702	MECHANICAL CONTROLS
XXXXXXXXXX	M-703	MECHANICAL CONTROLS
XXXXXXXXXX	E-001	ELECTRICAL GENERAL NOTES AND LEGEND
XXXXXXXXXX	ES101	ELECTRICAL DEMOLITION SITE PLAN
XXXXXXXXXX	ES102	ELECTRICAL CONSTRUCTION SITE PLAN
XXXXXXXXXX	ED101	ELECTRICAL DEMOLITION FLOOR PLAN
XXXXXXXXXX	ED102	ELECTRICAL DEMOLITION ROOF PLAN

NAVFAC DWG NO.	SHEET NO.	TITLE
XXXXXXXXXX	ED401	ELECTRICAL DEMOLITION ENLARGED FLOOR PLANS
XXXXXXXXXX	ED402	ELECTRICAL DEMOLITION ENLARGED FLOOR PLANS
XXXXXXXXXX	ED403	ELECTRICAL DEMOLITION ENLARGED FLOOR PLANS
XXXXXXXXXX	E-101	ELECTRICAL CONSTRUCTION FLOOR PLANS
XXXXXXXXXX	E-102	ELECTRICAL CONSTRUCTION ROOF AND ATTIC PLANS
XXXXXXXXXX	E-401	ELECTRICAL CONSTRUCTION ENLARGED FLOOR PLANS
XXXXXXXXXX	E-402	ELECTRICAL CONSTRUCTION ENLARGED FLOOR PLANS
XXXXXXXXXX	E-403	ELECTRICAL CONSTRUCTION ENLARGED FLOOR PLANS
XXXXXXXXXX	E-501	ELECTRICAL DETAILS
XXXXXXXXXX	E-502	ELECTRICAL DETAILS
XXXXXXXXXX	E-601	ELECTRICAL DIAGRAMS AND SCHEDULES
XXXXXXXXXX	E-602	ELECTRICAL PANEL BOARD SCHEDULES
XXXXXXXXXX	E-603	ELECTRICAL PANEL BOARD SCHEDULES
XXXXXXXXXX	E-604	ELECTRICAL PANEL BOARD SCHEDULES
XXXXXXXXXX	E-605	ELECTRICAL PANEL BOARD SCHEDULES
XXXXXXXXXX	E-901	PHOTOMETRIC FLOOR PLANS
XXXXXXXXXX	E-902	PHOTOMETRIC FLOOR PLANS
XXXXXXXXXX	T-001	GENERAL NOTES, LEGEND, AND ABBREVIATIONS
XXXXXXXXXX	T-002	TELECOMMUNICATIONS SITE PLAN
XXXXXXXXXX	TD101	TELECOMMUNICATIONS DEMOLITION FLOOR PLAN
XXXXXXXXXX	TD401	TELECOMMUNICATIONS DEMOLITION ENLARGED FLOOR PLANS
XXXXXXXXXX	TD402	TELECOMMUNICATIONS DEMOLITION ENLARGED FLOOR PLANS
XXXXXXXXXX	T-101	TELECOMMUNICATIONS CONSTRUCTION FLOOR PLAN
XXXXXXXXXX	T-401	TELECOMMUNICATIONS CONSTRUCTION ENLARGED FLOOR PLANS
XXXXXXXXXX	T-402	TELECOMMUNICATIONS CONSTRUCTION ENLARGED FLOOR PLANS
XXXXXXXXXX	T-501	TELECOMMUNICATIONS DETAILS AND RISER DIAGRAM
XXXXXXXXXX	FA001	GENERAL NOTES, LEGEND, AND ABBREVIATIONS
XXXXXXXXXX	FAD101	FIRE ALARM DEMOLITION FLOOR PLANS
XXXXXXXXXX	FAD401	FIRE ALARM DEMOLITION ENLARGED FLOOR PLANS
XXXXXXXXXX	FAD402	FIRE ALARM DEMOLITION ENLARGED FLOOR PLANS
XXXXXXXXXX	FA101	FIRE ALARM CONSTRUCTION FLOOR PLANS
XXXXXXXXXX	FA401	FIRE ALARM CONSTRUCTION ENLARGED FLOOR PLANS
XXXXXXXXXX	FA402	FIRE ALARM CONSTRUCTION ENLARGED FLOOR PLANS
XXXXXXXXXX	FA501	FIRE ALARM DETAILS AND RISER DIAGRAM
XXXXXXXXXX	FX001	GENERAL NOTES, LEGEND, AND ABBREVIATIONS
XXXXXXXXXX	FD101	FIRE PROTECTION DEMOLITION FLOOR PLANS
XXXXXXXXXX	FX101	FIRE PROTECTION CONSTRUCTION FLOOR PLANS

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PROJECT TABLE OF CONTENTS**DIVISION 01 - GENERAL REQUIREMENTS**

01 11 00	08/15	SUMMARY OF WORK
01 14 00	01/07	WORK RESTRICTIONS
01 20 00	04/12	PRICE AND PAYMENT PROCEDURES
01 30 00	03/12	ADMINISTRATIVE REQUIREMENTS
01 31 50	01/07	TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY
01 32 16	04/12	CONSTRUCTION PROGRESS DOCUMENTATION
01 33 00	05/13	SUBMITTAL PROCEDURES
01 35 29	06/11	SAFETY AND OCCUPATIONAL HEALTH REQUIREMENTS
01 42 00	11/14	SOURCES FOR REFERENCE PUBLICATIONS
01 45 10	09/01	QUALITY CONTROL
01 57 19	05/12	TEMPORARY ENVIRONMENTAL CONTROLS
01 78 00	05/13	CLOSEOUT PROCEDURES
01 78 23	07/06	OPERATION AND MAINTENANCE DATA
01 78 30	09/12	DIGITAL DATA DELIVERABLES (GIS)
01 78 30.00 22	11/18	GIS DATA DELIVERABLES
01 91 13	12/15	GENERAL COMMISSIONING REQUIREMENTS

DIVISION 02 - EXISTING CONDITIONS

02 41 00	05/10	DEMOLITION
02 82 30	03/12	RE-ESTABLISHING VEGETATION

DIVISION 03 - CONCRETE

03 01 00	02/18	REHABILITATION OF CONCRETE
03 30 00	02/19	CAST-IN-PLACE CONCRETE
03 30 53	05/14	MISCELLANEOUS CAST-IN-PLACE CONCRETE (SIDEWALKS ONLY)

DIVISION 04 - MASONRY

04 20 00	11/15	UNIT MASONRY
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DIVISION 05 - METALS

05 51 33	02/18	METAL LADDERS
05 52 00	02/11	METAL RAILINGS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 10 00	11/08	ROUGH CARPENTRY
06 61 16	08/10	SOLID POLYMER (SOLID SURFACING) FABRICATIONS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 57 13	05/11	SPRAYED POLYURETHANE FOAM (SPF) INSULATION
07 60 00	05/17	FLASHING AND SHEET METAL
07 61 15.00 20		ALUMINUM STANDING SEAM ROOFING
07 72 33	08/20	ROOF HATCHES
07 84 00	05/10	FIRESTOPPING
07 92 00	01/07	JOINT SEALANTS

DIVISION 08 - OPENINGS

08 11 13	02/10	STEEL DOORS AND FRAMES
08 14 00	08/16	WOOD DOORS
08 31 00	05/17	ACCESS DOORS AND PANELS
08 33 23	07/07	OVERHEAD COILING DOORS
08 51 13	05/11	ALUMINUM WINDOWS
08 71 00	02/16	DOOR HARDWARE
08 81 00	05/19	GLAZING
08 91 00	05/11	METAL WALL LOUVERS

DIVISION 09 - FINISHES

09 22 00	02/10	SUPPORTS FOR PLASTER AND GYPSUM BOARD
09 29 00	08/16	GYPSUM BOARD
09 30 10	08/17	CERAMIC, QUARRY, AND GLASS TILING
09 51 00	08/17	ACOUSTICAL CEILINGS
09 67 23.13	11/15	STANDARD RESINOUS FLOORING
09 90 00	05/11	PAINTS AND COATINGS

DIVISION 10 - SPECIALTIES

10 14 00.20		INTERIOR SIGNAGE
10 28 13	08/17	TOILET ACCESSORIES

DIVISION 11 - EQUIPMENT

11 24 24	10/20	ROOFTOP FALL PROTECTION ANCHORAGE SYSTEM
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DIVISION 12 - FURNISHINGS

12 24 13	08/20	ROLLER WINDOW SHADES
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DIVISION 21 - FIRE SUPPRESSION

21 13 13	08/20	WET PIPE SPRINKLER SYSTEMS, FIRE PROTECTION
21 13 16	08/20	DRY PIPE SPRINKLER SYSTEMS, FIRE PROTECTION

DIVISION 22 - PLUMBING

22 00 00	12/07	PLUMBING, GENERAL PURPOSE
----------	-------	---------------------------

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

23 03 00.00 20		BASIC MECHANICAL MATERIALS AND METHODS
23 05 93	06/18	TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 00	03/11	INSULATION OF MECHANICAL SYSTEMS
23 09 23.13	02/20	BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC
23 52 43.00 20	05/15	LOW PRESSURE WATER HEATING BOILERS (UNDER 800,000 BTU/HR OUTPUT)
23 73 33	01/07	HEATING, VENTILATING, AND COOLING SYSTEM

DIVISION 26 - ELECTRICAL

26 08 00	08/08	APPARATUS INSPECTION AND TESTING
26 12 19.10	04/04	THREE-PHASE PAD-MOUNTED TRANSFORMERS
26 20 00	01/07	INTERIOR DISTRIBUTION SYSTEM
26 27 14.00 20	02/11	ELECTRICITY METERING
26 41 00	11/13	LIGHTNING PROTECTION SYSTEM
26 51 00.00 22	08/12	INTERIOR LIGHTING
26 56 00	05/20	EXTERIOR LIGHTING

DIVISION 27 - COMMUNICATIONS

27 10 00	06/17	BUILDING TELECOMMUNICATIONS CABLING SYSTEM
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DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 31 76.00 22	04/16	INTERIOR COMBINATION EMERGENCY COMMUNICATIONS SYSTEMS
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DIVISION 31 - EARTHWORK

31 11 00	11/18	CLEARING AND GRUBBING
31 23 00.00 20	02/11, CHG 2: 08/15	EXCAVATION AND FILL

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 31 13.53	02/20	HIGH-SECURITY FENCES (ORNAMENTAL) AND GATES
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DIVISION 33 - UTILITIES

33 11 00	02/18	WATER UTILITY DISTRIBUTION PIPING
33 30 00	05/18	SANITARY SEWERAGE
33 40 00	02/10, CHG 6: 02/19	STORM DRAINAGE UTILITIES
33 71 02	12/10	UNDERGROUND ELECTRICAL DISTRIBUTION
33 82 00	06/17	TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

-- End of Project Table of Contents --

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SECTION 01 11 00

SUMMARY OF WORK

08/15

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Salvage Plan

1.2 WORK COVERED BY CONTRACT DOCUMENTS

1.2.1 Project Description

The work includes a full building renovation of Building B530, including all interior spaces. The renovation also includes; removal and replacement of HVAC system, replacement of plumbing fixtures, removal and replacement of electrical system, removal and replacement of telecommunications, and upgrade the fire protection system. Project also includes the tear off of asphalt shingles and installation of a new metal roof and incidental related work.

1.2.2 Location

The work is located at the Marine Corps Base Camp Lejeune, North Carolina,, approximately as indicated. The exact location will be shown by the Contracting Officer.

1.3 OCCUPANCY OF PREMISES

Before work is started, arrange with the Contracting Officer a sequence of procedure, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

1.4 EXISTING WORK

In addition to FAR 52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements:

- a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.
- b. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work must be in a condition equal to or better than that which existed before new work started.

1.5 LOCATION OF UNDERGROUND UTILITIES

Obtain digging permits prior to start of excavation, and comply with Installation requirements for locating and marking underground utilities. Contact local utility locating service a minimum of 48 hours prior to

excavating, to mark utilities, and within sufficient time required if work occurs on a Monday or after a Holiday. Verify existing utility locations indicated on contract drawings, within area of work.

1.5.1 Notification Prior to Excavation

Notify the Contracting Officer at least 48 hours prior to starting excavation work.

1.6 NAVY AND MARINE CORPS (NMCI) COORDINATION REQUIREMENTS

1.6.1 NMCI Contractor Access

Allow the NMCI Contractor access to the facility towards the end of construction (finishes 90 percent complete, rough-in 100 percent complete, Inside Plant (ISP)/Outside Plant (OSP) infrastructure in place) to provide equipment in the telecommunications rooms and make final connections. Coordinate efforts with the NMCI Contractor to facilitate joint use of building spaces during the final phases of construction. After the Contracting Officer has facilitated coordination meetings between the two contractors, within one week, incorporate the effort of additional coordination with the NMCI Contractor into the construction schedule to demonstrate a plan for maintaining the contract duration.

1.7 SALVAGE MATERIAL AND EQUIPMENT

Items, as indentified on the construction drawings, to be salvaged remain the property of the Government. Segregate, itemize, deliver and off-load the salvaged property at the Government designated storage area.

Provide a salvage plan, listing material and equipment to be salvaged, and their storage location. Maintain property control records for material or equipment designated as salvage. Use a system of property control that is approved by the Contracting Officer. Store and protect salvaged materials and equipment until disposition by the Contracting Officer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 14 00

WORK RESTRICTIONS

01/07

PART 1 GENERAL

1.1 CONTRACTOR ACCESS AND USE OF PREMISES

1.1.1 Station Regulations

Ensure that Contractor personnel employed on the Station become familiar with and obey Station regulations. Keep within the limits of the work and avenues of ingress and egress as directed. Do not enter restricted areas unless required to do so and until cleared for such entry. Wear hard hats in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. The Contractor's equipment shall be conspicuously marked for identification.

1.1.2 Working Hours

Regular working hours shall consist of an eight and one-half hour period established by the Contracting Officer, Monday through Friday, excluding Government holidays.

1.1.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Provide written request at least 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress. During periods of darkness, the different parts of the work shall be lighted in a manner approved by the Contracting Officer.

1.1.4 Occupied and Existing Buildings

The Contractor shall be working around existing buildings which are occupied. Do not enter the building without prior approval of the Contracting Officer.

1.1.5 Utility Cutovers and Interruptions

- a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in the paragraph "Work Outside Regular Hours."
- b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.
- c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, and compressed air shall be considered utility cutovers pursuant to the paragraph entitled "Work Outside Regular Hours." This time limit includes time for deactivation and reactivation.

- d. Operation of Station Utilities: The Contractor shall not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor shall notify the Contracting Officer giving reasonable advance notice when such operation is required.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

04/12

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE EP-1110-1-8 (1995) Construction Equipment Ownership
and Operating Expense Schedule

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-01 Preconstruction Submittals

Schedule of prices

1.3 SCHEDULE OF PRICES

1.3.1 Data Required

Within 15 calendar days of notice of award, prepare and deliver to Contracting Officer a schedule of prices (construction contract) on the forms furnished by the Government. Provide a detailed breakdown of the contract price, giving quantities for each of the various kinds of work, unit prices, and extended prices therefor. Schedule of prices shall be separated by individual building numbers with subtotals for each building.

1.3.2 Schedule Instructions

Payments will not be made until the schedule of prices has been submitted to and approved by the Contracting Officer. Identify the cost for site work, and include incidental work to the 5 foot line. Identify costs for the building(s), and include work out to the 5 foot line. Work out to the 5 foot line shall include construction encompassed within a theoretical line 5 feet from the face of exterior walls and shall include attendant construction, such as cooling towers, placed beyond the 5 foot line.

1.4 CONTRACT MODIFICATIONS

In conjunction with the Contract Clause "DFARS 252.236-7000, Modification Proposals-Price Breakdown," and where actual ownership and operating costs of construction equipment cannot be determined from Contractor accounting records, equipment use rates shall be based upon the applicable provisions

of the COE EP-1110-1-8.

1.5 CONTRACTOR'S PAYMENT REQUEST

1.5.1 Proper Payment Request

A proper request for payment/invoice shall comply with all requirements specified in this Section and the contract payment clauses. If any invoice does not comply with these requirements, it shall be returned with a statement of the reasons why it was not a proper invoice. A proper payment request/invoice includes the following information, completed forms, and number of copies indicated. Upon request, the Contracting Officer will furnish copies of Government forms.

- a. Contractor's Invoice on NAVFAC Form 7300/30, which shall show the basis for arriving at the amount of the invoice. Submit one original and two copies.
- b. Contractor's Monthly Estimate for Voucher (LANTNAVFACENGCOM Form 4-4330/110. Submit original and two copies.
- c. Payment Certification. Furnish as specified in "FAR Clause 52.232-5 (c) Payments under Fixed-Price Construction Contracts." Submit one original.
- d. QC Invoice Certification. Furnish as specified in Section 01 45 10, "Quality Control." Submit one original.

1.5.1.1 Progress Payments

In addition to the requirements stated in Paragraph 1.5.1, "Proper Payment Request" above, the Contractor's request for progress payments shall include the following:

- a. Updated Progress Schedule: Furnish an updated progress schedule as specified in contract clause FAR 52.236-15 "Schedules for Construction Contracts" and Section 01 32 16, "Construction Progress Documentation." Submit one copy.

1.5.1.2 Final Payments

The request for final payment is submitted after completion and acceptance of all work and all other requirements of the contract. Before submitting the final invoice the Contractor shall meet with the appropriate Government representatives to determine the final invoice amount, including the assessment of liquidated damages, if any, and to make sure the final release is complete and accurate. In addition to the requirements in Paragraph 1.5.1, "Proper Payment Request" above, the Contractor's request for final payment shall include the following:

- a. A final release executed on the standard form provided by the Contracting Officer. Submit two originals with final payment request.
- b. NC Tax certified statement and report for the prime and each subcontractor (FAR 52.229-7). Submit two copies.
- c. As-built drawings (if applicable).

- d. Warranties (if applicable).
- e. O&M manuals (if applicable).
- f. Final payrolls (FAR 52.222-6).
- g. A release for an assignment of claims (if applicable). Submit three originals.

1.5.2 Procedures for Submitting Payment Request

- a. The Contractor may submit only one invoice for payment each month as the work progresses.
- b. The invoice shall be delivered to the ROICC Office, Administrative Branch, between five calendar days before and five calendar days after the contract award date. Invoices received outside this schedule shall be returned to the Contractor unprocessed. The Contractor will have to wait until the following month to submit their next invoice.
- c. Invoices shall be delivered during normal work hours from 7:30 AM up to 4:00 PM (EST), Monday through Friday, excluding holidays.

1.6 PAYMENTS TO THE CONTRACTOR

Payments will be made on submission of a proper payment request/invoice by the Contractor.

1.6.1 Obligation of Government Payments

The obligation of the Government to make payments required under the provisions of this contract will, at the discretion of the Contracting Officer, be subject to the following:

- a. Reasonable retention and/or deductions due to defects in material or workmanship; potential liquidated damages; and/or failure to comply with any other requirements of the contract.
- b. Claims which the Government may have against the Contractor under or in connection with this contract; and
- c. Unless otherwise adjusted, repayment to the Government upon demand for overpayments made to the Contractor.
- d. Failure to provide up to date record drawings not current as stated in Contract Clause "FAC 5252.236-9310, Record Drawings"; NC State tax certified statement and report in accordance with FAR 52.229-2; labor payrolls in accordance with FAR 52.222-6; as-built drawings in accordance with Section 01 45 10, "Quality Control"; warranties and O&M manuals; and any other requirements in the contract.

1.6.2 Payment for Onsite and Offsite Materials

Progress payments may be made to the contractor for materials delivered on the site, for materials stored off construction sites, or materials that are in transit to the construction sites under the following conditions:

- a. FAR 52.232-5(b) Payments Under Fixed Price Construction Contracts.
- b. Materials delivered on the site but not installed, including completed preparatory work, and off- site materials to be considered for progress payment shall be major high cost, long lead, special order, or specialty items, not susceptible to deterioration or physical damage in storage or in transit to the construction site. Examples of materials acceptable for payment considerations include, but are not limited to, structural steel, non-magnetic steel, non-magnetic aggregate, equipment, machinery, large pipe and fittings, precast/ prestressed concrete products, plastic lumber (e.g. fender piles/ curbs), and high-voltage electrical cable. Materials no acceptable for payment include consumable materials such as nails, fasteners, conduits, gypsum board, glass, insulation, and wall coverings.
- c. Materials to be considered for progress payment prior to installation shall be specifically and separately identified in the Contractor's estimates of work submitted for the Contracting Officer's approval in accordance with Earned Value Report requirement of this contract. Requests for progress payment considerations for such items shall be supported by documents establishing their value and that the title requirements of the clause at FAR 52.232-5 have been met.
- d. Materials are adequately insured and protected from theft and exposure.
- e. Provide a written consent from the surety company with each payment request for offsite materials.
- f. Materials to be considered for progress payments prior to installation shall be stored in the Continental United States.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

03/12

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with the Section 01 33 00, "Submittal Procedures."

SD-01 Preconstruction Submittals

List of contact personnel

1.2 MINIMUM INSURANCE REQUIREMENTS

Procure and maintain during the entire period of performance under this contract the following minimum insurance coverage:

- a. Comprehensive general liability: \$500,000 per occurrence
- b. Automobile liability: \$200,000 per person, \$500,000 per occurrence, \$20,000 per occurrence for property damage
- c. Workmen's compensation as required by Federal and State workers' compensation and occupational disease laws,
- d. Employer's liability coverage of \$100,000, except in States where workers compensation may not be written by private carriers,
- e. Others as required by State law.

1.3 ELECTRONIC MAIL (EMAIL)

- a. The Contractor is required to establish and maintain electronic mail (email) capability along with the capability to open various electronic attachments in Microsoft, Adobe Acrobat, and other similar formats.
- b. Within 10 days after contract award; the Contractor shall provide the Contracting Officer a single (only one) email address for the ROICC office to send communications related to this contract correspondence. The ROICC office may also use email to notify the Contractor of base access conditions when emergency conditions warrant, such as hurricanes, terrorist threats, etc.
- c. Multiple email addresses are not authorized.
- d. It is the Contractor's responsibility to make timely distribution of all ROICC email within its own organization, including field office(s).
- e. The Contractor shall promptly notify the Contracting Officer, in

writing, of any changes to their email address.

1.4 CONTRACTOR PERSONNEL REQUIREMENTS

1.4.1 Subcontractors and Personnel

Furnish a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.4.2 Identification Badges

Identification badges will be furnished without charge. Application for and use of badges will be as directed below. Immediately report instances of lost or stolen badges to the Contracting Officer. Employees are required to resubmit a complete 50 state criminal records check in order to renew their contractor badge.

1.4.3 Business Access Security Requirements

1.4.3.1 Business Access Definition

Contractor/subcontractor employees requiring installation access to MCB, Camp Lejeune or MCAS New River, N.C. must obtain a Business Access Identification Badge for that particular installation. Regularly scheduled delivery personnel, to include FEDEX, UPS, Pick-up and deliveries, should, also, follow the Business Access guidelines described below. Personnel requiring Business Access Identification Badges shall submit all documentation listed below. Badges are not required if the contracted position requires the employee to obtain a Common Access Card (CAC) which will be identified separately within the Government contract.

1.4.3.2 Installation Security Access Requirements

Contractor shall accomplish the security requirements below within 10 days after award or prior to performance under the contract.

1.4.3.3 Business Access Identification Badge Requirement

In order to obtain a Business Access Identification Badge for access to MCB, Camp Lejeune, and satellite activities, or MCAS New River, NC, all personnel providing services under this contract shall be required to present the documentation below to the following offices, as applicable:

MCB, Camp Lejeune, NC and its satellite activities. Report as follows:

1. Identification Card Center, 60 Molly Pitcher Road for badge (910-450-8444).

MCAS New River, NC. Report as follows:

1. Pass and Identification Office, Bldg AS-187 for badge (910-449-7695) and vehicle pass (910-449-5513).

1.4.3.4 Proof of Employee Citizenship or Legal Alien Status

Employers may participate in the E-verify program (1-888-464-4218, www.DHS.gov/e-verify) allowing U.S. employers to verify name, DOB, and SSN

along with immigration information for non-citizens, against federal databases in order to verify the employment eligibility of both citizens and non-citizen new hires.

1.4.3.5 Proof of Criminal Records Check

Commercial and contract employees must provide proof a complete 50 state criminal records check on an annual basis. The record check may be obtained from any of the following Internet investigative services: Kroll (former Infolink Screening Services) at www.kroll.com, Castle Branch at www.castlebranch.com, or any other investigative services company that provides records checks for all 50 states. These services also validate social security card numbers. All criminal history checks must be completed no more than 30 days prior to start date of contract. (Note: These Internet screening services are listed as possible sources for obtaining a criminal background check. The United States government and the United States Marine Corps do not endorse nor are they affiliated with any of these services).

1.4.3.6 Letter Provided By Contracting Officer Indicating Contract

Letter provided by Contracting Officer indicating contract, contract period and prime contractor. Proof of employment on a valid Government contract (e.g., a letter on company letterhead from the prime contractor including contract number and term).

1.4.3.7 Photo ID

Valid state or federal issued picture identification card. Acceptable documents include state drivers license, DMV issued photo identification, or alien registration card.

1.4.3.8 National Crime Investigation Center (NCIC) Check

Provost Marshals are authorized to conduct a national crime information center (NCIC) check of all persons entering the installation, if/where applicable, the NCIC check may include drivers's license query, wants and warrants, and criminal history.

1.4.4 Denial of Access

Installation access shall be denied if it is determined that an employee:

- a. Is on the National Terrorist Watch List
- b. Is illegally present in the United States.
- c. Is subject to an outstanding warrant.
- d. Has knowingly submitted an employment questionnaire with false or fraudulent information.
- e. Has been issued a debarment order and is currently banned from military installations.
- f. Is a Registered Sexual Offender.
- g. Has been convicted of a felony or a drug crime within the past five years.

- h. Individuals who have received a DUI/DWI in the last year may be allowed access to the installation, but will not be permitted to drive on the installation.
- i. Any reason the Installation Commander deems reasonable for the good order and discipline.

1.4.5 Appeal Process

All appeals should be directed to the Base Inspector's Office for any individual that has been denied access to the Base.

1.4.6 Display of Badges

Contractors/subcontractors shall prominently display their badges on their person at all times. Upon completion/termination of this contract or an individual's employment, the Contractor shall collect and turn in to the Pass & ID Office all badges. If the Contractor fails to obtain the employee's badge, the Pass & ID Office will be notified within 24 hours. Immediately report instances of lost or stolen badges to the Contracting Officer.

1.4.7 Contractor and Subcontractor Vehicle Requirements

Each vehicle to be used in contract performance shall show the Contractor's or subcontractor's name so that it is clearly visible and shall always display a valid state license plate and safety inspection sticker. To obtain a vehicle decal, which will be valid for one year or contract period, whichever is shorter, Contractor or subcontractor vehicle operators shall provide to the Vehicle Registration Office, 60 Molly Pitcher Road (910-451-1158) or to MCAS, Building AS-187 (910-449-5513) for vehicle decal:

- a. An installation sponsor request forwarded to provost Marshall office
- b. A valid form of Federal or state government I.D.
- c. If driving a motor vehicle, a valid driver's license, vehicle registration and proof of insurance

Upon completion/termination of this contract or an individual's employment, the Contractor shall collect and turn in to Vehicle Registration all Government vehicle decals. If any are not collected, the Contractor shall notify the Vehicle Registration Office within 24 hours.

1.4.8 Security Checks

Contractor personnel and vehicles shall only be present in locations relevant to contract performance. All Contractor personnel entering the base shall conform to all Government regulations and are subject to such checks as may be deemed necessary to ensure that violations do not occur. Employees shall not be permitted on base when such a check reveals that their presence would be detrimental to the security of the base. Subject to security regulations, the Government will allow access to an area for servicing equipment and/or performing required services. Upon request, the Contractor shall submit to the Contracting Officer questionnaires and other forms as may be required for security purposes.

1.4.9 Subcontractor Special Requirements

1.4.9.1 Space Temperature Control, HVAC TAB, and Apparatus Inspection

All contract requirements shall be accomplished directly by a first tier subcontractor. No work required shall be accomplished by a second tier subcontractor.

1.4.9.2 Telecommunication and High Voltage Work

When telecommunications and high voltage work is required, all work associated with telecommunications and high voltage shall be accomplished by a first tier subcontractor. The contractor must possess a valid North Carolina Public Utility - Electrical, contractor's license and be insured to do such work in the State of North Carolina.

1.5 DISCLOSURE OF INFORMATION

Contractor shall comply as follows:

- (a) The Contractor shall not release to anyone outside the Contractor's organization any unclassified information, regardless of medium (e.g., film, tape, document), pertaining to any part of this contract or any program related to this contract, unless -
 - (1) The Contracting Officer has given prior written approval; or
 - (2) The information is otherwise in the public domain before the date of release.
- (b) Requests for approval shall identify the specific information to be released, the medium to be used, and the purpose for the release. The Contractor shall submit its request to the Contracting Officer at least 45 days before the proposed date for release.
- (c) The Contractor agrees to include a similar requirement in each subcontract under this contract. Subcontractors shall submit requests for authorization to release through the prime contractor to the Contracting Officer.

1.6 SUPERVISION

Have at least one qualified supervisor capable of reading, writing, and conversing fluently in the English language on the job site during working hours. In addition, if a Quality Control (CQ) representative is required on the contract, then that individual shall also have fluent English communication skills.

NOTE: If training and experience requirements of Section 01 45 10, "Quality Control" and 01 35 29, "Safety and Occupational Health Requirements" have been met the supervisor may also serve as QC Manager.

1.7 PRECONSTRUCTION CONFERENCE

After award of the contract but prior to commencement of any work at the site, meet with the Contracting Officer to discuss and develop a mutual understanding relative to the administration of the value engineering and safety program, preparation of the schedule of prices, shop drawings, and

other submittals, scheduling programming, and prosecution of the work.
Major subcontractors who will engage in the work shall also attend.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 30 01.00 22

DESIGN, PROCUREMENT AND INSTALLATION OF FURNITURE, FIXTURES AND EQUIPMENT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

UNIFIED FACILITIES CRITERIA (UFC)

UFC 03-120-10

Interior Design

1.2 SUBMITTALS

Submittals with an "ID" and "EE" designation are to be reviewed concurrently by the NAVFAC Interior Designer and Electrical Engineer. Refer to Section 01 33 00 Submittal Procedures. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Contractor's Interior Designer's Qualifications; ID

FF&E Schedule and Schedule Updates; ID

FF&E Concept Presentation Submittal / Over The Shoulder Review;
ID, EE

Best Value Determination Pricing Solicitation / Over The Shoulder Review; ID, EE

Best Value Determination Recommendation FF&E; ID, EE

Preliminary (Pre-Final) FF&E Package; ID, EE

Final FF&E Package; ID, EE

1.3 GENERAL REQUIREMENTS

Furnishings, Fixtures, and Equipment (FF&E) includes, but is not limited to items such as; systems and modular furniture, desks, workstations, seating, storage, filing, visual display items, accessories, artwork, training and conference furniture, soft window treatments, shop equipment, dorm and quarters furnishings and other miscellaneous items to support facility functions. Weapon racks, drying cages, and lockers are not typically considered FF&E. FF&E must be fully integrated with the building systems and finishes. FF&E may also include specialty items for which the customer activity will be responsible for specifying.

The design and documentation of the FF&E must be funded as Interior Design

Services and included in the Base Bid. The purchase and installation of the FF&E Package must be funded separately as the FF&E Planned Modification. The Government FF&E estimate on the SECTION 00 22 13.00 20 SUPPLEMENTARY INSTRUCTIONS to OFFERORS Bid Schedule/Price Proposal Form for the FF&E Planned Modification **do** NOT include the Contractor's Handling and Administration Rate (HAR). This Government FF&E estimate must not be altered by Contractors during the bid process.

All FF&E items are subject to the Buy American Act or Trade Agreement Act, unless they are considered COTS (Consumer Off The Shelf) items.

1.4 INTERIOR DESIGN SERVICES

1.4.1 Interior Designer Qualifications and Affiliations

Per **UFC 03-120-10**, The Prime Contractor must provide the services of an Interior Designer with the following qualifications. The Prime Contractor's Interior Designer, must be certified by the National Council for Interior Design Qualification (NCIDQ), must have attained certification, registration or licensure and must have experience as the primary interior designer on projects of similar type, size, scope and complexity. Experience writing non-proprietary, technical performance criteria for competitive furniture bids and experience analyzing competitive furniture bid proposals, is required and must be clearly indicated in resume. The Prime Contractor's Interior Designer, Design Firm owners, and any Specialists must NOT have any affiliation or partnership with any furniture, fixture, or equipment products, any furniture dealership or manufacturers. Provide a detailed resume, client references and documentation of the Prime [Contractor's Interior Designer's qualifications](#) and significant interior design experience to the NAVFAC Interior Designer PRIOR to the Kick-off/Partnering Meeting. The Government will approve/disapprove the Prime Contractor's Interior Designer based on the provided documentation and past performance.

1.4.2 Concept FF&E package

A basic concept FF&E package, prepared by the A/E's Interior Designer, indicating the salient characteristics of all required FF&E items, will be provided to the Prime Contractor. The Prime Contractor's Interior Designer must further develop and revise this concept package, as required, to prepare/provide a final, best valued FF&E package, in accordance with the requirements in this document. The Prime Contractor must provide the Contractor's Interior Designer a complete set of the construction drawings (CAD files) prior to commencement of work on the project.

1.4.3 [FF&E Schedule](#)

For all projects, including fast track projects and renovations, the Prime Contractor is responsible for sufficiently scheduling all FF&E meetings and deliverables early enough to:

- a. Obtain the required government approvals
- b. Meet all FF&E ordering and installation lead times
- c. Complete the FF&E installation by the contract completion date

All submittal due dates for the FF&E must be noted in the FF&E Schedule

and reflected in the Prime Contractor's construction schedule. A proposed FF&E schedule for all FF&E Services and Deliverables must be provided to the Construction Manager, NAVFAC Interior Designer and Contracting Officer seven business days after the Interior Design Orientation Meeting. An FF&E Schedule Guideline template is available from the NAVFAC Interior Designer, for your use in developing a schedule. Schedule updates must be submitted as the construction schedule is revised. The [Final FF&E package](#) must be submitted four months prior to the funding deadline (to be determined by funding source) and approved no later than nine months prior to the Contract Completion Date.

1.4.4 FF&E and CEQ (Collateral Equipment) Services

The Contractor's Interior Designer and Equipment Specialists are responsible for developing equipment packages for FF&E and other specialty equipment, i.e. shop equipment, kitchen equipment, fitness equipment, laboratory equipment, medical equipment, high density storage, etc., required in the project. The Contractor must obtain the services of equipment specialists to provide design services and assist the Interior Designer with the development of non-proprietary performance criteria for the specialty equipment. Specialty equipment may require coordination with the Prime Contractor and subcontractors for connection of power, data, communications, waterlines, gases, etc. and calibration, testing and training prior to facility turnover and operation. The Equipment Specialist(s) must provide coordination of all necessary steps to provide a completely functional and operational facility.

The Prime Contractor's Interior Designer and Equipment Specialist(s) are required to meet with the Activity to discuss the function of each area, validate all FF&E, CEQ and specialty equipment requirements, make any necessary changes and additions to the Concept FF&E package and recommend any adjustments/revisions to the interior building finishes and building infrastructure. The FF&E/CEQ effort includes the design, selection, specification, color coordination, procurement documentation and installation coordination of the equipment items necessary to meet the functional, operational, sustainability, and aesthetic needs of the facility. The FF&E/CEQ packages must be fully integrated with the design, construction, and schedule of all building finishes and all building systems (HVAC, Plumbing, Fire Protection, Communications, Electrical, Data, Architecture, etc.)

All electrical, data and communications outlets, switches, fire extinguishers, thermostats, sprinkler heads, etc. must be accommodated and be fully accessible once equipment is installed. ABA clearances must be accommodated. The Contractor's Interior Designer must work with the Prime Contractor and the electrical and telecommunication subcontractors to coordinate all infrastructure with the Recommended vendors. Dimensioned locations on plans and elevations for Multi-user Telecommunications Outlet Assemblies (MUTOAs), junction boxes, wall outlets and floor boxes, must be determined and provided by Contractor's Interior Designer, based on the sizes, layouts and configurations of the equipment items to be provided. See Section 1.5.9 Subsection g. If infrastructure planned for the building, such as power/data/communications requirements, must be revised to support the FF&E package, those revisions and coordination are the responsibility of the Contractor's Interior Designer and the Prime Contractor.

The FF&E plans must take into consideration any/all Collateral Equipment (CEQ) to include specialty equipment, existing and future

Government-Furnished, Government Installed (GFGI) equipment and Government-Furnished, Contractor-Installed Equipment (GFCI). These items may include, but are not limited to: multi-function devices, printers, shredders, safes, vending machines, etc.

- a. The Contractor's Interior Designer is responsible for incorporating new and existing CEQ into the FF&E plans.
- b. The Activity will supply the Contractor's Interior Designer with a complete list of all existing and new CEQ, to include sizes, utility requirements, weight, etc., to be relocated or used in the new facility. The Contractor's Interior Designer is responsible for incorporating this equipment into the FF&E plan.

These are minimum requirements and the Prime Contractor must be prepared to provide any/all additional meetings and submittals that may be necessary to support the Interior Design effort and FF&E coordination.

The Contractor's Interior Designer and equipment specialists are responsible for developing competitive and biddable Request for Proposal packages, with comprehensive, non-proprietary, technical performance criteria, as directed by the NAVFAC Interior Designer. Equipment must be biddable by at least three providers and the technical performance criteria must be based on product available through NAVSUP Blanket Purchase Agreements (BPA's), GSA schedules, and other Federal contracts, in compliance with priorities found in FAR Part 8.404, when possible. If NAVSUP BPA/GSA vendors do not have access to the required equipment, research to find appropriate specialty equipment vendors may be required. Utilization of NAVFAC-provided templates is required for all Best Value Determination efforts and deliverables. The utilization of the current NAVSUP BPA list is required for BVD Analysis Request for Pricing. The current NAVSUP BPA (vendor) list and NAVFAC standard templates are available at:

<http://www.wbdg.org/ffc/navy-navfac/collateral-equipment>

MIDLANT specific templates will be provided by the NAVFAC Interior Designer.

1.5 FF&E MEETINGS, PRESENTATIONS AND SUBMITTALS

The Prime Contractor's Interior Designer and the NAVFAC Interior Designer must attend all meetings, site visits and walk-throughs, as well as coordinate FF&E mock-ups, as required, obtain end-user and NAVFAC approvals and provide a complete and functional FF&E package. All meetings must be coordinated with advance notice to the NAVFAC Interior Designer, so that schedule and travel can be coordinated.

Each submittal must demonstrate thorough interaction with the Activity's functional requirements and complete coordination with the facility design and the Structural Interior Design (SID).

1.5.1 Interior Design Orientation Meeting

This meeting shall occur at the Pre-Construction/Kick-Off meeting via conference call within 7 days of Pre-Construction/Kick-Off meeting, unless Contractor's Interior Designer approval is pending. The NAVFAC Interior

Designer will review the following with the Prime Contractor and the Contractor's Interior Designer: Schedule Development, Concept FF&E package, Best Value Determination (BVD) NAVFAC templates and process, Number of Best Value Determinations required, and Blanket Purchase Agreement (BPAs), GSA or other mandatory sources to consider. A proposed preliminary schedule for the FF&E Meetings and Submittals must be submitted to the NAVFAC Interior Designer within 7 business days of this meeting. A final decision on the number of Best Value Determinations required may be dependent on the Prime Contractor's construction schedule and phasing.

1.5.2 FF&E Concept Presentation Submittal / Over The Shoulder Review

Prior to the FF&E Concept Presentation to the Activity/End User, the Contractor's Interior Designer must present the FF&E Concept to the NAVFAC Interior Designer. If the Contractor's Interior Designer is remotely located, they can submit one hard copy of the presentation to the NAVFAC Interior Designer and schedule a follow-up discussion to review the presentation. If the Contractor's Interior Designer is local to the Norfolk, VA area, a meeting is required. The submittal can be presented in a "loose" format or binder (no presentation boards required) for NAVFAC approval prior to the Activity presentation. Catalog cut sheets and visuals from various manufacturers for each major FF&E item must be provided, along with cut sheets depicting commonly available options. Cut sheets should be clearly labeled with the item numbers used in the Concept FF&E package and FF&E plans. Information on durability and availability of finishes should be readily available for discussion. Fabric and finishes should not be discussed, except in terms of durability. The "over-the-shoulder" review meeting will be held via conference call.

1.5.3 FF&E Concept Presentation to the Activity

After implementing all feedback from the NAVFAC FF&E Concept Presentation, the Prime Contractor's Interior Designer must present the NAVFAC approved Preliminary (Pre-final) FF&E package to the Activity, located at MCB Camp Lejeune, for feedback and approval. This meeting must include a walk-through of the Activity's existing facility(s) or similar facility. During this meeting, a detailed, functional review of the entire project must occur, with the proposed FF&E presentation to follow, to ensure that all current FF&E requirements have been captured. The presentation must include catalog cut sheets and visuals from various manufacturers for each major FF&E item, along with cut sheets depicting commonly available options. Cut sheets should be clearly labeled with the item numbers used in the FF&E plans. FF&E Presentation boards are not required. Minutes of this meeting with photos of the approved FF&E concept must be submitted to the NAVFAC Interior Designer within 7 business days.

1.5.4 Best Value Determination Pricing Solicitation / Over The Shoulder Review

After implementing all feedback from the FF&E Concept Presentation to the Activity, the Prime Contractor's Interior Designer will prepare a pricing solicitation package, using the provided NAVFAC templates, for use in soliciting FF&E pricing and determining a best value vendor. The Prime Contractor's Interior Designer must submit one electronic copy of the BVD Analysis Request for Pricing Cover Letter (live WORD document), one printed hard copy, in binder format, of the entire pricing solicitation package, and one book-marked, pdf format, electronic copy of the entire pricing solicitation package to the NAVFAC Interior Designer for an

"over-the-shoulder" review. This submittal should be in the final, edited format that will be sent to the NAVSUP BPA vendor list. If the Prime Contractor intends to attach an example of their subcontract agreement to the package, a copy of the subcontract agreement must be included in this submittal. This submittal must be approved by NAVFAC prior to requesting pricing.

BVD Pricing Solicitation must include the following;

- a. BVD Analysis Request for Pricing cover letter:
The NAVFAC Cover Letter template must be used and highlighted areas must be edited, as required for the specific project. The electronic version of this submittal must include a "live" WORD document of the letter with all revisions indicated by "tracked changes". Information to clarify the scope can be added to the NAVFAC template provided; but no information should be deleted from the template without discussion with the NAVFAC Interior Designer.
 1. The Contractor's Interior Designer must coordinate a proposed FF&E "hold pricing" timeframe, up to 12 months, with the Prime Contractor, based on the construction schedule. The "hold pricing" timeframe must be requested in the BVD Analysis Request for Pricing cover letter. If a known price increase is expected, and vendor pricing cannot be held for the "hold pricing" timeframe requested, then the proposed vendor pricing must reflect the anticipated price increase(s). All anticipated price increases during the "pricing hold" period must be funded in the FF&E planned modification. Manufacturer's documentation on the GSA price increase(s) and effective dates must be provided to NAVFAC.
- b. BVD Analysis Request for Pricing Spreadsheet/Questionnaire:
Item numbers must be updated to reflect all required FF&E items and tagged to coordinate with updated FF&E Plans. Spreadsheet info must include: Item Tag #, Basic Item Name/Brief Description, Basis of Design Manufacturer Name/Series/Product #, and a representative photo. Clear references to the applicable performance criteria should be provided below each item description.
- c. Performance Criteria:
Non-proprietary, technical, performance criteria must be created for each FF&E item, or each item category, to establish minimum acceptable FF&E requirements. Adequate level of detail must be provided so that comparable and competitive pricing can be obtained from at least three NAVSUP BPA vendors. Criteria must clearly reference the applicable FF&E item tags on the BVD Analysis Request for Pricing Spreadsheet and FF&E plans.
 1. Project Specific Workstation/Desk Typical:
Typicals for each item are required to include: a description, dimensioned plans with power, data and grommet locations, detailed elevations and isometric views, etc. as necessary to communicate the desired layout. Typical must clearly reference the applicable FF&E item tags on the BVD Analysis Request for Pricing Spreadsheet and FF&E plans.
- d. Updated FF&E Plans:
FF&E Plans must be transferred to the Contractor's Interior Designer's title block with a legend coded to the updated FF&E item numbers used

on the BVD Analysis Request for Pricing Spreadsheet. All Collateral equipment (CEQ), Government Furnished, Government Installed (GFGI) equipment such as printers and vending machines and Government Furnished, Contractor Installed (GFCI) equipment, must be indicated on drawings for coordination purposes.

e. Vendor Mock-Up Requirements:

Requirements, expectations and proposed schedule(s) for mock-ups should be outlined in the BVD Pricing Solicitation. If there is not adequate time in the schedule for mock-ups, the recommended vendor should be prepared to provide detailed 3-D renderings, prior to placing orders, to insure that the Activity is comfortable with the work station/desk design and layout.

1.5.6 BVD Vendor Recommendation and "Over the Shoulder Review"

The Prime Contractor's Interior Designer must submit one hard copy and one book-marked PDF copy of this submittal to the NAVFAC Interior Designer. Book-marked PDF copies must also be sent to the NAVFAC Construction Manager, the NAVFAC Contracting Officer, and IDD/Base Property for Marine Corps Projects.

The Prime Contractor's Interior Designer must schedule an "Over the Shoulder" review conference call to review the results of the BPA Pricing Solicitation and discuss the best value vendor recommendation. The NAVFAC Contracting Officer must provide verbal approval of the NAVSUP BPA vendor recommendation during this call. If clarifications, updates or revisions are required, documentation must be revised and resubmitted. This submittal should include the following:

- a. Binder Cover Page/Spine Identification (Project name, Project #, Location, Submittal date, Submittal title)
- b. BVD Analysis Request for Pricing Spreadsheets/Questionnaires, as submitted by the three highest rated NAVSUP BPA vendors.
- c. Documentation showing that all required NAVSUP BPA sources, including UNICOR, in the appropriate SIN category were contacted (copy of the email solicitation).
- d. Bid Response from UNICOR, if received.
- e. Completed BVD Analysis Pricing Evaluation Spreadsheet, comparing ALL vendor pricing and responses in a side-by-side format. This spreadsheet must highlight proposed items that do not meet the required performance criteria, indicate specific proposal shortcomings, indicate the recommended BPA vendor, and highlight key factors supporting the best value NAVSUP BPA vendor recommendation. Open Market items and items that do not comply with the Buy America Act or Trade Agreement Act, must be indicated.
- f. Back-up information submitted by each bidder. (cut sheets/highlighted pricing sheets/technical specifications, pricing, dealer and manufacturer qualifications for each product showing that product meets all requirements). Provide in cd format and include in the binder for the NAVFAC Interior Designer.

g. A comprehensive written statement outlining the evaluation of each vendor's proposal and the key factors supporting the best value NAVSUP BPA vendor recommendation.

1.5.7 Vendor Recommendation Letter and De-Briefs

Following the approval of the NAVSUP BPA vendor recommendation, the Contractor's Interior Designer must send out notification to the NAVSUP BPA vendors who submitted pricing proposals and provide de-briefs to vendors, if requested. Templates for these notification letters and guidance for a standard de-brief will be provided by the NAVFAC Interior Designer.

1.5.9 Preliminary FF&E Presentation and Best Value Determination Recommendation FF&E Submittal

Once the best value vendor recommendation has been made, the Prime Contractor's Interior Designer must work in conjunction with the recommended vendor to develop the FF&E package that will be procured for the project. This package must be presented to the Activity and NAVFAC in loose format at a meeting to occur at the Activity, located in MCB [Camp Lejeune](#). Recommended FF&E finish and fabric samples for all major FF&E items should also be presented with large samples of the building interior finishes available for reference. All final product decisions, accessory additions and finish selections must be finalized at this meeting. Once Activity and NAVFAC feedback are implemented into the package, the Preliminary FF&E package must be submitted, in binder format, for review and comment.

Quantity of submittals required:

Provide one binder and one bookmarked electronic copy each, for the NAVFAC Interior Designer, the Activity and for Base Property/IDD for Marine Corps projects. Provide bookmarked electronic copies only for the Construction Manager and Contracting Officer.

The Preliminary FF&E Submittal must include the following:

- a. Binder Cover Page/Spine Identification (Project name, Project #, Location, Submittal date, Submittal title)
- b. Table of Contents and Identification Tabs for each section.
- c. Point of Contact List to include contact info for recommended BPA vendor(s), subcontractors and manufacturers.
- d. Preliminary FF&E Cost Summary to include shipping, freight, handling, professional installation, project management, HAR, SIOH and applicable sales tax. Cost summary template will be provided by the NAVFAC Interior Designer.
- e. Procurement Data "spec" Sheets for each product indicating item number, item manufacturer/series/product number, detailed item description, quantity, room location, general appearance, and proposed finish and fabric selections. Procurement Data Sheet template will be provided by NAVFAC Interior Designer. Creation of these Procurement Data Sheets is the responsibility of the Contractor's Interior

Designer; not the BPA vendor or dealership. Item costs listed on Procurement Data Sheets must match costs on

f. Updated FF&E Plans coded to the FF&E Cost Summary List and Procurement Data Sheets. All sizes and configurations of the FF&E to be provided should be reflected on these updated plans. All Collateral equipment (CEQ), Government Furnished, Government Installed (GFGI) equipment such as printers and vending machines and Government Furnished, Contractor Installed (GFCI) equipment must be indicated on drawings for coordination purposes.

g. FF&E Cost Comparison worksheet, listing all cost differences between bid pricing and final pricing, with justifications.

h. Updated Electrical and Telecommunication Plans: Provide dimensioned locations on plans and elevations for Multi-user Telecommunications Outlet Assemblies (MUTOAs), junction boxes, wall outlets and floor boxes, based on the sizes, layouts and configurations of the FF&E items to be provided.

i. Performance Criteria for all FF&E that was used in the BVD Pricing Solicitation.

j. Finish and fabric samples for all FF&E items attached to 8-1/2" x 11" mat boards and inserted into heavy duty plastic sheet protectors. All samples must have the manufacturer names and numbers listed and must reference the FF&E Item tags on the Procurement Data Sheets. Actual finish and fabric samples are required.

k. Copy of Manufacturer Bill of Materials (BOM) on manufacturer letterhead for each vendor. Bill of Materials must be coded to the FF&E Cost Summary Item codes. Sum of all manufacturer's Bill of Material totals must match Cost Summary totals exactly.

l. Best Value Determination Guideline sheets; completed and signed by the Contractor's Interior Designer. Templates and guidance can be found at:

<http://www.wbdg.org/ffc/navy-navfac/collateral-equipment>

1.5.10 Final FF&E Submittal

Once Activity and NAVFAC feedback are implemented into the package, the Final FF&E package must be submitted, in binder format, for review and approval.

Quantity of submittals required:

Provide one binder and one bookmarked electronic copy each for the NAVFAC Interior Designer, the Activity, and for Base Property. Provide bookmarked electronic copies only for the Contracting Officer and the Construction Manager.

The Final FF&E Submittal must include the following:

a. Binder Cover Page/Spine Identification (Project name, Project #,

Location, Submittal date, Submittal title)

- b. Table of Contents and Identification Tabs for each section.
- c. Point of Contact List to include contact info for recommended BPA vendor(s), subcontractors and manufacturers.
- d. Final FF&E Cost Summary to include shipping, freight, handling, professional installation, project management, HAR, SIOH, and applicable sales tax. Cost summary template will be provided by the NAVFAC Interior Designer.
- e. Final Procurement Data "Spec" Sheets for each product indicating item number, item manufacturer/series/product number, detailed item description, quantity, room location, general appearance, and proposed finish and fabric selections. Procurement Data Sheet template will be provided by NAVFAC Interior Designer. Creation of these Procurement Data Sheets is the responsibility of the Contractor's Interior Designer; not the BPA vendor or dealership. Item costs listed on Procurement Data Sheets must match costs on Cost Summary and costs on the Bill of Materials from each vendor.
- f. Final updated FF&E Plans coded to the FF&E Cost Summary List and Procurement Data Sheets. All sizes and configurations of the FF&E to be provided should be reflected on these updated plans. All Collateral equipment (CEQ), Government Furnished, Government Installed (GFGI) equipment such as printers and vending machines and Government Furnished, Contractor Installed (GFCI) equipment must be indicated on drawings for coordination purposes.
- g. FF&E Final Cost Comparison worksheet, listing all cost differences between bid pricing and final pricing with justifications.
- h. Updated Electrical and Telecommunication Plans: Provide dimensioned locations on plans and elevations for Multi-user Telecommunications Outlet Assemblies (MUTOAs), junction boxes, wall outlets and floor boxes, based on the sizes, layouts and configurations of the FF&E items to be provided.
- i. Performance Criteria for all FF&E that was used in the BVD Pricing Solicitation.
- j. Finish and fabric samples for all FF&E items attached to 8-1/2" x 11" mat boards and inserted into heavy duty plastic sheet protectors. All samples must have the manufacturer names and numbers listed and must reference the FF&E Item tags on the Procurement Data Sheets. Actual finish and fabric samples are required.
- k. Copy of Manufacturer Bill of Materials (BOM) on manufacturer letterhead for each vendor. Bill of Materials must be coded to the FF&E Cost Summary Item codes. Sum of all manufacturer's Bill of Material totals must match Cost Summary totals and Procurement Data sheets exactly.
- l. Best Value Determination Guideline sheets; completed and signed by the Contractor's Interior Designer. Templates and guidance can be found at:

<http://www.wbdg.org/ffc/navy-navfac/collateral-equipment>

1.6 BEST VALUE DETERMINATION

A Best Value Determination (BVD) is required by FAR 8.404 when placing orders against Federal Supply Schedules for the selection of furniture and furnishings. Best Value is defined in FAR 2.101 as ensuring that the order to be placed under a Federal Supply Schedule results in the lowest overall cost alternative (considering quality, price, special features, administrative costs and client's functionality) to meet the government's needs.

- a. A (BVD) shall be performed on a minimum of three manufacturers for orders exceeding a total procurement of \$10,000 from an individual manufacturer. Multiple BVDs may be required in order to complete the final FF&E package.
- b. The required quantity of BVD's to be performed will be determined by the NAVFAC Interior Designer and as necessary to support the construction schedule during the design phase and is dependent on the appropriate NAVSUP BPA category(s) to be utilized and specific project requirements.
- c. Documentation must be provided to the Government with the final FF&E package. Specific Documentation is indicated in the BVD Vendor Recommendation and the Final FF&E Submittal. The Best Value Determination Guidelines form must be completed and signed by the Contractor's Interior Designer.

1.6.1 BVD Justifications

The Prime Contractor's Interior Designer is responsible for the following written BVD justifications:

For FF&E procurements with a value of \$10,000 or less, the Interior Designer may utilize any current NAVSUP BPA holder. If none of the NAVSUP BPA holders can supply the item, then any other manufacturer may be utilized.

For FF&E procurements with a value greater than \$10,000 and \$250,000 or less, the Prime Contractor's Interior Designer must always review published pricing from at least three current NAVSUP BPA holders, in the applicable SIN Category and Region. Pricing from Federal Prison Industries (UNICOR) must also be requested, via email, and reviewed if UNICOR holds a BPA in the applicable SIN Category. Documentation of the email to UNICOR is required. In addition to the review of published list prices, the Contractor's Interior Designer must confirm the pricing with the vendor via a written quote. The BVD Guidelines Micro Purchase Threshold - Simplified Acquisition Threshold form must be completed and submitted for all FF&E procurements greater than \$10,000 and \$250,000 or less.

For FF&E procurements greater than \$250,000, UNICOR and all BPA holders in the applicable SIN Category and Region must always be solicited. Documentation of the email to UNICOR is required. The Prime Contractor's Interior Designer must develop a Request for Proposal pricing package complete with non-proprietary performance criteria and project requirements based on a generic design. This Request for Proposal must have adequate information for the BPA holders and UNICOR to develop an FF&E price and performance proposal and must be distributed to all NAVSUP

BPA holders in the applicable SIN Category and Region. The BVD Guidelines Greater than Simplified Acquisition Threshold form must be completed and submitted for all FF&E procurements greater than \$250,000 and manufacturer's quotes and a summary of all proposals must be attached.

1.6.2 Evaluation Factors

The Best Value Determination must address issues such as:

- a. Space planning; human factors data related to anthropometrics (reach, clearance, adjustability), space, and acoustics.
- b. Ergonomics.
- c. Product quality (including construction and materials); sustainability features, product warranties; history of the product and/or manufacturer.
- d. Ability to service products through dealers or others within a certain geographical range of the project.
- e. Price (including freight, design, project management and installation)
- f. Aesthetics.
- g. Appropriateness; lighting, power and telecommunications systems management and/or coordination as related to the facility (when applicable); and other project specific factors as identified and/or required.
- h. The goal is to create a fully integrated design solution by providing quality FF&E products to meet the functional needs of the customer. Customer preferences must be considered. The focus must be on the best overall value. Use of the NAVFAC Best Value Determination form templates provided by the NAVFAC Interior Designer, is required.

PART 2 FF&E TURNKEY EFFORT

2.1 FF&E PACKAGE PLANNED MODIFICATION

FF&E Planned Modification: As a planned modification, provide procurement and installation coordination of the complete and usable Final FF&E package. The FF&E Package must include shipping, freight, handling, installation and the Prime Contractor's FF&E Handling and Administration Rate (HAR) percentage as applied to the final FF&E total cost and sales tax, if applicable.

2.1.1 Authorization

The Government will provide separate funding for procurement and installation coordination of the FF&E package. Construction funds will not be used. Upon receipt of required funding, the Prime Contractor will be authorized by the Contracting Officer, as a planned modification to the construction contract, to procure and install all Final FF&E utilizing NAVSUP Blanket Purchase Agreements (BPA's), GSA schedules, and other Federal contracts and complying with priorities found in FAR Part 8.404.

The Prime Contractor will be expected to procure and coordinate the installation of the approved Final FF&E package exactly as specified , or NAVFAC approved equal. The amount of the modification will be the actual cost of these items from the Federal Government price schedules NAVSUP BPAs and/or GSA, including any freight and installation charges from the furniture supplier as well as the Prime Contractor's Handling and Administration Rate (HAR) and any applicable state sales tax. The HAR must cover all of the Prime Contractor's effort related to storage, coordination, handling, administration of subcontractors, and all other associated costs and profit for the procurement of FF&E.

The Government will indicate the FF&E preliminary estimate based on the Concept Design in Spec Section 00 22 13 Supplementary Instructions to Bidders. This Government estimate must not be altered by Prime Contractors during the bid process. Prime Contractors must propose a HAR only. The Prime Contractor's proposed HAR may not exceed 5 percent of the total FF&E costs, as noted on the Supplementary Instructions to Bidders. The HAR must not include costs associated with the effort required in Part 1.4 INTERIOR DESIGN SERVICES.

FF&E items are subject to the Buy American Act or Trade Agreement Act, unless they are considered COTS (Consumer Off The Shelf) items by the Contracting Officer.

2.1.2 Procurement, Installation Schedule and Price Increases

The Prime Contractor and Contractor's Interior Designer must coordinate the building completion date with the installation dealer(s) specified in the FF&E Package and keep the NAVFAC Interior Designer updated on the status.

FF&E product should be ordered as soon as the planned modification is awarded to avoid incurring additional costs for price increases. Delayed production and phased delivery dates can be coordinated with the installation dealer at the time of order placement, to coincide with the contract completion date.

The Prime Contractor must anticipate possible manufacturer price increases if order placement is delayed. Any costs incurred due to manufacturer price increases after the FF&E planned modification will be the burden of the Prime Contractor. Any FF&E storage costs incurred due to construction delays and lack of communication with the installation dealer are the responsibility of the Prime Contractor.

2.1.3 Use of Blanket Purchase Agreements (BPA) and GSA Schedules

The Prime Contractor will receive a letter of authorization from the Contracting Officer citing the name of the furniture dealer(s) and authorization to access the Federal Government supply sources.

2.1.4 Deposits

The Prime Contractor must anticipate providing a deposit(s) of between 30 percent and 50 percent of the FF&E costs when placing the orders with the manufacturer's dealerships.

2.1.5 Davis Bacon Wages

Davis Bacon wages do not apply to the FF&E installer from the Government supply sources. The workforce for the FF&E installation and delivery must be separate and distinct from the labor workforce performing under the construction contract.

2.1.6 Sales Tax

The Prime Contractor must take maximum advantage of all exemptions from State and Local taxation authorities whether available to it directly or available to the Prime Contractor based on an exemption afforded the Government. The responsibility for paying applicable taxes rests with the Prime Contractor. Any state and local taxes applicable to the FF&E must be included within the FF&E Dealer's quote and funded in the FF&E planned modification. Any items purchased as building materials, such as carpet, are taxable.

2.1.7 Bonds

FF&E items are not considered construction and the Prime Contractor is not required by the Government to secure any additional bonds for the award of the FF&E line item, unless otherwise indicated in the contract. If any additional bond is required for the FF&E line item it is to be included in the Prime Contractor's FF&E HAR.

2.1.8 Unique Item Identification (IUID) and Valuation

Unique item identification and valuation is a system of marking and valuing items delivered to DoD that enhances logistics, contracting, and financial business transactions. The IUID policy is mandatory for all DoD contracts that require the delivery of items. An item is a single article or a single unit formed by a grouping of subassemblies, components, or constituent parts. The Prime Contractor must provide DoD Unique item identification, valuation and delivery of data for all required FF&E items for which the government's unit acquisition cost is \$5,000 or more. This information must be provided in the Ordering Documentation referenced in Section 3.3 at the final FF&E punch list site visit.

PART 3 EXECUTION

3.1 Installation

The FF&E package includes the installation of all furniture and furnishings as specified in the FF&E package. The FF&E installation dealer(s) specified in the FF&E package must receive, store as required, transport to the project site, off load, inside deliver, unpack, assemble, place/install, clean, and dispose of all the trash for all FF&E package. It is the Prime Contractor's responsibility to coordinate the building completion, occupancy, and furniture installation dates with the installation dealer(s) specified in the FF&E package. Any costs associated with or delaying FF&E shipments is the responsibility of the Prime Contractor.

3.2 Installation Warranty

All FF&E must be installed in accordance with the manufacturer's instructions and warranty requirements. All FF&E must be leveled and aligned. All doors, drawers and accessories must be leveled and aligned

to open, close and otherwise operate smoothly and securely.

All FF&E must be installed by the furniture manufacturer's dealer of record and not the Prime Contractor. The Government reserves the right to approve/disapprove the Prime Contractor's FF&E installers. In addition, dealer, teaming partners and installation team(s) must be located within a 250 mile radius of the project site, unless approved by the NAVFAC Interior Designer. The Prime Contractor must repair, to the Government's satisfaction, any/all damage to any facility finish that is a result of the furniture installation and correct all punch list items for the FF&E. The Prime Contractor must obtain services of equipment specialists to install the electrical equipment, to include but not limited to televisions, Video Teleconference Equipment, ceiling mounted projectors, and mission essential electronic equipment included in the FF&E package.

3.3 Ordering Documentation

After award of the FF&E package, two CD copies of all ordering documentation, including Factory Order number (FO), warranty information and operating instructions for all products, must be provided to the Contracting Officer at the final FF&E punch list walk-thru.

3.4 Post Award Changes

The Government requires the Prime Contractor to provide FF&E items exactly as specified in the Final FF&E submittals and as awarded in the FF&E planned modification. Should changes become necessary, careful consideration is essential to assure that equivalent quality, price and functionality of the item are maintained. Coordination with building finishes and other FF&E items is required for all proposed substitutions. Information on specific item type, quality, color, finish, fabric, price, sustainability, life cycle, and dealership service must be provided to the NAVFAC Interior Designer for item approval. After award of the FF&E planned modification, any request to change the FF&E items which affects the price of the item must be negotiated and may not be funded. The Prime Contractor must obtain approval from the NAVFAC Interior Designer and the Contracting Officer for any changes to the FF&E Package.

Post award FF&E manufacturer's price increases, beyond the "hold pricing" date, are the responsibility of the Prime Contractor and must not be transferred to the Government.

3.5 Punch List

The Contractor, his Interior Designer must attend at least one punch list site visit with the installation dealer(s), NAVFAC Interior Designer and the Base Representative/Activity Contact. The site visit must identify all punch list items (at installation dealer's 98 percent completion).

-- End of Section --

ELECTRONIC CONSTRUCTION AND FACILITY SUPPORT CONTRACT MANAGEMENT SYSTEM
05/17

PART 1 GENERAL

1.1 CONTRACT ADMINISTRATION

Utilize the Naval Facilities Engineering Command's (NAVFAC's) Electronic Construction and Facility Support Contract Management System (eCMS) for the transfer, sharing and management of electronic technical submittals and documents. The web-based eCMS is the designated means of transferring technical documents between the Contractor and the Government. Paper media or e-mail submission, including originals or copies, of the documents identified in Table 1 are not permitted, except where eCMS is unavailable, non-functional or specifically requested in addition to electronic submission. When specifically requested to provide documents outside of eCMS, upload all final project documentation (e.g. documents that are signed and/or adjudicated by the Government) mentioned in Table 1 into the subject eCMS document management folders that are associated with that document type. Include the identification number of the document, type of document; the name/subject or title; and for daily reports the date (day of work) with format YYYY/MM/DD in the filename. For example for RFI's 0011_RFI_Roof_Leaking.doc; For submittals 0032a_Submittals_Light_Fixture.pdf; For Daily Reports 0132_Daily_Report_20190504.xls. Contact the Contracting Officer's Representative (COR) regarding availability of eCMS training and reference materials.

1.2 USER PRIVILEGES

The Contractor will be provided access to eCMS. All technical submittals and documents must be transmitted to the Government via the COR. Project roles and system roles will be established to control each user's menu, application, and software privileges, including the ability to create, edit, or delete objects.

1.3 SUBMITTALS

Government approval or acknowledgement is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contractor's Personnel; G

1.4 SYSTEM REQUIREMENTS AND CONNECTIVITY

1.4.1 General

The eCMS requires a web-browser (platform-neutral) and Internet connection. Obtain from an approved vendor an External Certification Authority (ECA), Primary Key Infrastructure (PKI) certificate, or other similar digital identification to support two-factor authentication and access to eCMS. Provide and maintain computer hardware and software for the eCMS access throughout the duration of the contract for all

Contractor-designated users. Provide connectivity, speed, bandwidth, and access to the Internet to ensure adequate functionality. Neither upgrading of the Contractor's computer system nor delays associated from the usage of the eCMS will be justification or grounds for a time extension or cost adjustment to the Contract.

1.4.2 Contractor Personnel List

Within 20 calendar days of contract award, provide to the Contracting Officer a [list of Contractor's personnel](#) who will have the responsibility for the transfer, sharing and management of electronic technical submittals and documents and will require access to the eCMS. Project personnel roles to be filled in the eCMS include the Contractor's Project Manager, Superintendent, Quality Control (QC) Manager, and Site Safety and Health Officer (SSHO). Personnel must be capable of electronic document management. Notify the COR immediately of any personnel changes to the project. The Contracting Officer reserves the right to perform a security check on all potential users. Provide the following information:

First Name
Last Name
E-mail Address
Office Address
Project Role (e.g. Project Manager, QC Manager, Superintendent)

1.5 SECURITY CLASSIFICATION

In accordance with Department of Navy guidance, all military construction contract data are unclassified, unless specified otherwise by a properly designated Original Classification Authority (OCA) and in accordance with an established Security Classification Guide (SCG). Refer to the project's OCA when questions arise about the proper classification of information.

The eCMS and tablet computer must only be used for the transaction of unclassified information associated with construction projects. In conformance with the Freedom of Information Act (FOIA), Department of Defense Manual 5200.01-V4: DoD Information Security Program: Controlled Unclassified Information (CUI), and DoD requirements, any unclassified project documentation uploaded into the eCMS must be designated either "U - UNCLASSIFIED" (U) or "FOUO - UNCLASSIFIED-FOR OFFICIAL USE ONLY" (FOUO).

1.6 ECMS UTILIZATION

Establish, maintain, and update data and documentation in the eCMS throughout the duration of the contract.

Personally Identifiable Information (PII) transmittal is not permitted in the eCMS.

1.6.1 Information Security Classification/Identification

The eCMS must be used for the transmittal of the following documents. This requirement supersedes conflicting requirements in other sections, however, submittal review times in Section [01 33 00 SUBMITTAL PROCEDURES](#) remain applicable. Table 1 - Project Documentation Types provides the appropriate U and FOUO designations for various types of project documents. Construction documents requiring FOUO status must be marked accordingly. Apply the appropriate markings before any document is uploaded into eCMS. Markings are not required on U documents.

Table 1 also identifies which eCMS application is to be used in the transmittal of data (these are subject to change based on the latest software configuration). If a designated application is not functional within 4 hours of initial attempt, defer to the Submittal application and submit the required data as an uploaded portable document (e.g. PDF), word processor, spreadsheet, drawing, or other appropriate format. Hard copy or e-mail submission of these items is acceptable only if eCMS is documented to be not available or not functional or specifically requested in addition to electronic submission. After uploading documents to the Submittal application, transmit the submittals and attachments to the COR via the Transmittal application. For Submittals, select the following:

Preparation by = Contractor personnel assigned to prepare the submittal
Approval by = Contracting Officer Representative (COR)
Returned by = Design Lead/Manager
Forwarded to = Contractor project manager

Table 1 - Project Documentation Types

SUBJECT/NAME	CLASS	REMARKS	ECMS APPLICATION
As-Built Drawings	U	Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager	Submittals and Transmittals
Building Information Modeling (BIM)	U	1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager 2. Design reviews will be performed in existing "Dr Checks"	Submittals and Transmittals
Construction Permits	U	Refer to rules of the issuing activity, state or jurisdiction	Submittals and Transmittals
Construction Schedules (Activities and Milestones)	U	After the schedule submittal is approved by the COR, import the schedule file into the scheduling application, and select "Approve" to establish a new schedule baseline	Submittals, Transmittals and Scheduling App

SUBJECT/NAME	CLASS	REMARKS	ECMS APPLICATION
Construction Schedules (Cost-Loaded)	FOUO	After the schedule submittal is approved by the COR, import the schedule file into the scheduling application, and select "Approve" to establish a new schedule baseline	Submittals, Transmittals and Scheduling App
Construction Schedules (3-Week Lookahead)	U	Import the schedule file into the scheduling application, and select "Approve" to establish a new schedule baseline	Scheduling App
DD 1354 Transfer of Real Property	U		Submittals and Transmittals
Daily Production Reports	FOUO	Provide weather conditions, crew size, man-hours, equipment, and materials information	Daily Report
Daily Quality Control (QC) Reports	FOUO	Provide QC Phase, Definable Features of Work Identify visitors	Daily Report
Designs and Specifications	U	1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager 2. Design reviews will be performed in existing "Dr Checks"	Submittals and Transmittals
Environmental Notice of Violation (NOV), Corrective Action Plan	U	Refer to rules of the issuing activity, state or jurisdiction	Submittals and Transmittals
Environmental Protection Plan (EPP)	FOUO		Submittals and Transmittals
Invoice (Supporting Documentation)	FOUO	Applies to supporting documentation only. Invoices are submitted in Wide-Area Workflow (WAWF)	Submittals and Transmittals

SUBJECT/NAME	CLASS	REMARKS	ECMS APPLICATION
Jobsite Documentation, Bulletin Board, Labor Laws, SDS	U		Submittals and Transmittals
Meeting Minutes	FOUO		Meeting Minutes
Modification Documents	FOUO	Provide final modification documents for the project. Upload into "Modifications - RFPs"	Document Management
Operations & Maintenance Support Information (OMSI/eOMSI), Facility Data Worksheet	U	1. Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager 2. Design reviews will be performed in existing "Dr Checks"	Submittals and Transmittals
Photographs	U	Subject to base/installation restrictions	Submittals and Transmittals
QCM Initial Phase Checklists	FOUO		Checklists (Site Management)
QCM Preparatory Phase Checklists	FOUO		Checklists (Site Management)
Quality Control Plans	FOUO		Submittals and Transmittals
QC Certifications	U		Submittals and Transmittals
QC Punch List	U		Punch Lists (Testing Logs)
Red-Zone Checklist	U		Checklists (Site Management)
Rework Items List	FOUO		Punch Lists (Testing Logs)
Request for Information (RFI) Post-Award	FOUO		RFIs
Safety Plan	FOUO		Daily Report

SUBJECT/NAME	CLASS	REMARKS	ECMS APPLICATION
Safety - Activity Hazard Analyses (AHA)	FOUO		Daily Report
Safety - Mishap Reports	FOUO		Daily Report
SCIF/SAPF Accreditation Support Documents	FOUO	Note: Some Construction Security plans may be classified as Secret. Classified information must not be uploaded into eCMS. Refer to the Site Security Manager, as applicable.	Submittals and Transmittals
Shop Drawings	U	Locations of sensitive areas must be labeled as either "Controlled Area" or "Restricted Area" and may be shown on unclassified documents with the approval from Site Security Manager	Submittals and Transmittals
Storm Water Pollution Prevention (Notice of Intent - Notice of Termination)	U	Refer to rules of the issuing activity, state or jurisdiction	Submittals and Transmittals
Submittals and Submittal Log	U		Submittals and Transmittals
Testing Plans, Logs, and Reports	FOUO		Submittals and Transmittals
Training/Reference Materials	U		Submittals and Transmittals
Training Records (Personnel)	FOUO		Submittals and Transmittals
Utility Outage/Tie-In Request/Approval	FOUO		Submittals and Transmittals
Warranties/BOD Letter	FOUO		Submittals and Transmittals
Quality Assurance Reports	FOUO		Checklists (Government initiated)

SUBJECT/NAME	CLASS	REMARKS	ECMS APPLICATION
Non-Compliance Notices	FOUO		Non-Compliance Notices (Government initiated)
Other Government-prepared documents	FOUO		GOV ONLY
All Other Documents	FOUO	Refer to FOIA guidelines and contact the FOIA official to determine whether exemptions exist	As applicable

1.6.2 Markings on FOUO documents

- a. Only FOUO documents being electronically uploaded into the eCMS (.docx, .xlsx, .pptx and others as appropriate), and associated paper documents described in the paragraph CONTRACT ADMINISTRATION require FOUO markings as indicated in the subparagraphs below.
- b. FOUO documents that are originally created within the eCMS application using the web-based forms (RFIs, Daily Reports, and others as appropriate) will be automatically watermarked by the eCMS software, and these do not require additional markings.
- c. FOUO documents must be marked "UNCLASSIFIED//FOR OFFICIAL USE ONLY" at the bottom of the outside of the front cover (if there is one), the title page, the first page, and the outside of the back cover (if there is one).
- d. FOUO documents must be marked on the internal pages of the document as "UNCLASSIFIED//FOR OFFICIAL USE ONLY" at top and bottom.
- e. Where Installations require digital photographs to be designated FOUO, place the markings on the face of the photograph.
- f. For visual documentation, other than photographs and audio documentation, mark with either visual or audio statements as appropriate at both the beginning and end of the file.

1.7 QUALITY ASSURANCE

Requested Government response dates on Transmittals and Submittals must be in accordance with the terms and conditions of the Contract. Requesting response dates earlier than the required review and response time, without concurrence by the Government COR, may be cause for rejection.

Incomplete submittals will be rejected without further review and must be resubmitted. Required Government response dates for resubmittals must reflect the date of resubmittal, not the original submittal date.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 31 50

TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY

01/07

PART 1 GENERAL

1.1 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00
SUBMITTAL PROCEDURES:

SD-11 Closeout Submittals

Interim DD-1354, Transfer & Acceptance of Military Real Property

1.2 Interim DD-1354, Transfer & Acceptance of Military Real Property

Submit Interim DD-1354 thirty (30) days prior to beneficial occupancy date
(draft copy attached).

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

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SECTION 01 32 16

CONSTRUCTION PROGRESS DOCUMENTATION

04/12

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-01 Preconstruction Submittals

Construction schedule

Equipment delivery schedule

1.2 CONSTRUCTION SCHEDULE

Within 21 days after receipt of the Notice of Award, prepare and submit to the Contracting Officer for approval a Critical Path Method (CPM), Network Schedule in accordance with the terms in Contract Clause "FAR 52.236-15, Schedules for Construction Contracts," except as modified in this contract. Primavera P6 will be utilized to produce and update all progress schedules.

1.3 EQUIPMENT DELIVERY SCHEDULE

1.3.1 Initial Schedule

Within 30 calendar days after approval of the proposed construction schedule, submit for Contracting Officer approval a schedule showing procurement plans for materials, plant, and equipment. Submit in the format and content as prescribed by the Contracting Officer, and include as a minimum the following information:

- a. Description.
- b. Date of the purchase order.
- c. Promised shipping date.
- d. Name of the manufacturer or supplier.
- e. Date delivery is expected.
- f. Date the material or equipment is required, according to the current construction schedule.

1.4 NETWORK ANALYSIS SYSTEM (NAS)

The Contractor shall use the critical path method (CPM) to schedule and control construction activities. The Network shall have a minimum of 25

activities and a maximum of 75 activities. The schedule shall identify as a minimum:

- a. Construction time for all major systems and components;
- b. Major submittals and submittal processing time; and
- c. Major equipment lead time.

1.4.1 CPM Submittals and Procedures

The Contractor shall use the critical path method (CPM) to schedule and control project activities. Project schedules shall be prepared and maintained using Primavera P6, Primavera SureTrak or current mandated scheduling program. Save files in Concentric P6 or current mandated scheduling program file format, compatible with the Governments version of the scheduling program. The network analysis system shall be kept current, with changes made to reflect the actual progress and status of the construction.

1.5 UPDATED SCHEDULES

Update the construction schedule and equipment delivery schedule at monthly intervals or when schedule has been revised. Reflect any changes occurring since the last update. Submit copies of the purchase orders and confirmation of the delivery dates as directed.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 33 00
SUBMITTAL PROCEDURES

05/13

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Government-Furnished Information

Submittal register will be delivered to the contractor in hard copy format. Register will have the following fields completed, to the extent that will be required by the Government during subsequent usage.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD No. and type, e.g. SD-04 Drawings) required in each specification section.

Column (e): Lists one principal paragraph in specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting project requirements.

Column (f): Indicate approving authority for each submittal. The Contracting Officer is approving authority for all submittals.

1.2 DEFINITIONS

1.2.1 Submittal

Shop drawings, product data, samples, and administrative submittals presented for review and approval. Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

1.2.2 Types of Submittals

All submittals are classified as indicated in paragraph "Submittal Descriptions (SD)". Submittals also are grouped as follows:

- a. Shop drawings: As used in this section, drawings, schedules, diagrams, and other data prepared specifically for this contract, by contractor or through contractor by way of subcontractor, manufacturer, supplier, distributor, or other lower tier contractor, to illustrate portion of work.
- b. Product data: Preprinted material such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, catalog data, and other data to illustrate portion of work, but not prepared exclusively

for this contract.

- c. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to portion of work, illustrating portion of work or establishing standards for evaluating appearance of finished work or both.
- d. Administrative submittals: Data presented for reviews and approval to ensure that administrative requirements of project are adequately met but not to ensure directly that work is in accordance with design concept and in compliance with contract documents.

1.2.3 Submittal Descriptions (SD)

SD-01 Preconstruction Submittals

Certificates of insurance
Surety bonds
List of proposed subcontractors
List of proposed products
Construction Progress Schedule
Submittal schedule
Schedule of values
Health and safety plan
Work plan
Quality control plan
Environmental protection plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the contractor for integrating the product or system into the project.

Drawings prepared by or for the contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the

project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports

Daily checklists

Final acceptance test and operational test procedure

SD-07 Certificates

Statements signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

Factory test reports.

SD-10 Operation and Maintenance Data

Data intended to be incorporated in operations and maintenance manuals.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

As-built drawings

Special warranties

Posted operating instructions

Training plan

1.2.4 Approving Authority

Person authorized to approve submittal.

1.2.5 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce construction and materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.3 SUBMITTALS

Submit the following in accordance with the requirements of this section.

SD-11 Closeout Submittals

Submittal register

Complete Submittal Package 2 CD/DVD's

1.4 USE OF SUBMITTAL REGISTER

Prepare and maintain submittal register, as the work progresses. Use the hard copy submittal register furnished by the Government or other approved format. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by government; retain data which is output in columns (a), (g), (h), and (i) as approved.

1.4.1 Submittal Register

Submit submittal register as a hard copy. Submit with quality control plan and project schedule required. Do not change data in columns (c), (d), (e), and (f) as delivered by the government. Verify that all submittals required for project are listed and add missing submittals. Complete the following on the register:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for approving

authority to receive submittals.

Column (h) Contractor Approval Date: Date contractor needs approval of submittal.

Column (i) Contractor Material: Date that contractor needs material delivered to contractor control.

1.4.2 Contractor Use of Submittal Register

Update the following fields in the government-furnished submittal register.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (j) Action Code (k): Date of action used to record contractor's review when forwarding submittals to QC.

Column (l) List date of submittal transmission.

Column (q) List date approval received.

1.4.3 Approving Authority Use of Submittal Register

Update the following fields in the government-furnished submittal register.

Column (b).

Column (l) List date of submittal receipt.

Column (m) through (p).

Column (q) List date returned to contractor.

1.4.4 Contractor Action Code and Action Code

Entries used will be as follows (others may be prescribed by Transmittal Form):

NR - Not Received

AN - Approved as noted

A - Approved

RR - Disapproved, Revise, and Resubmit

1.4.5 Copies Delivered to the Government

Deliver one copy of submitted register updated by contractor to government with each invoice request.

1.4.6 Submittals reserved for Marine Corps North Carolina IPT approval

a. Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM: All submittals. Provide an information copy of all submittals to Base Telephone through the Contracting Officer. Base Telephone will coordinate their review and approval through the Marine Corps North Carolina IPT.

b. Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP): All submittals. Provide an information copy of all submittals to Base Telephone through the Contracting Officer. Base Telephone will coordinate their review and approval through the Marine Corps North Carolina IPT.

1.5 PROCEDURES FOR SUBMITTALS

1.5.1 Reviewing, Certifying, Approving Authority

QC organization shall be responsible for reviewing and certifying that submittals are in compliance with contract requirements. The Contracting Officer is the approving authority for all submittals.

1.5.2 Constraints

- a. Submittals listed or specified in this contract shall conform to provisions of this section, unless explicitly stated otherwise.
- b. Submittals shall be complete for each definable feature of work; components of definable feature interrelated as a system shall be submitted at same time.
- c. When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.
- d. Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.5.3 Scheduling

- a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential requirements to resubmit.
- b. Except as specified otherwise, allow review period, beginning with receipt by approving authority, that includes at least 15 working days for submittals for QC manager approval and 20 working days for submittals for contracting officer approval. Period of review for submittals with contracting officer approval begins when Government receives submittal from QC organization. Period of review for each resubmittal is the same as for initial submittal.
- c. For submittals requiring review by fire protection engineer, allow review period, beginning when government receives submittal from QC organization, of 45 working days for return of submittal to the contractor. Period of review for each resubmittal is the same as for initial submittal.

1.5.4 Variations

Variations from contract requirements require Government approval pursuant to contract Clause entitled "FAR 52.236-21, Specifications and Drawings for Construction" and will be considered where advantageous to government.

1.5.4.1 Considering Variations

Discussion with contracting officer prior to submission, will help ensure functional and quality requirements are met and minimize rejections and resubmittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

1.5.4.2 Proposing Variations

When proposing variation, deliver written request to the contracting officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to government. If lower cost is a benefit, also include an estimate of the cost saving. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.5.4.3 Warranting That Variation Are Compatible

When delivering a variation for approval, contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.5.4.4 Review Schedule Is Modified

In addition to normal submittal review period, a period of 10 working days will be allowed for consideration by the Government of submittals with variations.

1.5.5 Contractor's Responsibilities

- a. Determine and verify field measurements, materials, field construction criteria; review each submittal; and check and coordinate each submittal with requirements of the work and contract documents.
- b. Transmit submittals to QC organization in accordance with schedule on approved Submittal Register, and to prevent delays in the work, delays to government, or delays to separate contractors.
- c. Advise contracting officer of variation, as required by paragraph entitled "Variations."
- d. Correct and resubmit submittal as directed by approving authority. When resubmitting disapproved transmittals or transmittals noted for resubmittal, the contractor shall provide copy of that previously submitted transmittal including all reviewer comments for use by approving authority. Direct specific attention in writing or on resubmitted submittal, to revisions not requested by approving authority on previous submissions.
- e. Furnish additional copies of submittal when requested by contracting officer, to a limit of 20 copies per submittal.
- f. Complete work which must be accomplished as basis of a submittal in time to allow submittal to occur as scheduled.
- g. Ensure no work has begun until submittals for that work have been

returned as "approved," or "approved as noted", except to the extent that a portion of work must be accomplished as basis of submittal.

1.5.6 QC Organization Responsibilities

- a. Note date on which submittal was received from contractor on each submittal.
- b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.
- c. Review submittals for conformance with project design concepts and compliance with contract documents.
- d. Act on submittals, determining appropriate action based on QC organization's review of submittal.

(1) When QC manager is approving authority, take appropriate action on submittal from the possible actions defined in paragraph entitled, "Actions Possible."

(2) When contracting officer is approving authority or when variation has been proposed, forward submittal to Government with certifying statement or return submittal marked "not reviewed" or "revise and resubmit" as appropriate. The QC organization's review of submittal determines appropriate action.

- e. Ensure that material is clearly legible.
- f. Stamp each sheet of each submittal with QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

(1) When approving authority is contracting officer, QC organization will certify submittals forwarded to contracting officer with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with contract Number N40085-15-B-011, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Certified by QC manager _____, Date _____"
(Signature)

- g. Sign certifying statement or approval statement. The person signing certifying statements shall be QC organization member designated in the approved QC plan. The signatures shall be in original ink. Stamped signatures are not acceptable.
- h. Update submittal register as submittal actions occur and maintain the submittal register at project site until final acceptance of all work by contracting officer.

- i. Retain a copy of approved submittals at project site, including contractor's copy of approved samples.

1.5.7 Government's Responsibilities

When approving authority is contracting Officer, the Government will:

- a. Note date on which submittal was received from QC manager, on each submittal for which the contracting officer is approving authority.
- b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.
- c. Identify returned submittals with one of the actions defined in paragraph entitled "Actions Possible" and with markings appropriate for action indicated.

1.5.8 Actions Possible

Submittals will be returned with one of the following notations:

- a. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by contractor or for being incomplete, with appropriate action, coordination, or change.
- b. Submittals marked "approved" "approved as submitted" authorize contractor to proceed with work covered.
- c. Submittals marked "approved as noted" authorize contractor to proceed with work as noted provided contractor takes no exception to the notations.
- d. Submittals marked "revise and resubmit" or "disapproved" indicate submittal is incomplete or does not comply with design concept or requirements of the contract documents and shall be resubmitted with appropriate changes. No work shall proceed for this item until resubmittal is approved.

1.6 FORMAT OF SUBMITTALS

1.6.1 Complete Submittal Package

Contractor shall make electronic copies of all submittals, including the approved transmittal sheets, and provide two (2) CD/DVD's containing all submittals for the project.

The CD/DVD's shall be marked "Complete Submittal Package - Contract # 20-0075 Repair BEQ FC530."

1.6.2 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to office of approving authority. Transmit submittals with transmittal form

prescribed by contracting officer and standard for project. The transmittal form shall identify contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample panels and sample installations.

1.6.3 Identifying Submittals

Identify submittals, except sample panel and sample installation, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

- a. Project title and location.
- b. Construction contract number.
- c. Section number of the specification section by which submittal is required.
- d. Submittal description (SD) number of each component of submittal.
- e. When a resubmission, alphabetic suffix on submittal description, for example, SD-10A, to indicate resubmission.
- f. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other second tier contractor associated with submittal.
- g. Product identification and location in project.

1.6.4 Format for Product Data

- a. Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.
- b. Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.
- c. Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project.

1.6.5 Format for Shop Drawings

- a. Shop drawings shall not be less than 8 1/2 by 11 inches nor more than 30 by 42 inches.
- b. Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.
- c. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals."

- d. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Shop drawing dimensions shall be the same unit of measure as indicated on the contract drawings. Identify materials and products for work shown.

1.6.6 Format of Samples

- a. Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:
 - (1) Sample of Equipment or Device: Full size.
 - (2) Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.
 - (3) Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.
 - (4) Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.
 - (5) Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.
 - (6) Color Selection Samples: 2 by 4 inches.
 - (7) Sample Panel: 4 by 4 feet.
 - (8) Sample Installation: 100 square feet.
- b. Samples Showing Range of Variation: Where variations are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range.
- c. Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples shall be in undamaged condition at time of use.
- d. Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.
- e. When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.6.7 Format of Administrative Submittals

- a. When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply contractor's approval stamp to document, but to a separate sheet accompanying document.
- b. Operation and Maintenance Manual Data: Submit in accordance with Section 01 78 23, "Operation and Maintenance Data." Include

components required in that section and the various technical sections.

1.7 QUANTITY OF SUBMITTALS

1.7.1 Number of Copies of Product Data

- a. Submit five copies of submittals of product data requiring review and approval only by the Contracting Officer. Submit three copies of submittals of product data for operation and maintenance manuals.

1.7.2 Number of Copies of Shop Drawings

Submit shop drawings in compliance with quantity requirements specified for product data.

1.7.3 Number of Samples

- a. Submit two samples, or two sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by approving authority and one will be returned to contractor.
- b. Submit one sample panel. Include components listed in technical section or as directed.
- c. Submit one sample installation, where directed.
- d. Submit one sample of non-solid materials.

1.7.4 Number of Copies of Administrative Submittals

- a. Unless otherwise specified, submit administrative submittals compliance with quantity requirements specified for product data.
- b. Submit administrative submittals required under "SD-19 Operation and Maintenance Manuals" to conform to Section 01 78 23, "Operation and Maintenance Data."

1.8 FORWARDING SUBMITTALS

1.8.1 Samples and Submittals

Except as otherwise noted, submit samples and submittals to:

The Walker Group Architecture, Inc.
409 Broad Street
New Bern, NC 28560

1.8.1.1 Administrative Submittals

Submit administrative submittals for asbestos/lead removal and environmental protection plan to the Resident Officer in Charge of Construction (ROICC/OICC).

1.8.1.2 Fire Protection and Fire Alarm System Submittals

Submit fire protection and fire alarm system submittals to ROICC/OICC.

1.8.1.3 TAB Submittals

Submit to ROICC/OICC for all projects.

1.8.2 Shop Drawings, Product Data, and O&M Data

As soon as practicable after award of the contract, and before procurement or fabrication, submit shop drawings, product data and O&M Data required in the technical sections of this specification.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

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SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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	01 11 00		SD-01 Preconstruction Submittals	1.7														
			Salvage Plan															
	01 20 00		SD-01 Preconstruction Submittals	1.3														
			Schedule of prices															
	01 30 00		SD-01 Preconstruction Submittals	1.4.1														
			List of contact personnel															
	01 31 50		SD-11 Closeout Submittals	1.2														
			Interim DD-1354, Transfer &															
			Acceptance of Military Real															
			Property															
	01 32 16		SD-01 Preconstruction Submittals	1.2														
			Construction schedule															
			Equipment delivery schedule	1.3														
	01 33 00		SD-11 Closeout Submittals	1.4.1														
			Submittal register	1.6.1														
			Complete Submittal Package															
	01 45 10		SD-02 Shop Drawings	1.3														
			Coordination Drawings															
			SD-11 Closeout Submittals	1.7														
			QC PLAN															
	01 57 19		SD-06 Test Reports	3.6.1														
			Abrasive blasting															
			SD-11 Closeout Submittals	1.4.1														
			Solid waste disposal permit	1.4.2														
			Disposal permit for hazardous waste															

SUBMITTAL REGISTER

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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	01 57 19		Environmental training documentation	1.2														
			Permit to transport hazardous waste	1.4.3														
			Hazardous waste certification	1.4.4														
	01 78 00		SD-10 Operation and Maintenance Data															
			Equipment/product warranty list	1.4.1														
			SD-11 Closeout Submittals															
			As-built drawings	1.2.1														
			Record of materials	1.2.2														
			Maximo requirements	1.3														
			Complete Submittal Package	1.6														
			Equipment/product warranty tag	1.4.2														
	01 78 30		SD-11 Closeout Submittals															
			GIS Data Deliverables	1.3.13														
	01 78 30.00 22		SD-11 Closeout Submittals															
			GIS Data Deliverables	1.3.6														
	01 91 13		SD-01 Preconstruction Submittals															
			Construction Checklist	3.15														
			SD-06 Test Reports															
			Test Reports	3.5.1														
			Independent Testing Reports	3.5.2														
			Construction Checklist Forms	3.6														
			SD-10 Operation and Maintenance															
			Data															

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

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	01 91 13		Operations & Maintenance Manuals	3.10													
			SD-11 Closeout Submittals														
			As-Built Drawings	3.10													
			Equipment Start up	3.1													
			DALT	1.6.1.2													
			Pre-PVT	3.1													
	02 41 00		SD-01 Preconstruction Submittals														
			Demolition Plan	1.2.2													
			Existing Conditions	1.9													
			SD-07 Certificates														
			Notification	1.6													
	03 01 00		SD-01 Preconstruction Submittals														
			Qualifications	1.5.3													
			Work Plan	1.5.5													
			Work Plan	1.6.1													
			Quality Control Plan	1.5.2													
			SD-03 Product Data														
			Conventional Concrete	2.4													
			Polymers	2.5													
			Miscellaneous Materials And Equipment	2.6													
			SD-05 Design Data														
			Repair Procedures	1.5.1													
			Mixture Proportioning	2.7													
			SD-06 Test Reports														

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION										CONTRACTOR							
20-0075 Repair BEQ FC530																	
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	03 01 00		Mixture Proportioning	2.7													
			Quality Control	3.1.5													
			Conventional Concrete	2.4													
			Polymers	2.5													
			Miscellaneous Materials And Equipment	2.6													
			SD-07 Certificates														
			Qualifications	1.5.3													
			Conventional Concrete	2.4													
			Polymers	2.5													
			SD-08 Manufacturer's Instructions														
			Equipment For Concrete Preparation	2.2													
			Conventional Concrete	2.4													
			Polymers	2.5													
			Miscellaneous Materials And Equipment	2.6													
	03 30 00		SD-01 Preconstruction Submittals														
			Quality Control Plan	1.6.5													
			Quality Control Personnel	1.6.6													
			Certifications														
			Quality Control Organizational Chart	1.6.6													
			Laboratory Accreditation	1.6.8													
			SD-02 Shop Drawings														
			Reinforcing Steel	1.6.2.1													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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	03 30 00		SD-03 Product Data	2.4.4													
			Joint Sealants	2.4.3													
			Joint Filler	2.3.1													
			Cementitious Materials	2.4.5													
			Vapor Retarder	2.4.1													
			Concrete Curing Materials	2.6													
			Reinforcement	2.3.4													
			Admixtures	1.7.1													
			Local/Regional Materials	2.4.2													
			Nonshrink Grout														
			SD-05 Design Data	1.6.1.1													
			Concrete Mix Design														
			SD-06 Test Reports	1.6.1.1													
			Concrete Mix Design	1.6.3.1													
			Fly Ash	1.6.3.1													
			Pozzolan	1.6.3.1													
			Slag Cement	1.6.3.2													
			Aggregates	1.6.3.3													
			Compressive Strength Tests	3.12.2.3													
			Air Content	3.12.2.4													
			Slump Tests	3.12.2.1													
			Water	2.3.2													
			SD-07 Certificates														
			Reinforcing Bars	2.6.1													
			Field Testing Technician and	1.6.6.2													
			Testing Agency														

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T O R C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
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	03 30 00		Curing Compound	2.4.1													
	03 30 53		SD-03 Product Data														
			Air-Entraining Admixture	2.2.3.1													
			Water-Reducing or Retarding Admixture	2.2.3.2													
			Curing Materials	2.2.10													
			Expansion Joint Filler Strips, Premolded	2.2.6													
			Conveying and Placing Concrete	3.2													
			Formwork	2.2.7													
			Mix Design Data	2.3													
			Ready-Mix Concrete	2.3													
			Mechanical Reinforcing Bar Connectors	2.2.5													
			SD-06 Test Reports														
			Aggregates	2.2.2													
			Concrete Mixture Proportions	2.1.3													
			Compressive Strength Testing	3.8.3													
			Slump	3.8.3													
			Air Content	3.8.3													
			Water	2.2.4													
			SD-07 Certificates														
			Cementitious Materials	2.2.1													
			Pozzolan	2.1													
			Aggregates	2.2.2													
			Delivery Tickets	2.3													

CONTRACT NO.

SUBMITTAL REGISTER

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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	04 20 00		SD-02 Shop Drawings															
			Cut CMU	3.3.2.1														
			SD-03 Product Data															
			Hot Weather Procedures	1.4.1														
			Cold Weather Procedures	1.4.2														
			Clay or Shale Brick	2.2.2														
			Cement	2.2.3.1.1														
			Cementitious Materials	2.4.1.1														
			SD-04 Samples															
			Clay or Shale Brick	2.2.2														
			Concrete Masonry Units (CMU)	2.2.3.1														
			SD-05 Design Data															
			Masonry Compressive Strength	2.1.1														
			SD-07 Certificates															
			Concrete Masonry Units (CMU)	2.2.3.1														
			Cementitious Materials	2.4.1.1														
			Admixtures for Masonry Mortar	2.4.1.3														
			SD-08 Manufacturer's Instructions															
			Admixtures for Masonry Mortar	2.4.1.3														
	05 51 33		SD-02 Shop Drawings															
			Ladders	2.3														
			SD-03 Product Data															
			Ladders	2.3														
	05 52 00		SD-02 Shop Drawings															
			Fabrication Drawings	1.2.1														

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
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	05 52 00		Steel Shapes, Plates, Bars and Strips	2.1													
			Steel Shapes, Plates, Bars and Strips	3.1													
			SD-03 Product Data														
			Structural Steel Plates, Shapes, and Bars	1.2.1													
			Structural Steel Plates, Shapes, and Bars	2.3													
			Protective Coating	1.2.1													
			Protective Coating	2.1													
			Protective Coating	2.7													
			MASONRY ANCHORAGE DEVICES	2.5													
			STEEL RAILINGS AND HANDRAILS	1.2.1													
			STEEL RAILINGS AND HANDRAILS	2.1													
			STEEL RAILINGS AND HANDRAILS	2.8													
			Anchorage and Fastening Systems	1.2.1													
			Anchorage and Fastening Systems	2.1													
			Samples	2.1													
			Design Data	2.1													

CONTRACT NO.

SUBMITTAL REGISTER

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

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	05 52 00		SD-07 Certificates															
			Welder Qualification	1.4.1														
			SD-08 Manufacturer's Instructions															
			Installation Instructions	3.1														
	06 10 00		SD-02 Shop Drawings															
			Nailing Strips	2.3.3.1														
			SD-03 Product Data															
			Oriented Strand Board	2.2														
			Plywood	2.2														
			SD-07 Certificates															
			Certificates of grade	1.7.1														
	06 61 16		SD-02 Shop Drawings															
			Detail Drawings	1.4.2														
			Installation	3.1														
			SD-03 Product Data															
			Solid polymer material	2.1														
			Qualifications	1.4.1														
			Fabrications	2.3														
			SD-04 Samples															
			Material	2.1														
			SD-06 Test Reports															
			Solid polymer material	2.1														
			SD-07 Certificates															
			Fabrications	2.3														
			Qualifications	1.4.1														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

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	06 61 16		SD-10 Operation and Maintenance Data														
			Clean-up	3.2													
	07 57 13		SD-03 Product Data	2.1													
			Spray urethane foam	3.4.5													
			Protective coating	2.2													
			Primer	2.3													
			Sealants														
			SD-07 Certificates														
			Qualification of Manufacturer	1.3.1													
			Qualification of Applicator	1.3.2													
			SD-08 Manufacturer's Instructions														
			SPRAY URETHANE FOAM	2.1													
			PROTECTIVE COATING	3.4.5													
	07 60 00		SD-02 Shop Drawings														
			Exposed Sheet Metal	2.1.1													
			Gutters	3.1.6													
			Downspouts	3.1.7													
			Gravel Stops and Fasciae	2.1.1													
			Flashing at Roof Penetrations	3.1.8													
			and Equipment Supports														
			Reglets	2.1.10													
			SD-08 Manufacturer's Instructions														
			Quality Control Plan	3.5													
	07 61 15.00 20		SD-02 Shop Drawings														
			Roofing Panels	2.1													

CONTRACT NO.

SUBMITTAL REGISTER

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	
	07 61 15.00 20		Gutter/Downspout Assembly	2.3														
			SD-03 Product Data															
			Roofing Panels	2.1														
			Attachment Clips	2.2														
			Closures	2.3.1														
			Accessories	2.3														
			Underlayment	2.4														
			Warranty	1.8														
			Fasteners	2.3														
			Fasteners	2.3.2														
			Pressure Sensitive Tape	2.3														
			Gaskets	2.3														
			Sealing Material	2.3														
			SD-04 Samples															
			Roofing Panels	2.1														
			Accessories	2.3														
			SD-05 Design Data															
			Load Calculations	1.5														
			SD-06 Test Reports															
			Panel Finish	1.6.6														
			Manufacturer's Field Inspection	3.5														
			Leakage Test Reports	1.6.6.10														
			Wind Uplift Test Reports	1.6.6.11														
			SD-07 Certificates															
			Technical Representative	1.6.2														
			Qualification of Installer	1.6.3														

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER		A C T I O N C O D E	DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	07 61 15.00 20		Coil Stock	2.1.1.5													
			SD-08 Manufacturer's Instructions														
			Sealant	2.3.3													
			Installation	3.3													
			SD-11 Closeout Submittals														
			Information Card	3.7													
			Warranty	1.8													
	07 72 33		SD-03 Product Data														
			Product Data	1.3.1													
			SD-11 Closeout Submittals														
			Warranty	1.5													
	07 84 00		SD-02 Shop Drawings														
			Firestopping System	2.1													
			SD-03 Product Data														
			Firestopping Materials	2.2													
			SD-06 Test Reports														
			Inspection	3.3													
			SD-07 Certificates														
			Inspector Qualifications	1.5.2													
			Firestopping Materials	2.2													
			Installer Qualifications	1.5.1													
	07 92 00		SD-03 Product Data														
			Sealants	2.1													
			Primers	2.2													
			Bond breakers	2.3													
			Backstops	2.4													

SUBMITTAL REGISTER

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N	DATE OF ACTION	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	07 92 00		SD-07 Certificates														
			Sealant	3.3.6													
	08 11 13		SD-02 Shop Drawings														
			Doors	2.1													
			Doors	2.1													
			Frames	2.6													
			Frames	2.6													
			Weatherstripping	2.8													
			SD-03 Product Data														
			Doors	2.1													
			Frames	2.6													
			Weatherstripping	2.8													
	08 14 00		SD-02 Shop Drawings														
			Doors	2.1													
			SD-03 Product Data														
			Doors	2.1													
			Accessories	2.2													
			Warranty	1.5													
			Sound Transmission Class	2.1.2													
			Rating														
			SD-04 Samples														
			Doors	2.1													
			Door Finish Colors	2.3.6.1													
			SD-06 Test Reports														
			Cycle-Slam	2.4													
			Hinge Loading Resistance	2.4													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION		(m)	(n)	(o)	(p)		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		08 14 00	SD-07 Certificates														
			Certificates of Grade	1.3.1													
			SD-11 Closeout Submittals														
			Warranty	1.5													
		08 31 00	SD-02 Shop Drawings														
			Access Doors And Panels	1.3													
			SD-03 Product Data														
			Access Doors And Panels	1.3													
			Hardware	1.3.2													
			Accessories	2.1.8													
			SD-04 Samples														
			Finishes	2.4													
			SD-06 Test Reports														
			Fire-rating(s) of Assemblies	1.3.1													
	08 33 23		SD-02 Shop Drawings														
			Overhead Colling Doors	2.1													
			Counterbalancing Mechanism	1.6													
			Counterbalancing Mechanism	2.3													
			Manual Door Operators	1.6													
			Manual Door Operators	2.4													
			Bottom Bar	2.1.2													
			Guides	1.5													
			Mounting Brackets	2.3.1													
			Overhead Drum	2.1.7													
			Painting	1.6													
			Installation Drawings	1.5													

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E		DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	08 33 23		SD-03 Product Data														
			Overhead Coiling Doors	2.1													
			Hardware	2.2													
			Counterbalancing Mechanism	1.6													
			Counterbalancing Mechanism	2.3													
			Manual Door Operators	1.6													
			Manual Door Operators	2.4													
			SD-05 Design Data														
			Overhead Coiling Doors	2.1													
			Hardware	2.2													
			Counterbalancing Mechanism	1.6													
			Counterbalancing Mechanism	2.3													
			Manual Door Operators	1.6													
			Manual Door Operators	2.4													
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	1.5													
			Manuals														
			Overhead Coiling Door	1.6													
			Assemblies														
			Materials	1.6													
			Devices	1.6													
			Procedures	1.6													
			Manufacture's Brochures	1.6													
			Parts Lists	1.6													
			Cleaning	3.3.2													

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER		A C T I O N C O D E	DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	08 51 13		SD-02 Shop Drawings														
			Windows	2.1													
			Fabrication Drawings	1.8													
			SD-03 Product Data														
			Windows	2.1													
			Hardware	2.2.3.1													
			Fasteners	2.2.1													
			Accessories	2.2.3													
			SD-04 Samples														
			Finish Sample	1.4.2.1													
			SD-10 Operation and Maintenance														
			Data														
			Windows	2.1													
	08 71 00		SD-02 Shop Drawings														
			Manufacturer's Detail Drawings	1.3													
			Verification of Existing Conditions	1.3													
			Hardware Schedule	1.5													
			SD-03 Product Data														
			Hardware Items	2.3													
			SD-08 Manufacturer's Instructions														
			Installation	3.1													
			SD-10 Operation and Maintenance														
			Data														
			Hardware Schedule	1.5													
	08 81 00		SD-03 Product Data														
			Insulating Glass	2.3													

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER			A C T I O N
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	08 81 00		Glazing Accessories	1.3													
			Sealants	2.4.1.1													
			Joint Backer	2.4.2													
			SD-07 Certificates														
			Insulating Glass	2.3													
			SD-08 Manufacturer's Instructions														
			Setting and Sealing Materials	2.4													
			Glass Setting	3.2													
			SD-11 Closeout Submittals														
			Insulated Glass Units	1.6.1													
	08 91 00		SD-02 Shop Drawings														
			Wall louvers	1.4													
			Wall louvers	1.5													
			SD-03 Product Data														
			Metal Wall Louvers	2.2													
	09 22 00		SD-02 Shop Drawings														
			Metal support systems	2.1													
	09 29 00		SD-03 Product Data														
			Water-Resistant Gypsum Backing Board	2.1.2													
			Accessories	2.1.5													
			Gypsum Board	2.1.1													
			SD-07 Certificates														
			Asbestos Free Materials	2.1													
	09 30 10		SD-03 Product Data														
			Porcelain Tile	2.1.1													

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER		A C T I O N C O D E	DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	09 30 10		Setting-Bed	2.2													
			Mortar, Grout, and Adhesive	2.4													
			Reinforcing Wire Fabric	2.2.6													
			SD-04 Samples														
			Tile	2.1													
			Accessories	2.1													
			Transition Strips	2.1													
			Transition Strips	2.6													
			Grout	2.4.3													
			SD-08 Manufacturer's Instructions														
			Maintenance Instructions	3.7													
			SD-10 Operation and Maintenance														
			Data														
			Installation	3.2													
	09 51 00		SD-02 Shop Drawings														
			Approved Detail Drawings	2.1													
			SD-04 Samples														
			Acoustical Units	2.2													
			SD-06 Test Reports														
			Ceiling Attenuation Class and Test	2.1.1													
	09 67 23.13		SD-02 Shop Drawings														
			Installation Drawings	2.1													
			SD-03 Product Data														
			Manufacturer's Catalog Data	1.2.1													
			SD-04 Samples														

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE FWD TO OTHER REVIEWER	DATE RCD FROM CONTR	DATE RCD FROM OTH REVIEWER		A C T I O N	DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	09 67 23.13		Hardboard Mounted Epoxy	1.5.2													
			Flooring														
			Floor Topping	3.1.4													
			SD-05 Design Data														
			Design Mix Data	1.2.2													
			SD-07 Certificates														
			Listing of Product Installations	1.5.1													
			Referenced Standards	1.5													
			Certificates														
			SD-11 Closeout Submittals														
			Warranty	1.6													
	09 90 00		SD-03 Product Data														
			Materials	2.1													
			Coating	2.1													
			Manufacturer's Technical Data	2.1													
			Sheets														
			SD-04 Samples														
			Color	1.8													
			SD-07 Certificates														
			Applicator's qualifications	1.3													
			SD-08 Manufacturer's Instructions														
			Application instructions	3.2.1													
			Mixing	3.5.2													
			Manufacturer's Material Safety	1.6.2													
			Data Sheets														

SUBMITTAL REGISTER

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N	DATE OF ACTION		DATE FWD TO OTHER REVIEWER	RCD FROM OTH REVIEWER	DATE OF ACTION			
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	09 90 00		SD-10 Operation and Maintenance Data														
			Coatings:	2.1													
	10 14 00.20		SD-02 Shop Drawings														
			Detail Drawings	1.3.2													
			SD-03 Product Data														
			Installation	3.1													
			Warranty	1.5													
			SD-04 Samples														
			Interior Signage	1.3.1													
			Approved Manufacturer's Instructions	3.1													
			Protection and Cleaning	3.1.2													
	10 28 13		SD-03 Product Data														
			Finishes	2.1.2													
			Accessory Items	2.2													
			SD-04 Samples														
			Finishes	2.1.2													
			Accessory Items	2.2													
			SD-07 Certificates														
			Accessory Items	2.2													
			SD-10 Operation and Maintenance														
			Data														
			Electric Hand Dryer	2.2.10													
	11 24 24		SD-01 Preconstruction Submittals														
			Experience Information	1.4													

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER		A C T I O N C O D E	DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	11 24 24		SD-02 Shop Drawings	1.1													
			Fall Protection System														
			SD-03 Product Data														
			Product Data	1.4													
			System Components	2.4													
			Fasteners	2.2													
			SD-10 Operation and Maintenance														
			Data														
			Operations and Maintenance	3.2													
			Manuals														
			SD-11 Closeout Submittals														
			Installation Certificate	3.3													
12 24 13			SD-02 Shop Drawings														
			Detailed Drawings	3.3													
			Location Schedule	2.1													
			SD-03 Product Data														
			Window Shades	2.1													
			SD-04 Samples														
			Window Shades	2.1													
			SD-06 Test Reports														
			Flammability Requirements	1.3.2													
			SD-07 Certificates														
			Qualifications	1.3.1.1													
			SD-10 Operation and Maintenance														
			Data														
			Window Shades	2.1													

SUBMITTAL REGISTER

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N	DATE OF ACTION		DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	21 13 13		SD-01 Preconstruction Submittals	1.2.3													
			Qualified Fire Protection Engineer (QFPE)														
			Sprinkler System Designer	1.4.2.1													
			Sprinkler System Installer	1.4.2.2													
			SD-02 Shop Drawings														
			Shop Drawing	1.2.1.1													
			SD-03 Product Data														
			Pipe	2.2.1													
			Fittings	2.3.1.2													
			Valves	2.3.5													
			Relief Valves	2.8.5													
			Sprinklers	2.7													
			Pipe Hangers and Supports	2.3.4													
			Sprinkler Alarm Switch	2.4.1													
			Valve Supervisory (Tamper)	2.4.2													
			Switch														
			Fire Department Connection	2.6													
			Backflow Prevention Assembly	2.5													
			Air Vent	2.8.6													
			Hose Valve	2.5.1													
			Nameplates	2.1.2													
			SD-05 Design Data														
			Hydraulic Calculations	1.2.1.2													
			SD-06 Test Reports														
			Test Procedures	3.7.1													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N	DATE OF ACTION		DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	21 13 13		SD-07 Certificates														
			Verification of Compliant	3.7.2.1													
			Installation														
			Request for Government Final	3.7.2.2													
			Test														
			SD-10 Operation and Maintenance														
			Data														
			Operating and Maintenance	3.9													
			(O&M) Instructions														
			Spare Parts	1.6													
			SD-11 Closeout Submittals														
			As-built drawings	3.9													
	21 13 16		SD-01 Preconstruction Submittals														
			Qualified Fire Protection Engineer	1.2.4													
			(QFPE)														
			Sprinkler System Designer	1.4.2.1													
			Sprinkler System Installer	1.4.2.2													
			Nitrogen Generation System	1.4.2.3													
			Commissioning Technician														
			SD-02 Shop Drawings														
			Shop Drawing	1.2.1.1													
			SD-03 Product Data														
			Pipe	2.2.1.1													
			Fittings	2.2.1.2													
			Valves	2.2.3													
			Relief Valves	2.9.5													

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E	DATE OF ACTION	DATE FWD TO APPR AUTH/	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER		A C T I O N C O D E	DATE OF ACTION
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	21	13	16														
			Sprinklers	2.8													
			Pipe Hangers and Supports	2.2.2													
			Sprinkler Alarm Switch	2.5.1													
			Valve Supervisory (Tamper)	2.5.3													
			Switch														
			Fire Department Connection	2.7													
			Backflow Prevention Assembly	2.6													
			High/Low-Nitrogen Pressure	2.5.2													
			Supervisory Switch														
			Nitrogen Generation System	1.4.2.3													
			Nameplates	2.1.2													
			Dry Pipe Valve	2.3													
			SD-05 Design Data														
			Hydraulic Calculations	1.2.1.2													
			SD-06 Test Reports														
			Test Procedures	3.6.1													
			SD-07 Certificates														
			Verification of Compliant	3.6.2.1													
			Installation														
			Request for Government Final	3.6.2.2													
			Test														
			SD-10 Operation and Maintenance														
			Data														
			Operating and Maintenance	3.8													
			(O&M) Instructions														
			Spare Parts	1.6													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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	21 13 16		SD-11 Closeout Submittals														
			As-built drawings	3.8													
	22 00 00		SD-02 Shop Drawings														
			Plumbing System	3.8.1													
			SD-03 Product Data														
			Fixtures	2.4													
			Flush valve water closets	2.4.2													
			Wall hung lavatories	2.4.3													
			Countertop lavatories	2.4.4													
			Service sinks	2.4.5													
			Drinking-water coolers	2.4.6													
			Pumps	2.8													
			Backflow prevention assemblies	3.8.1.1													
			Shower Faucets	2.6.2													
			Welding	1.5.1													
			Vibration-Absorbing Features	3.4													
			Plumbing System	3.8.1													
			SD-06 Test Reports														
			Tests, Flushing and Disinfection	3.8													
			Test of Backflow Prevention Assemblies	3.8.1.1													
			Prefunctional Construction	3.12.1													
			Checklists														
			SD-07 Certificates														
			Materials and Equipment	1.3													
			Bolts	2.1.1													

SUBMITTAL REGISTER

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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	22 00 00		SD-10 Operation and Maintenance Data														
			Plumbing System	3.8.1	G												
	23 05 93		SD-02 Shop Drawings	1.4.2													
			TAB Schematic Drawings	1.4.2													
			Report Forms														
			SD-03 Product Data														
			Equipment and Performance	1.3													
			Data														
			Calibration	1.5.1.1													
			TAB procedures	1.5.1.1													
			TAB verification	1.5.2.3													
			SD-06 Test Reports														
			Pre-Final DALT Report	3.3.5													
			Final DALT report	3.3.8													
			SD-07 Certificates														
			Independent TAB agency and personnel qualifications	1.5.1													
			Advance Notice of Final DALT	3.3.2													
			Field Work														
	23 07 00		SD-03 Product Data														
			Piping insulation	2.1													
			Piping insulation finishes	2.1.7													
			Heating, ventilating, and air conditioning systems insulation	2.2													
			Duct insulation finishes	2.2.3													

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
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	23 07 00		Accessory materials	2.5													
			Adhesives, sealants, and coating compounds	2.4													
	23 09 23.13		SD-02 Shop Drawings														
			Control System Drawings Title Sheet	1.4.1.1													
			List of I/O Points	1.4.1.2													
			Control System Components List	1.4.1.3													
			Control System Schematics	1.4.1.4													
			HVAC Equipment Control Ladder Diagrams	1.4.1.5													
			Component Wiring Diagrams	1.4.1.6													
			Terminal Strip Diagrams	1.4.1.7													
			BACnet Communication	1.4.1.8													
			Architecture Schematic (Network Riser)														
			Sequence of Operations	3.5.8													
			Control Panel Layout	1.4.1.8													
			SD-03 Product Data														
			Direct Digital Controllers	2.1.3													
			BACnet Gateways	2.1.3.12													
			Notebook Computer Software	2.1.6													
			BACnet Operator Workstation	2.1.6.2													
			Notebook Computer	2.1.5													
			Sensors and Input Hardware	2.2													
			Output Hardware	2.3													

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION										CONTRACTOR							
20-0075 Repair BEQ FC530																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
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	23 09 23.13		Surge and Transient Protection	2.4.2													
			Duct smoke detectors	2.5.1													
			Variable Frequency (Motor) Drives	2.6													
			SD-05 Design Data														
			Performance Verification Testing	3.5.2													
			Plan														
			SD-06 Test Reports														
			Performance Verification Testing	3.5.11													
			Report														
			Bus Waveform Report	3.5.12													
			Pre-Performance Verification	3.5.4													
			Testing Checklist														
			SD-07 Certificates														
			Contractor's Qualifications	1.6.6													
			Contractor's Training	3.6.1													
			Certifications														
			SD-10 Operation and Maintenance														
			Data														
			BACnet Direct Digital Control	1.4													
			Systems														
			Controls System Operators	3.4													
			Manuals														
			VFD Service Manuals	2.6.2													
			SD-11 Closeout Submittals														
			Training Documentation	3.6.1													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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	23 52 43.00 20		SD-02 Shop Drawings															
			Fuel Train	2.2.1														
			SD-03 Product Data															
			Boilers	2.1														
			Boiler Trim and Control Equipment	2.3														
			Burners and Control Equipment	2.2														
			Stack, Breeching, and Supports	2.3.15														
			Direct Vent	2.4.5.1														
			Boiler Circulating Pumps	2.6														
			Expansion Tank	2.7.1														
			Air Separator	2.7.2														
			SD-06 Test Reports															
			Operational Tests	3.4.1														
			SD-07 Certificates															
			Boilers	2.1														
			Burners and Control Equipment	2.2														
			Boiler Trim and Control Equipment	2.3														
			SD-08 Manufacturer's Instructions															
			Boilers	2.1														
			Feedwater Treatment Feeder	2.3.7														
			SD-10 Operation and Maintenance															
			Data															
			Boilers	2.1														
			SD-11 Closeout Submittals															

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
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		23 52 43.00 20	Boilers	2.1													
		23 73 33	SD-02 Shop Drawings														
			Temperature control systems	1.3.1													
			Equipment layout drawings	1.3.2													
			SD-03 Product Data														
			Dedicated Outside Air Unit	2.1.1													
			Mini-Split heat pumps	2.1.3													
			Air-handling units	2.1.4													
			Air-cooled water chillers	2.1.5													
			Packaged terminal heat pumps	2.1.6													
			Unit heaters	2.1.7													
			Pumps	2.1.8													
			Exhaust fans	2.1.9													
			Fire dampers	2.3.7													
			Expansion tanks	2.5.9													
			Buffer tanks	2.5.10													
			Dirt-Air separators	2.5.11													
			Heat tape	2.6													
			Pipe hangers and supports	2.5.1													
			Flexible pipe connectors	2.5.7													
			Dampers	2.3.3													
			Diffusers, registers, and grilles	2.3.4													
			Outside air intake louvers	2.3.5													
			Flexible round ducts	2.3.8													
			Valves	2.4.7													
			Pipe and fittings	2.4													

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
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	23 73 33		Dehumidifiers	2.1.2													
			SD-06 Test Reports														
			Air-handling units	2.1.4													
			Air-cooled water chillers	2.1.5													
			SD-07 Certificates														
			Certification of welders' qualifications	1.3.4													
			Equipment field test plans	1.3.5													
			SD-08 Manufacturer's Instructions														
			Installation manual	1.3.3													
			SD-10 Operation and Maintenance														
			Data														
			Mini-Split heat pumps	2.1.3													
			Air-handling units	2.1.4													
			Air-cooled water chillers	2.1.5													
			Packaged terminal heat pumps	2.1.6													
			Unit heaters	2.1.7													
			Pumps	2.1.8													
			Exhaust fans	2.1.9													
			Fire dampers	2.3.7													
			SD-11 Closeout Submittals														
			Air-cooled water chillers	2.1.5													
			Air filter inventory	1.3.6													
	26 08 00		SD-06 Test Reports														
			Acceptance tests and inspections	3.1													
			SD-07 Certificates														

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
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	26 08 00		Qualifications	1.3.1													
			Acceptance test and inspections procedure	1.3.3													
	26 12 19.10		SD-02 Shop Drawings														
			Pad-mounted transformer	1.4.1	G												
			drawings														
			SD-03 Product Data														
			Pad-mounted transformers	2.2	G												
			SD-06 Test Reports														
			Acceptance checks and tests	3.5.1													
			SD-07 Certificates														
			Transformer losses	1.4.2													
			SD-09 Manufacturer's Field Reports														
			design tests	2.5.2													
			routine and other tests	2.5.3													
			SD-10 Operation and Maintenance														
			Data														
			Transformer(s)	1.5.1	G												
			SD-11 Closeout Submittals														
			Transformer test schedule	2.5.1													
	26 20 00		SD-02 Shop Drawings														
			Panelboards	2.11	G												
			SD-03 Product Data														
			Receptacles	2.10	G												
			Circuit breakers	2.11.2	G												

SUBMITTAL REGISTER										CONTRACT NO.												
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR												
(a)	(b)	(c)	(d)	P A R A G R A P H # A A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS							
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	26 20 00		Switches	2.9	G																	
			Motor controllers	2.13	G																	
			Manual motor starters	2.14																		
			Surge protective devices	2.18	G																	
			SD-06 Test Reports																			
			600-volt wiring test	3.2.2																		
			Grounding system test	3.2.4																		
			Ground-fault receptacle test	3.2.3																		
			SD-07 Certificates																			
			Fuses	2.12																		
			SD-10 Operation and Maintenance																			
			Data																			
			Electrical Systems	1.4.1	G																	
	26 27 14.00 20		SD-02 Shop Drawings																			
			Installation Drawings	1.4.1																		
			SD-03 Product Data																			
			Electricity meters	2.1.4																		
			Current transformer	2.1.3																		
			Potential transformer	2.1.2																		
			communications	2.2																		
			Configuration Software	3.1.2																		
			SD-06 Test Reports																			
			Acceptance checks and tests	3.2.1																		
			System functional verification	3.2.2																		
			Building meter installation sheet,	3.2.1																		
			per building																			

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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		26 27 14.00 20	Completed meter installation schedule	3.2.1														
			Completed meter data schedule	3.2.1														
			Meter configuration template	2.1.1														
			Meter configuration report	3.2.1														
			SD-10 Operation and Maintenance															
			Data															
			Electricity Meters and Accessories	1.5.1														
			SD-11 Closeout Submittals															
			System functional verification	3.2.2														
	26 41 00		SD-02 Shop Drawings															
			Overall lightning protection system	1.4.1.1														
			Each major component	1.4.1.2														
			SD-06 Test Reports															
			Lightning Protection and Grounding System Test Plan	1.4.3														
			Lightning Protection and Grounding System Test	3.4.1														
			SD-07 Certificates															
			Lightning Protection System	1.2.3														
			Installers Documentation															
			Component UL Listed and Labeled	1.4.2														

SUBMITTAL REGISTER

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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	26 41 00		Lightning protection system inspection certificate	1.4.4														
			Roof manufacturer's warranty	3.1.1														
	26 51 00.00 22		SD-01 Preconstruction Submittals															
			LED Luminaire Warranty	1.7.1														
			SD-02 Shop Drawings															
			LED Luminaire drawings	1.6.1.1	G													
			SD-03 Product Data															
			LED luminaires	2.1	G													
			Exit signs	2.5	G													
			Emergency lighting equipment	2.6	G													
			Occupancy sensors	2.8	G													
			SD-06 Test Reports															
			LED Luminaire - IESNA LM-79	1.6.2														
			Test Report															
			LED Light Source - IESNA LM-80	1.6.3														
			Test Report															
			Operating test	3.3														
			SD-07 Certificates															
			Luminaire Useful Life Certificate	1.7.1														
			SD-10 Operation and Maintenance															
			Data															
			Lighting Control System	1.4.1	G													
	26 56 00		SD-02 Shop Drawings															
			Luminaire Drawings	1.5.1.1	G													

SUBMITTAL REGISTER										CONTRACT NO.							
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	26 56 00		Control System One-Line Diagram	1.7.2	G												
			SD-03 Product Data														
			Luminaires	2.2	G												
			Light Sources	2.3	G												
			LED Drivers	2.4	G												
			Luminaire Warranty	1.6.1	G												
			Lighting Controls Warranty	1.6.2	G												
			Photosensors	2.5.1.2	G												
			Time Clock	2.5.1.1	G												
			Lighting Contactor	2.5.1.3	G												
			SD-05 Design Data														
			Luminaire Design Data	1.5.2	G												
			SD-06 Test Reports														
			IES LM-79 Test Report	1.5.3	G												
			IES LM-80 Test Report	1.5.4	G												
			IES TM-21 Test Report	1.5.5	G												
			SD-10 Operation and Maintenance														
			Data														
			Lighting System	1.7.1	G												
			Exterior Lighting Control System	1.7.2	G												
			Maintenance Staff Training Plan	3.3.1.1	G												
			End-User Training Plan	3.3.1.2	G												
	27 10 00		SD-02 Shop Drawings														
			Telecommunications drawings	1.6.1.1	G												

SUBMITTAL REGISTER

CONTRACT NO.

CONTRACTOR																	
TITLE AND LOCATION			CONTRACTOR														
ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH#	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
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		27 10 00	Telecommunications Space Drawings	1.6.1.2	G												
			SD-03 Product Data														
			Telecommunications cabling	2.4	G												
			Patch panels	2.5.6	G												
			Telecommunications outlet/connector assemblies	2.6	G												
			Equipment support frame	2.5.2	G												
			Connector blocks	2.5.3	G												
			SD-06 Test Reports														
			Telecommunications cabling testing	3.5.1	G												
			SD-07 Certificates														
			Telecommunications Contractor	1.6.2.1	G												
			Key Personnel	1.6.2.2	G												
			Manufacturer Qualifications	1.6.2.3	G												
			Test plan	1.6.3	G												
			SD-09 Manufacturer's Field Reports														
			Factory reel tests	2.13.1	G												
			SD-10 Operation and Maintenance Data														
			Telecommunications cabling and pathway system	1.10.1	G												
			SD-11 Closeout Submittals														
			Record Documentation	1.10.2	G												

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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	28 31 76.00 22		SD-01 Preconstruction Submittals	1.6.1.1	G													
			Qualifications for Fire Alarm	1.6.1.1	G													
			System Subcontractor															
			On Staff Fire Alarm System	1.6.1.1.1	G													
			Designer(s)															
			Supervising Fire Alarm	1.6.1.1.2	G													
			Technician															
			Installing Technicians	1.6.1.1.3	G													
			Testing Personnel	1.6.1.1.4	G													
			SD-02 Shop Drawings															
			Wiring Diagrams	3.2.1	G													
			System Layout	1.4.1	G													
			System Operation	2.23	G													
			Notification Appliances	2.14	G													
			Amplifiers	2.5	G													
			As-Built Drawings	3.5.2														
			SD-03 Product Data															
			Technical Data And Computer	1.4.2														
			Software															
			Fire alarm control unit	2.3														
			Autonomous control unit	2.3														
			Local operating consoles	2.4														
			Amplifiers	2.5														
			Digitalized voice generators	2.5														
			Digitalized voice generators	2.5														

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
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	28 31 76.00 22		Supplementary notification	2.6													
			appliance circuit panel														
			Auxiliary power supply panel	2.7													
			Digital alarm communicator	2.8.1													
			transmitter (DACT)														
			Batteries	2.9.1													
			Battery chargers	2.9.2													
			Wiring	2.10													
			Surge protection	2.11													
			Ceiling bridges	2.12													
			Back boxes and conduit	2.13													
			Notification appliances	2.14													
			Addressable monitor module	2.15													
			Addressable control/relay module	2.16													
			Manual stations	2.17													
			Smoke detectors	2.18													
			Heat detector	2.19	G												
			Waterflow switches	2.20													
			Tamper switches	2.21													
			Environmental enclosures or guards	2.22													
			Manufacturer's installation and maintenance manuals	1.8													
			SD-05 Design Data														
			System Operation		G												
			SD-06 Test Reports	2.23													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY			MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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	28 31 76.00 22		Field Quality Control	3.5													
			Testing Procedures	3.5.1													
			Smoke detector testing	2.18.2													
			Heat detector testing	2.19.6													
			SD-09 Manufacturer's Field Reports														
			Combination emergency communications system panel	2.3													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance (O&M) Instructions	1.8													
			Instruction of Government Employees	3.6													
	31 11 00		SD-03 Product Data														
			Tree Wound Paint	2.1.1													
	31 23 00.00 20		SD-01 Preconstruction Submittals														
			Shoring and Sheeting Plan	1.7.1													
			Dewatering work plan	1.7.2													
			SD-06 Test Reports														
			Borrow Site Testing	1.6													
			Fill and backfill	3.13.2.1													
			Select material	3.13.2.2													
			Porous fill	3.13.2.3													
			Density tests	3.13.2.4													
			Moisture Content Tests	3.13.2.5													

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION		CONTRACTOR															
20-0075 Repair BEQ FC530																	
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
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	32 31 13.53		SD-02 Shop Drawings														
			Fence Installation Drawings	3.2.1													
			SD-03 Product Data														
			Posts	2.1.2.1													
			Sleeves	3.2.3.2													
			Latches	2.1.2.1													
			Latches	3.2.4													
			Hinges	2.1.2.1													
			Stops	3.2.4													
			Keepers	3.2.4													
			Ornamental Fence Systems	2.1.1													
			Swing Gates	2.1.2.1													
			SD-07 Certificates														
			Gate Hardware and Accessories	3.2.1													
			Concrete	2.2.1													
	33 11 00		SD-01 Preconstruction Submittals														
			Connections	3.1.1													
			SD-03 Product Data														
			Pipe, Fittings, Joints and Couplings	2.1.1													
			Valves	2.1.2													
			Valve Boxes	2.1.2.5													
			Pipe Restraint	2.2.1													
			Corporation Stops	2.2.6.1													
			Backflow Preventer	1.4.2.1.1													
			Disinfection Procedures	3.2.4													

SUBMITTAL REGISTER

TITLE AND LOCATION

20-0075 Repair BEQ FC530

CONTRACTOR

A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/	APPROVING AUTHORITY				MAILED TO CONTR/	DATE RCD FRM APPR AUTH	REMARKS
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	33 11 00		Enclosure	2.1.4.1														
			Meters	3.2.2														
			SD-06 Test Reports															
			Backflow Preventer Tests	3.3.1.5														
			Bacteriological Samples	3.3.1.4														
			Leakage Test	3.3.1.3														
			Hydrostatic Test	3.3.1.1														
			SD-07 Certificates															
			Pipe, Fittings, Joints and	2.1.1														
			Couplings															
			Lining	2.1.1.1.1														
			Lining	2.1.1.1.1														
			Lining for Fittings	2.1.1.2.1.2														
			Valves	2.1.2														
			Backflow Prevention Training	1.4.2.1.1.2														
			Certificate															
			Backflow Tester	1.4.2.1.1.1														
			Turbine Type Meters	2.1.3.1														
			SD-08 Manufacturer's Instructions															
			Ductile Iron Piping	2.1.1.1														
			PVC Piping	2.1.1.2.1.1														
			PVC Piping For Service Lines	2.1.1.2.2														
	33 30 00		SD-01 Preconstruction Submittals															
			Contractor's License	1.3.1														
			SD-02 Shop Drawings															
			Installation Drawings	3.1.1														

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
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	33 30 00		SD-03 Product Data														
			Gravity Pipe	2.2.1													
			SD-07 Certificates														
			Portland Cement	2.2.2													
	33 40 00		SD-03 Product Data														
			Pipe	2.1													
			SD-07 Certificates														
			Resin Certification	2.1.1													
			Leakage Test	3.5.1.2													
			Hydrostatic Test on Watertight Joints	3.5.1.1													
			Determination of Density	3.5.1.3													
			Placing Pipe	3.3													
	33 71 02		SD-03 Product Data														
			Medium voltage cable	2.5	G												
			Medium voltage cable joints	2.7	G												
			Medium voltage cable terminations	2.6	G												
			Precast concrete structures	2.12	G												
			Cable supports	2.13	G												
			SD-06 Test Reports														
			Arc-proofing test	2.15.1													
			Arc-proofing test	2.15.1													
			Medium voltage cable qualification and production tests	2.15.2													

SUBMITTAL REGISTER										CONTRACT NO.							
TITLE AND LOCATION 20-0075 Repair BEQ FC530										CONTRACTOR							
A C T I V I T Y N O	T R A N S M I T T A L N O	S P E C S E C T	DESCRIPTION ITEM SUBMITTED	P A R A G R A P H	G O V T C L A S S I F I C A T I O N	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS	
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	33 71 02		Field Acceptance Checks and Tests	3.14.1													
			Cable Installation Plan and Procedure	3.3													
			SD-07 Certificates														
			Cable splicer/terminator	1.4.1													
			Cable Installer Qualifications	1.4.2													
	33 82 00		SD-02 Shop Drawings														
			Telecommunications Outside Plant	1.6.1.1	G												
			Telecommunications Entrance Facility Drawings	1.6.1.2	G												
			SD-03 Product Data														
			Wire and cable	2.8	G												
			Cable splices, and connectors	2.5	G												
			Closures	2.3	G												
			Building protector assemblies	2.2.1	G												
			Protector modules	2.2.2	G												
			Cross-connect terminal cabinets	2.4	G												
			Spare Parts	1.8.2	G												
			SD-06 Test Reports														
			Pre-installation tests	3.4.1	G												
			Acceptance tests	3.4.2	G												
			Outside Plant Test Plan	1.6.3	G												
			SD-07 Certificates														
			Telecommunications Contractor	1.6.2.1	G												

SECTION 01 35 29

SAFETY AND OCCUPATIONAL HEALTH REQUIREMENTS

06/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z359.1 (1992; R 1999) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components

ASME INTERNATIONAL (ASME)

ASME B30.3 (1996) Construction Tower Cranes

ASME B30.5 (2000) Mobile and Locomotive Cranes

ASME B30.8 (2000) Floating Cranes and Floating Derricks

ASME B30.22 (2000) Articulating Boom Cranes

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10 (2013) Standard for Portable Fire Extinguishers

NFPA 241 (2013; Errata 2015) Standard for Safeguarding Construction, Alteration, and Demolition Operations

NFPA 51B (2003) Fire Prevention During Welding, Cutting, and Other Hot Work

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

NFPA 70E (2018; TIA 18-1; TIA 81-2) Standard for Electrical Safety in the Workplace

U. S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1910.94	Ventilation
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.500	Fall Protection

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00
SUBMITTAL PROCEDURES:

1.3 DEFINITIONS

- a. Associate Safety Professional (ASP). An individual who is currently certified by the Board of Certified Safety Professionals.
- b. Certified Construction Health & Safety Technician (CHST). An individual who is currently certified as a CHST by the Board of Certified Safety Professionals.
- c. Certified Industrial Hygienist (CIH). An individual who is currently certified as a CIH by the American Board of Industrial Hygiene.
- d. Certified Safety Professional (CSP). An individual who is currently certified as a CSP by the Board of Certified Safety Professionals.
- e. Certified Safety Trained Supervisor (STS). An individual who is currently certified as an STS by the Board of Certified Safety Professionals.
- f. Competent Person for Fall Protection. A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as their application and use with related equipment, and has the authority to take prompt corrective measures to eliminate the hazards of falling.
- g. High Visibility Accident. Any mishap which may generate publicity and/or high visibility.
- h. Low-slope roof. A roof having a slope less than or equal to 4 in 12 (vertical to horizontal).
- i. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even though provided by a physician or registered personnel.

j. Multi-Employer Work Site (MEWS). A multi-employer work site, as defined by OSHA, is one in which many employers occupy the same site. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors.

k. Operating Envelope. The area surrounding any crane. Inside this "envelope" is the crane, the operator, riggers, rigging gear between the hook and the load, the load and the crane's supporting structure (ground, rail, etc.).

l. Qualified Person for Fall Protection. A person with a recognized degree or professional certification, extensive knowledge, training and experience in the field of fall protection who is capable of performing design, analysis, and evaluation of fall protection systems and equipment.

m. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:

- (1) Death, regardless of the time between the injury and death, or the length of the illness;
- (2) Days away from work;
- (3) Restricted work;
- (4) Transfer to another job;
- (5) Medical treatment beyond first aid;
- (6) Loss of consciousness; or
- (7) A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

n. Site Safety and Health Officer (SSHO). The superintendent or other qualified or competent person who is responsible for the on-site safety and health required for the project.

o. Steep roof. A roof having a slope greater than 4 in 12 (vertical to horizontal).

p. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.

q. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the six elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; and collision, including unplanned contact between the load, crane, and/or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.).

1.4 CONTRACTOR SAFETY SELF-EVALUATION CHECKLIST

Contracting Officer will provide a "Contractor Safety Self-Evaluation checklist" to the Contractor at the pre-construction conference. The checklist will be completed monthly by the Contractor and submitted with each request for payment voucher. An acceptable score of 90 or greater is required. Failure to submit the completed safety self-evaluation checklist or achieve a score of at least 90, will result in a retention of up to 10 percent of the voucher.

1.5 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, work performed shall comply with USACE EM 385-1-1, and the following laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.6 DRUG PREVENTION PROGRAM

Conduct a proactive drug and alcohol use prevention program for all workers, prime and subcontractor, on the site. Ensure that no employee uses illegal drugs or consumes alcohol during work hours. Ensure there are no employees under the influence of drugs or alcohol during work hours. After accidents, collect blood, urine, or saliva specimens and test the injured and involved employees for the influence of drugs and alcohol. A copy of the test shall be made available to the Contracting Officer upon request.

1.7 SITE QUALIFICATIONS, DUTIES AND MEETINGS

1.7.1 Personnel Qualifications

Work performed under this contract shall meet Level 2.

1.7.1.1 Site Safety and Health Officer (SSHO)

Site Safety and Health Officer (SSHO) shall be provided at the work site at all times to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The SSHO shall meet the following requirements:

Level 1:

- Worked on similar projects.
- 10-hour OSHA construction safety class or equivalent within last 3 years.
- Competent person training as needed.

Level 2:

- A minimum of 3 years safety work on similar project.
- 30-hour OSHA construction safety class or equivalent within last 3 years.
- Competent person training as needed.

Level 3:

- A minimum of 5 years safety work on similar projects.

30-hour OSHA construction safety class or equivalent within the last 5 years.

An average of at least 24 hours of formal safety training each year for the past 5 years.

Competent person training as needed.

Level 4:

A minimum of 10 years safety work of a progressive nature with at least 5 years of experience on similar projects.

30-hour OSHA construction safety class or equivalent within the last 5 years.

An average of at least 24 hours of formal safety training each year for the past 5 years with training for competent person status for at least the following areas of competency: Excavation; Scaffolding; Fall protection; Hazardous energy; Confined space; Health hazard recognition, evaluation and control of chemical, physical and biological agents; Personal protective equipment and clothing to include selection, use and maintenance.

Level 5:

An Associate Safety Professional (ASP), Certified Safety Trained Supervisor (STS) and/or Construction Health & Safety Technician (CHST).

A minimum of 10 years safety work of a progressive nature with at least 5 years of experience on similar projects.

30-hour OSHA construction safety class or equivalent within the last 5 years.

An average of at least 24 hours of formal safety training each year for the past 5 years with training for competent person status for at least the following areas of competency: Excavation; Scaffolding; Fall protection; Hazardous energy; Confined space; Health hazard recognition, evaluation and control of chemical, physical and biological agents; Personal protective equipment and clothing to include selection, use and maintenance.

Level 6: A

Certified Safety Professional (CSP) and/or Certified Industrial Hygienist (CIH).

A minimum of 10 years safety work of a progressive nature with at least 5 years of experience on similar projects.

30-hour OSHA construction safety class or equivalent within the last 5 years.

An average of at least 24 hours of formal safety training each year for the past 5 years with training for competent person status for at least the following areas of competency: Excavation; Scaffolding; Fall protection; Hazardous energy; Confined space; Health hazard recognition, evaluation and control of chemical, physical and biological agents; Personal protective equipment and clothing to include selection, use and maintenance.

1.7.1.2 Certified Safety Professional (CSP) and/or Certified Industrial hygienist (CIH)

Provide a Certified Safety Professional (CSP) and/or Certified Industrial Hygienist (CIH) at the work site to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The CSP and/or CIH shall be the safety and occupational health "competent person" as defined by USACE EM 385-1-1. The CSP and/or CIH shall have no other duties than safety and occupational health

management, inspections, and/or industrial hygiene.

1.7.1.3 Associate Safety professional (ASP), Certified Safety Trained Supervisor (STS) and/or Construction Health and Safety Technician (CHST).

Provide an Associate Safety Professional (ASP); Certified Safety Trained Supervisor (STS); and/or Construction Health & Safety Technician (CHST) at the work site to perform safety management, surveillance, inspections, and safety enforcement for the Contractor to meet the designated safety level in paragraph 1.6.1. The ASP, STS, and/or CHST shall be the safety and occupational health "competent person" as defined by USACE EM 385-1-1. The ASP, STS, and/or CHST shall be at the work site at all times whenever work or testing is being performed and shall conduct and document daily safety inspections. The ASP, STS, and/or CHST shall have no other duties other than safety and occupational health management, inspections, and enforcement on this contract.

1.7.1.4 Competent Person for Confined Space Entry

Provide a competent person meeting the requirements of EM 385-1-1 who is assigned in writing by the Designated Authority to assess confined spaces and who possesses demonstrated knowledge, skill and ability to:

- a. Identify the structure, location, and designation of confined and permit-required confined spaces where work is done;
- b. Calibrate and use testing equipment including but not limited to, oxygen indicators, combustible gas indicators, carbon monoxide indicators, and carbon dioxide indicators, and to interpret accurately the test results of that equipment;
- c. Perform all required tests and inspections specified in 29 CFR 1910.146 and 29 CFR 1915 Subpart B;
- d. Assess hazardous conditions including atmospheric hazards in confined space and adjacent spaces and specify the necessary protection and precautions to be taken;
- e. Determine ventilation requirements for confined space entries and operations;
- f. Assess hazards associated with hot work in confined and adjacent space and determine fire watch requirements; and,
- g. Maintain records required.

When the work involves marine operations that handle combustible or hazardous materials, this qualified person shall be a NFPA certified marine chemist.

1.7.1.5 Competent Person for the Health Hazard Control and Respiratory Protection Program

Provide a competent person meeting the requirements of EM 385-1-1 who is:

- a. Capable by education, specialized training and/or experience of anticipating, recognizing, and evaluating employee exposure to hazardous chemical, physical and biological agents in accordance with USACE EM 385-1-1, Section 6.

- b. Capable of specifying necessary controls and protective actions to ensure worker health.

1.7.2 Personnel Duties

1.7.2.1 Site Safety and Health Officer (SSHO)/Superintendent

- a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Safety inspection logs shall be attached to the Contractors' daily report.
- b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.
- c. Maintain applicable safety reference material on the job site.
- d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.
- e. Implement and enforce accepted APPS and AHAs.
- f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. A list of unresolved safety and health deficiencies shall be posted on the safety bulletin board.
- g. Ensure sub-contractor compliance with safety and health requirements.
- h. Ensure an approved "Special Permission Energized Electrical Work Permit" prior to starting any activity on energized electrical systems.

Failure to perform the above duties will result in dismissal of the superintendent and/or SSHO, and a project work stoppage. The project work stoppage will remain in effect pending approval of a suitable replacement.

1.7.2.2 Certified Safety Professional (CSP), Certified Industrial Hygienist (CIH), Associate Safety Professional (ASP), Certified Safety Trained Supervisor (STS), and/or Certified Construction Health & Safety Technician (CHST)

- a. Perform safety and occupational health management, surveillance, inspections, and safety enforcement for the project.
- b. Perform as the safety and occupational health "competent person" as defined by USACE EM 385-1-1.
- c. Be on site whenever work or testing is being performed.
- d. Conduct and document safety inspections.
- e. Shall have no other duties other than safety and occupational health management, inspections, and enforcement on this contract.

If the CSP, CIH, ASP, STS, CHST is appointed as the SSHO all duties of that position shall also be performed.

1.7.3 Meetings

1.7.3.1 Preconstruction Conference

a. The Contractor will be informed, in writing, of the date of the preconstruction conference. The purpose of the preconstruction conference is for the Contractor and the Contracting Officer's representatives to become acquainted and explain the functions and operating procedures of their respective organizations and to reach mutual understanding relative to the administration of the overall project's Accident Prevention Plan (APP) before the initiation of work.

b. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

c. The Contractor shall discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.

d. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Work shall not begin until there is an accepted APP.

e. The functions of a Preconstruction conference may take place at the Post-Award Kickoff meeting for Design Build Contracts.

1.7.3.2 Weekly Safety Meetings

Conduct weekly safety meetings at the project site for all employees. The Contracting Officer will be informed of the meeting in advance and be allowed attendance. Minutes showing contract title, signatures of attendees and a list of topics discussed shall be attached to the Contractors' daily report.

1.7.3.3 Work Phase Meetings

The appropriate AHA shall be reviewed and attendance documented by the Contractor at the preparatory, initial, and follow-up phases of quality control inspection. The analysis should be used during daily inspections to ensure the implementation and effectiveness of safety and health controls.

1.8 TRAINING

1.8.1 New Employee Indoctrination

New employees (prime and sub-contractor) will be informed of specific site hazards before they begin work. Documentation of this orientation shall be kept on file at the project site.

1.8.2 Periodic Training

Provide Safety and Health Training in accordance with USACE EM 385-1-1 and the accepted APP. Ensure all required training has been accomplished for all onsite employees.

1.8.3 Training on Activity Hazard Analysis (AHA)

Prior to beginning a new phase, training will be provided to all affected employees to include a review of the AHA to be implemented.

1.9 DISPLAY OF SAFETY INFORMATION

Within 1 calendar days after commencement of work, erect a safety bulletin board at the job site. The following information shall be displayed on the safety bulletin board in clear view of the on-site construction personnel, maintained current, and protected against the elements and unauthorized removal:

- a. Map denoting the route to the nearest emergency care facility.
- b. Emergency phone numbers.
- c. Copy of the most up-to-date APP.
- d. Current AHA(s).
- e. OSHA 300A Form.
- f. OSHA Safety and Health Protection-On-The-Job Poster.
- g. Hot work permit.
- h. A sign indicating the number of hours worked since last lost workday accident.
- i. Safety and Health Warning Posters.

1.10 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in the article "References." Maintain applicable equipment manufacturer's manuals.

1.11 EMERGENCY MEDICAL TREATMENT

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

1.12 HOT WORK

Prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, a written permit shall be requested from the Fire Division. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of 30 minutes after completion of the task or as specified on the hot work permit.

- a. Oil painting materials (paint, brushes, empty paint cans, etc.), and all flammable liquids shall be removed from the facility at quitting time. All painting materials and flammable liquids shall be stored outside in a suitable metal locker or box and will require re-submittal with non-hazardous materials.
- b. Accumulation of trays, paper, shavings, sawdust, boxes and other packing materials shall be removed from the facility at the close of each workday and such material disposed of in the proper containers located away from the facility.
- c. The storage of combustible supplies shall be a safe distance from structures.
- d. Area outside the facility undergoing work shall be cleaned of trash, paper, or other discarded combustibles at the close of each workday.
- e. All portable electric devices (saws, sanders, compressors, extension chord, lights, etc.) shall be disconnected at the close of each workday. When possible, the main electric switch in the facility shall be deactivated.
- f. When starting work in the facility, Contractors shall require their personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency phone number 911. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED IMMEDIATELY.
- g. Obtain services from the FIRE DIVISION for "HOT WORK" within or around flammable materials (such as fuel systems, welding/cutting on fuel pipes) or confined spaces (such as sewer wet wells, manholes, vaults, etc.) that have the potential for flammable or explosive atmospheres.

PART 2 PRODUCTS

2.1 CONFINED SPACE SIGNAGE

The Contractor shall provide permanent signs integral to or securely attached to access covers for all required confined spaces. Signs wording: "DANGER--PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER -" in bold letters a minimum of 25 mm(one inch) in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" shall be red and readable from 1.52 m(5 feet).

2.2 FALL PROTECTION ANCHORAGE

Fall protection anchorage, conforming to ANSI Z359.1, installed under the supervision of a qualified person in fall protection, shall be left in place for continued customer use and so identified by signage stating the capacity of the anchorage (strength and number of persons who may be tied-off to it at any one time).

PART 3 EXECUTION

3.1 CONSTRUCTION AND/OR OTHER WORK

The Contractor shall comply with USACE EM 385-1-1, NFPA 241, the APP, the AHA, Federal and/or State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard shall prevail.

3.1.1 Hazardous Material Use

Each hazardous material must receive approval prior to being brought onto the job site or prior to any other use in connection with this contract. Allow a minimum of 10 working days for processing of the request for use of a hazardous material. Any work or storage involving hazardous chemicals or materials must be done in a manner that will not expose Government or Contractor employees to any unsafe or unhealthful conditions. Adequate protective measures must be taken to prevent Government or Contractor employees from being exposed to any hazardous condition that could result from the work or storage. The Prime Contractor shall keep a complete inventory of hazardous materials brought onto the work-site. Approval by the Contracting Officer of protective measures and storage area is required prior to the start of the work.

3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials.

3.1.3 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos. If additional material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

Contractors are required to apply for utility outages at least 15 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Contracting Officer to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

3.3 FALL HAZARD PROTECTION AND PREVENTION

The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and escape procedures.

3.3.1 Training

The Contractor shall institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, the Contractor shall provide training for each employee who might be exposed to fall hazards. A competent person for fall protection shall provide the training. Training requirements shall be in accordance with USACE EM 385-1-1, section 21.A.16.

3.3.2 Fall Protection Equipment

The Contractor shall enforce use of the fall protection equipment designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is on a surface 1.8 m(6 feet) or more above lower levels. Fall protection systems such as guardrails, personnel fall arrest system, safety nets, etc., are required when working within 1.8m (6 feet) of any leading edge. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, paragraphs 05.I. and 05.J. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems may be required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M and USACE EM 385-1-1.

3.3.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ANSI Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest

system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabiners shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 1.8 m (6 feet). The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

3.3.3 Fall Protection for Roofing Work

Fall protection controls shall be implemented based on the type of roof being constructed and work being performed. The roof area to be accessed shall be evaluated for its structural integrity including weight-bearing capabilities for the projected loading.

a. Low Sloped Roofs:

(1) For work within 1.8 m (6 feet) of an edge, on low-slope roofs, personnel shall be protected from falling by use of personal fall arrest systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized.

(2) For work greater than 1.8 m (6 feet) from an edge, warning lines shall be erected and installed in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

b. Steep Roofs: Work on steep roofs requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also includes residential or housing type construction.

3.3.4 Safety Nets

If safety nets are used as the selected fall protection system on the project, they shall be provided at unguarded workplaces, leading edge work or when working over water, machinery, dangerous operations and or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors, fall arrest systems or restraint/positioning systems are impractical. Safety nets shall be tested immediately after installation with a drop test of 181.4 kg (400 pounds) dropped from the same elevation a person might fall, and every six months thereafter.

3.3.5 Existing Anchorage

Existing anchorages, to be used for attachment of personal fall arrest equipment, shall be certified (or re-certified) by a qualified person for fall protection in accordance with ANSI Z359.1. Existing horizontal lifeline anchorages shall be certified (or re-certified) by a registered professional engineer with experience in designing horizontal lifeline systems.

3.3.6 Horizontal Lifelines

Horizontal lifelines shall be designed, installed, certified and used under the supervision of a qualified person for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

3.3.7 Guardrail Systems

Guardrails shall consist of top and mid-rails, post and toe boards. The top edge height of standard railing must be 42 inches plus or minus 3 inches above the walking/working level. When mid-rails are used, they must be installed at a height midway between the top edge of the guardrail system and the walking/working level. Posts shall be placed no more than 8 feet apart (29 CFR 1926.500 and USACE EM 385-1-1).

3.3.8 Rescue and Evacuation Procedures

When personal fall arrest systems are used, the contractor must ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. A Rescue and Evacuation Plan shall be prepared by the contractor and include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. The Rescue and Evaluation Plan shall be included in the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP).

3.4 PERSONAL PROTECTIVE EQUIPMENT

All personnel who enter a construction site area shall wear Personal Protective Equipment (PPE) at all times as outlined in the EM 385 1-1. In addition to the requirements of the EM 385 1-1, Safety Glasses (ANSI Z87.1) and High-Visibility Apparel (ANSI 107-2004 Performance Class II, Shirt or Vest) will be worn at all times on construction sites. Hearing protection is required in noise hazard areas or when performing noise hazard tasks. Mandatory PPE on all construction sites includes:

- a. Hard Hats
- b. Safety Glasses
- c. High-Visibility Shirt or Vest
- d. Safety-Toed Shoes or Boots

3.5 SCAFFOLDING

Employees shall be provided with a safe means of access to the work area on the scaffold. Climbing of any scaffold braces or supports not specifically designed for access is prohibited. Access to scaffold platforms greater than 6 m (20 feet) in height shall be accessed by use of a scaffold stair system. Vertical ladders commonly provided by scaffold system manufacturers shall not be used for accessing scaffold platforms greater than 6 m (20 feet) in height. The use of an adequate gate is required. Contractor shall ensure that employees are qualified to perform scaffold erection and dismantling. Do not use scaffold without the capability of supporting at least four times the maximum intended load or without appropriate fall protection as delineated in the accepted fall protection and prevention plan. Stationary scaffolds must be attached to structural building components to safeguard against tipping forward or backward. Special care shall be given to ensure scaffold systems are not overloaded. Side brackets used to extend scaffold platforms on self-supported scaffold systems for the storage of material is

prohibited. The first tie-in shall be at the height equal to 4 times the width of the smallest dimension of the scaffold base. Work platforms shall be placed on mud sills. Scaffold or work platform erectors shall have fall protection during the erection and dismantling of scaffolding or work platforms that are more than six feet. Delineate fall protection requirements when working above six feet or above dangerous operations in the Fall Protection and Prevention (FP&P) Plan and Activity Hazard Analysis (AHA) for the phase of work.

3.5.1 Stilts

The use of stilts for gaining additional height in construction, renovation, repair or maintenance work is prohibited.

3.6 EQUIPMENT

3.6.1 Material Handling Equipment

- a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.
- b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.
- c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

3.6.2 Weight Handling Equipment

- a. Cranes must be equipped with:
 - (1) Load indicating devices (LIDs) and a boom angle or radius indicator,
 - (2) or load moment indicating devices (LMIs).
 - (3) Anti-two block prevention devices.
 - (4) Boom hoist hydraulic relief valve, disconnect, or shutoff (stops hoist when boom reaches a predetermined high angle).
 - (5) Boom length indicator (for telescoping booms).
 - (6) Device to prevent uncontrolled lowering of a telescoping hydraulic boom.
 - (7) Device to prevent uncontrolled retraction of a telescoping hydraulic boom.
- b. The Contractor shall notify the Contracting Officer 15 days in advance of any cranes entering the activity so that necessary quality assurance spot checks can be coordinated. Contractor's operator shall remain with the crane during the spot check.
- c. The Contractor shall comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Erection shall be performed

under the supervision of a designated person (as defined in ASME B30.5). All testing shall be performed in accordance with the manufacturer's recommended procedures.

d. The Contractor shall comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.

e. The presence of Government personnel does not relieve the Contractor of an obligation to comply with all applicable safety regulations. The Government will investigate all complaints of unsafe or unhealthful working conditions received in writing from contractor employees, federal civilian employees, or military personnel.

f. Each load shall be rigged/attached independently to the hook/master-link in such a fashion that the load cannot slide or otherwise become detached. Christmas-tree lifting (multiple rigged materials) is not allowed.

g. Under no circumstance shall a Contractor make a lift at or above 90% of the cranes rated capacity in any configuration.

h. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and shall follow the requirements of USACE EM 385-1-1 section 11 and ASME B30.5 or ASME B30.22 as applicable.

i. Crane suspended personnel work platforms (baskets) shall not be used unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Personnel shall not be lifted with a line hoist or friction crane.

j. A fire extinguisher having a minimum rating of 10BC and a minimum nominal capacity of 5lb of extinguishing agent shall be available at all operator stations or crane cabs. Portable fire extinguishers shall be inspected, maintained, and recharged as specified in NFPA 10, Standard for Portable Fire Extinguishers.

k. All employees shall be kept clear of loads about to be lifted and of suspended loads.

l. A weight handling equipment operator shall not leave his position at the controls while a load is suspended.

m. The Contractor shall use cribbing when performing lifts on outriggers.

n. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.

o. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.

p. A substantial and durable rating chart containing legible letters and figures shall be provided with each crane and securely mounted onto the crane cab in a location allowing easy reading by the operator while seated in the control station.

q. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.

r. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.

s. The Contractor shall certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

3.6.3 Equipment and Mechanized Equipment

a. Equipment shall be operated by designated qualified operators. Proof of qualifications shall be kept on the project site for review.

b. Manufacture specifications or owner's manual for the equipment shall be on site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Such additional safety precautions or requirements shall be incorporated into the AHAs.

c. Equipment and mechanized equipment shall be inspected in accordance with manufacturer's recommendations for safe operation by a competent person prior to being placed into use.

d. Daily checks or tests shall be conducted and documented on equipment and mechanized equipment by designated competent persons.

3.7 EXCAVATIONS

The competent person for excavations performed as a result of contract work shall be on-site when excavation work is being performed, and shall inspect, and document the excavations daily prior to entry by workers. The competent person must evaluate all hazards, including atmospheric, that may be associated with the work, and shall have the resources necessary to correct hazards promptly. The competent person shall perform soil classification in accordance with 29 CFR 1926.

3.7.1 Utility Locations

All underground utilities in the work area must be positively identified by a third party, independent, private utility locating company in addition to any station locating service and coordinated with the station utility department. Any markings made during the utility investigation must be maintained throughout the contract.

3.7.2 Utility Location Verification

The Contractor must physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system. Digging within 2 feet of a known utility must not be performed by means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility the utility shall be exposed by hand digging every 100 feet if parallel within 5 feet

of the excavation.

3.7.3 Utilities Within and Under Concrete, Bituminous Asphalt and Other Impervious Surfaces

Utilities located within concrete slabs or pier decks, bridges, parking areas, and the like, are extremely difficult to identify. Whenever contract work involves chipping, saw cutting, or core drilling through concrete, bituminous asphalt or other impervious surfaces, the existing utility location must be coordinated with station utility departments in addition to location and depth verification by a third party, independent, private locating company. The third party, independent, private locating company shall locate utility depth by use of Ground Penetrating Radar (GPR), X-ray, bore scope, or ultrasound prior to the start of demolition and construction. Outages to isolate utility systems must be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the contractor from meeting this requirement.

3.7.4 Shoring Systems

Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on site for review. Job-made shoring or shielding shall have the registered professional engineer stamp, specifications, and tabulated data. Extreme care must be used when excavating near direct burial electric underground cables.

3.7.5 Trenching Machinery

Trenching machines with digging chain drives shall be operated only when the spotters/laborers are in plain view of the operator. Operator and spotters/laborers shall be provided training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Documentation of the training shall be kept on file at the project site.

3.8 ELECTRICAL

3.8.1 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Positive cable identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must

use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. In addition, provide electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may be required, depending on the specific job and as delineated in the Contractor's AHA.

3.8.2 Arc Flash Risk/Hazard Analysis

Contractor shall provide an Arc Flash Risk/Hazard Analysis in accordance with NFPA 70E for all locations where workers may be exposed to arc flash hazard (work on energized electrical equipment). The Arc Flash Risk/Hazard Analysis shall be sealed and signed by a qualified professional engineer.

3.8.3 Arc Flash Risk/Hazard Analysis Qualifications

Contractor shall engage the services of a qualified organization to provide Arc Flash Risk/Hazard Analysis of the electrical distribution system. Organization shall be independent of the supplier, manufacturer, and installer of the equipment. The organization shall be a first tier subcontractor. This work shall not be performed by a second tier subcontractor.

- a. Submit name and qualifications of organization. Organization shall have been regularly engaged in providing Arc Flash Risk/Hazard Analysis for a minimum of 5 years.
- b. Submit name and qualifications of the professional engineer performing the analysis. Include a list of three comparable jobs performed by the engineer with specific names and telephone numbers for reference.

3.8.4 Special Permission Energized Electrical Work Permit

All work on energized electrical systems, including high voltage, must have an approved "Special Permission Energized Electrical Work Permit." The results of a Arc Flash Risk/Hazard Analysis, per NFPA 70E, shall be included in the "Special Permission Energized Electrical Work Permit" request. Flame-resistant (FR) clothing and personal protective equipment (PPE) shall be rated for a minimum of 8 calories per square centimeter even if the flash hazard analysis indicates a lower value. A blank copy of the permit request is attached. An editable version may be obtained from the Contracting Officer.

3.8.5 Portable Extension Cords

Portable extension cords shall be sized in accordance with manufacturer ratings for the tool to be powered and protected from damage. All damaged extension cords shall be immediately removed from service. Portable extension cords shall meet the requirements of NFPA 70.

3.9 WORK IN CONFINED SPACES

The Contractor shall comply with the requirements in Section 06.I of USACE EM 385-1-1 and OSHA 29 CFR 1910.146. Any potential for a hazard in the confined space requires a permit system to be used.

- a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 06.I.05 of USACE EM 385-1-1 for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.
- b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.
- c. Ensure the use of rescue and retrieval devices in confined spaces greater than 1.5 m (5 feet) in depth. Conform to Sections 06.I.09, 06.I.10 and 06.I.11 of USACE EM 385-1-1.
- d. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.
- e. Include training information for employees who will be involved as entrants and attendants for the work. Conform to Section 06.I.06 of USACE EM 385-1-1.
- f. Daily Entry Permit. Post the permit in a conspicuous place close to the confined space entrance.

3.10 CRYSTALLINE SILICA

Grinding, abrasive blasting, and foundry operations of construction materials containing crystalline silica, shall comply with OSHA regulations, such as 29 CFR 1910.94, and USACE EM 385-1-1, Appendix C. The Contractor shall develop and implement effective exposure control and elimination procedures to include dust control systems, engineering controls, and establishment of work area boundaries, as well as medical surveillance, training, air monitoring, and personal protective equipment.

3.11 HOUSEKEEPING

3.11.1 Clean-Up

All debris in work areas shall be cleaned up daily or more frequently if necessary. Construction debris may be temporarily located in an approved location, however garbage accumulation must be removed each day.

3.11.2 Falling Object Protection

All areas must be barricaded to safeguard employees. When working overhead, barricade the area below to prevent entry by unauthorized employees. Construction warning tape and signs shall be posted so they are clearly visible from all possible access points. When employees are working overhead all tools and equipment shall be secured so that they will not fall. When using guardrail as falling object protection, all openings shall be small enough to prevent passage of potential falling objects.

-- End of Section --

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SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS

11/14

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g. ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

ACOUSTICAL SOCIETY OF AMERICA (ASA)
1305 Walt Whitman Road, Suite 300
Melville, NY 11747-4300
Ph: 516-576-2360
Fax: 631-923-2875
E-mail: asa@aip.org
Internet: <http://asa.aip.org>

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)
30 West University Drive
Arlington Heights, IL 60004-1893
Ph: 847-394-0150
Fax: 847-253-0088
E-mail: amca@amca.org
Internet: <http://www.amca.org>

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC> (AMCA)
30 West University Drive
Arlington Heights, IL 60004-1893
Ph: 847-394-0150
Fax: 847-253-0088
E-mail: amca@amca.org
Internet: <http://www.amca.org>

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC> (AMCA)

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)
2111 Wilson Blvd, Suite 500
Arlington, VA 22201
Ph: 703-524-8800
Fax: 703-562-1942

Internet: <http://www.ahrinet.org>

ALUMINUM ASSOCIATION (AA)
National Headquarters
1525 Wilson Boulevard, Suite 600
Arlington, VA 22209
Ph: 703-358-2960
E-Mail: info@aluminum.org
Internet: <http://www.aluminum.org>

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1827 Walden Office Square, Suite 550
Schaumburg, IL 60173-4268
Ph: 847-303-5664
Fax: 847-303-5774
E-mail: customerservice@aamanet.org
Internet: <http://www.aamanet.org>

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@ashto.org
Internet: <http://www.aashto.org>

AMERICAN CONCRETE INSTITUTE (ACI)

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
1330 Kemper Meadow Drive
Cincinnati, OH 45240
Ph: 513-742-2020 or 513-742-6163
Fax: 513-742-3355
E-mail: mail@acgih.org
Internet: <http://www.acgih.org>

AMERICAN FOREST & PAPER ASSOCIATION (AF&PA)

AMERICAN HARDBOARD ASSOCIATION (AHA)
1210 West Northwest Highway
Palatine, IL 60067
Ph: 847-934-8800
Fax: 847-934-8803
E-mail: aha@hardboard.org
Internet: <http://domensino.com/AHA/>

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)
3141 Fairview Park Dr, Suite 777
Falls Church, VA 22042
Tel: 703-849-8888
Fax: 703-207-3561
E-mail: infonet@aiha.org
Internet <http://www.aiha.org>

AMERICAN IRON AND STEEL INSTITUTE (AISI)
25 Massachusetts Avenue, NW Suite 800
Washington, DC 20001
Ph: 202-452-7100

Internet: <http://www.steel.org>

AMERICAN LADDER INSTITUTE (ALI)
2025 M St. NW
Washington, DC 20036
Ph: 202-367-1217
Fax: 202-973-8712
E-mail: info@americanladderinstitute.org
Internet: <http://www.americanladderinstitute.org>

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)
P.O. Box 210
Germantown, MD 20875-0210
Ph: 301-972-1700
Fax: 301-540-8004
E-mail: alsc@alsc.org
Internet: <http://www.alsc.org>

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
1899 L Street, NW, 11th Floor
Washington, DC 20036
Ph: 202-293-8020
Fax: 202-293-9287
E-mail: storemanager@ansi.org
Internet: <http://www.ansi.org/>

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20191
Ph: 703-295-6300; 800-548-2723
E-mail: member@asce.org
Internet: <http://www.asce.org>

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)
1791 Tullie Circle, NE
Atlanta, GA 30329
Ph: 800-527-4723 or 404-636-8400
Fax: 404-321-5478
E-mail: ashrae@ashrae.org
Internet: <http://www.ashrae.org>

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
1800 East Oakton Street
Des Plaines, IL 60018
Ph: 847-699-2929
Internet: <http://www.asme.org>

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)
18927 Hickory Creek Drive, Suite 220
Mokena, IL 60448
Ph: 708-995-3019
Fax: 708-479-6139
E-mail: staffengineer@asse-plumbing.org
Internet: <http://www.asse-plumbing.org>

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

6666 West Quincy Avenue
Denver, CO 80235-3098
Ph: 303-794-7711
E-mail: distribution@awwa.org
Internet: <http://www.awwa.org>

AMERICAN WELDING SOCIETY (AWS)

13301 NW 47 Ave
Miami, FL 33054

Ph: 888-WELDING, 305-824-1177, 305-826-6192
Fax: 305-826-6195
E-mail: customer.service@awspubs.com
Internet: <http://www.aws.org>

AMERICAN WOOD COUNCIL (AWC)

222 Catoctin Circle SE, Suite 201
Leesburg, VA 20175
Ph: 800-890-7732
Fax: 412-741-0609
E-mail: publications@awc.org
Internet: <http://www.awc.org>

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

7011 South 19th St.
Tacoma, WA 98466-5333
Ph: 253-565-6600
Fax: 253-565-7265
Internet: <http://www.apawood.org>

ARCNET TRADE ASSOCIATION (ATA)

E-mail: info@arcnet.com
Internet: <http://www.arcnet.com/index.htm></URL

ASME INTERNATIONAL (ASME)

Two Park Avenue, M/S 10E
New York, NY 10016-5990
Ph: 800-843-2763
Fax: 973-882-1717
E-mail: customercare@asme.org
Internet: <http://www.asme.org>

ASSOCIATED AIR BALANCE COUNCIL (AABC)

1518 K Street, NW
Washington, DC 20005
Ph: 202-737-0202
Fax: 202-638-4833
E-mail: info@aabc.com
Internet: <http://www.aabc.com/>

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

600 North 18th Street
P.O. Box 2641
Birmingham, AL 35291-0992
Ph: 205-257-3839
E-Mail: aeicdir@bellsouth.net

Internet: <http://www.aeic.org>

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 877-909-2786
Internet: <http://www.astm.org>

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)
355 Lexington Avenue, 15th Floor
New York, NY 10017
Ph: 212-297-2122
Fax: 212-370-9047
Internet: <http://www.buildershardware.com>

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)
PO Box 997377, MS 0500
Sacramento, CA 95899-7377
Ph: 916-558-1784
Internet: <http://www.cdph.ca.gov>

CAST IRON SOIL PIPE INSTITUTE (CISPI)
3008 Preston Station Drive
Hixson, TN 37343
Ph: 423-842-2122
Internet: <http://www.cispi.org>

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)
933 North Plum Grove Road
Schaumburg, IL 60173-4758
Ph: 847-517-1200
Fax: 847-517-1206
Internet: <http://www.crsi.org/>

CONSUMER ELECTRONICS ASSOCIATION (CEA)
1919 South Eads St.
Arlington, VA 22202
Ph: 866-858-1555 or 703-907-7634
Fax: 866-858-2555 or 703-907-7693
E-mail: standards@CE.org
Internet: <http://www.CE.org>

COPPER DEVELOPMENT ASSOCIATION (CDA)
Internet: <http://www.copper.org>

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)
2214 Rock Hill Rd., Suite 170
Herndon, VA 20170
Ph: 571-323-0294
Fax: 571-323-0245
E-mail: emikoski@ecaus.org
Internet: <http://www.ecianow.org/>

EUROPEAN UNION (EU)
CEN-CENELEC Management Centre
Avenue Marnix 17

B-1000 Brussels
Ph: 32-2-550-08-11
Fax: 32-2-550-08-19
Internet: <http://www.cen.eu/Pages/default.aspx>

FM GLOBAL (FM)
270 Central Avenue
P.O. Box 7500
Johnston, RI 02919-4923
Ph: 877-364-6726
Fax: 401-275-3029
E-mail: servicedesk.myrisk@fmglobal.com
Internet: <http://www.fmglobal.com>

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH
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University of South California
Research Annex 219
3716 South Hope Street
Los Angeles, CA 90089-7700
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E-mail: fccchr@usc.edu
Internet: <http://www.usc.edu/dept/fccchr>

GLASS ASSOCIATION OF NORTH AMERICA (GANA)
800 SW Jackson St., Suite 1500
Topeka, KS 66612-1200
Ph: 785-271-0208
E-mail: gana@glasswebsite.com
Internet: <http://www.glasswebsite.com>

GREEN SEAL (GS)
1001 Connecticut Avenue, NW
Suite 827
Washington, DC 20036-5525
Ph: 202-872-6400
Fax: 202-872-4324
Internet: <http://www.greenseal.org>

GYPSUM ASSOCIATION (GA)
6525 Belcrest Road, Suite 480
Hyattsville, MD 20782
Ph: 301-277-8686
Fax: 301-277-8747
E-mail: info@gypsum.org
Internet: <http://www.gypsum.org>

HYDRONICS INSTITUTE DIVISION OF AHRI (HYI)
35 Russo Place
P.O. Box 218
Berkeley Heights, NJ 07922-0218
Ph: 908-464-8200
Fax: 908-464-7818
Internet: <http://www.ahrinet.org>

ILLUMINATING ENGINEERING SOCIETY (IES)
120 Wall Street, 17th Floor

New York, NY 10005-4001
Ph: 212-248-5000
Fax: 212-248-5018
E-mail: IES@IES.org
Internet: <http://www.IES.org>

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
445 and 501 Hoes Lane
Piscataway, NJ 08854-4141
Ph: 732-981-0060 or 800-701-4333
Fax: 732-562-9667
E-mail: onlinesupport@ieee.org
Internet: <http://www.ieee.org>

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)
P.O. Box 1568
Carrollton, GA 30112
E-mail:
http://www.icea.net/Public_Pages/Contact/Email_Contact.html
Internet: <http://www.icea.net>

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)
27 N. Wacker Dr. Suite 365
Chicago, IL 60606-2800
Ph: 613-233-1510
Fax: 613-482-9436
E-mail: enquiries@igmaonline.org
Internet: <http://www.igmaonline.org>

INTELLIGENCE COMMUNITY STANDARD (ICS)
Homeland Security Digital Library
Internet: <https://www.hsdl.org/c/>

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS
(IAPMO)
4755 E. Philadelphia St.
Ontario, CA 91761
Ph: 909-472-4100
Fax: 909-472-4150
E-mail: iapmo@iapmo.org
Internet: <http://www.iapmo.org>

INTERNATIONAL CODE COUNCIL (ICC)
500 New Jersey Avenue, NW
6th Floor, Washington, DC 20001
Ph: 800-786-4452 or 888-422-7233
E-mail: order@iccsafe.org
Internet: www.iccsafe.org

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)
3050 Old Centre Ave. Suite 102
Portage, MI 49024
Ph: 269-488-6382
Internet: <http://www.netaworld.org>

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
3, rue de Varembe
P.O. Box 131
CH-1211 Geneva 20, Switzerland

Ph: 41-22-919-02-11
Fax: 41-22-919-03-00
Internet: <http://www.iec.ch>

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)
1, ch. de la Voie-Creuse
Case Postale 56
CP 56 - CH-1211 Geneva 20
Switzerland
Ph: 41-22-749-01-11
Fax: 41-22-733-34-30
E-mail: central@iso.ch
Internet: <http://www.iso.org>

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)
1901 North Moore Street
Arlington, VA 22209-1762
Ph: 703-525-1695
Fax: 703-528-2148
Internet: <http://www.safetysafetyequipment.org/>

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)
127 Park Street, NE
Vienna, VA 22180-4602
Ph: 703-281-6613
E-mail: info@mss-hq.com
Internet: <http://mss-hq.org/Store/index.cfm>

MARBLE INSTITUTE OF AMERICA (MIA)
380 E. Lorain Street
Oberlin, OH 44074
Ph: 440-250-9222
Fax: 440-774-9222
E-mail: miainfo@marble-institute.com
Internet: <http://www.marble-institute.com>

MASTER PAINTERS INSTITUTE (MPI)
2800 Ingleton Avenue
Burnaby, BC CANADA V5C 6G7
Ph: 1-888-674-8937
Fax: 1-888-211-8708
E-mail: info@paintinfo.com or techservices@mpi.net
Internet: <http://www.mpi.net/>

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)
800 Roosevelt Road, Bldg C, Suite 312
Glen Ellyn, IL 60137
Ph: 630-942-6591
Fax: 630-790-3095
E-mail: wlewis7@cox.net (Wes Lewis, technical consultant)
Internet: <http://www.naamm.org>

NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS (NBBI)
1055 Crupper Avenue
Columbus, OH 43229-1183
Ph: 614-888-8320
Fax: 614-888-0750
E-mail: information@nationalboard.org

Internet: <http://www.nationalboard.org>

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)
3 Bethesda Metro Center, Suite 1100
Bethesda, MD 20814
Ph: 301-657-3110
Fax: 301-215-4500
Internet: <http://www.necanet.org/>

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
1300 North 17th Street, Suite 900
Arlington, VA 22209
Ph: 703-841-3200
Internet: <http://www.nema.org/>

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)
8575 Grovemont Circle
Gaithersburg, MD 20877
Ph: 301-977-3698
Fax: 301-977-9589
Internet: <http://www.nebb.org>

NATIONAL FENESTRATION RATING COUNCIL (NFRC)
6305 Ivy Lane, Suite 140
Greenbelt, MD 20770
Ph: 301-589-1776
Fax: 301-589-3884
E-Mail: info@nfrc.org
Internet: <http://www.nfrc.org>

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
1 Batterymarch Park
Quincy, MA 02169-7471
Ph: 617-770-3000
Fax: 617-770-0700
Internet: <http://www.nfpa.org>

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)
6830 Raleigh LaGrange Road
PO Box 34518
Memphis, TN 38184
Ph: 901-377-1818
Store: 901-399-7563
Internet: <http://www.nhla.org>

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES
(NICET)
1420 King Street
Alexandria, VA 22314-2794
Ph: 888-476-4238 (1-888 IS-NICET)
E-mail: tech@nicet.org
Internet: <http://www.nicet.org>

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)
100 Bureau Drive
Stop 1070
Gaithersburg, MD 20899-1070
Ph: 301-975-NIST (6478)
E-mail: inquiries@nist.gov

Internet: <http://www.nist.gov>

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)
10255 West Higgins Road, Suite 600
Rosemont, IL 60018-5607
Ph: 866-275-6722 (866-ASK-NRCA)
Fax: 847-299-1183
E-mail: info@nrca.net
Internet: <http://www.nrca.net>

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)
272 Tuttle Road
Cumberland, ME 04021
Ph: 207-829-6901
Fax: 207-829-4293
E-mail: info@nelma.org
Internet: <http://www.nelma.org>

NSF INTERNATIONAL (NSF)
789 North Dixboro Road
P.O. Box 130140
Ann Arbor, MI 48105
Ph: 734-769-8010 or 800-NSF-MARK
Fax: 734-769-0109
E-mail: info@nsf.org
Internet: <http://www.nsf.org>

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)
2, rue Andre Pascal
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Fax: 33 1 45 24 85 00
Internet: <http://www.oecd.org>
U.S. Contact Center
OECD Washington Center
2001 L Street, NW, Suite 650
Washington, DC 20036-4922
Ph: 202-785-6323
Fax: 202-785-0350
E-mail: washington.contact@oecd.org

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)
800 Roosevelt Road
Building C, Suite 312
Glen Ellyn, IL 60137
Ph: 630-858-6540
Fax: 630-790-3095
Internet: <http://www.ppfahome.org>

PLUMBING AND DRAINAGE INSTITUTE (PDI)
800 Turnpike Street, Suite 300
North Andover, MA 01845
Ph: 978-557-0720 or 800-589-8956
E-Mail: pdi@PDIONline.org
Internet: <http://www.pdionline.org>

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD
ASSOCIATION (CRA)
818 Grayson Road, Suite 201
Pleasant Hill, CA 94523
Ph: 925-935-1499
Fax: 925-935-1496
E-Mail: ris@calredwood.org
Internet: <http://www.redwoodinspection.com/>

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)
2000 Powell Street, Suite 600
Emeryville, CA 94608
Ph: 800-326-3228
E-mail: info@SCSglobal services.com
Internet: <http://www.scsglobalservices.com/>

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
(SMACNA)
4201 Lafayette Center Drive
Chantilly, VA 20151-1219
Ph: 703-803-2980
Fax: 703-803-3732
Internet: <http://www.smacna.org>

SOCIETY FOR PROTECTIVE COATINGS (SSPC)
40 24th Street, 6th Floor
Pittsburgh, PA 15222
Ph: 412-281-2331
Fax: 412-281-9992
E-mail: info@sspc.org
Internet: <http://www.sspc.org>

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)
400 Commonwealth Drive
Warrendale, PA 15096
Ph: 724-776-4970
Fax: 877-606-7323
E-mail: customerservice@sae.org
Internet: <http://www.sae.org>

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)
21865 Copley Drive
Diamond Bar, CA 91765
Ph: 909-396-2000
E-mail: webinquiry@aqmd.gov
Internet: <http://www.aqmd.gov>

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)
665 Rodi Road, Suite 305
Pittsburgh, PA 15235
Ph: 412-244-0440
Fax: 412-244-9090
E-Mail: member-services@cypressinfo.org
Internet: <http://www.cypressinfo.org>

SOUTHERN PINE INSPECTION BUREAU (SPIB)
P.O. Box 10915

Pensacola, FL 32504-0915
Ph: 850-434-2611
Fax: 850-433-5594
Internet: <http://www.spib.org>

SPRAY POLYURETHANE FOAM ALLIANCE (SPFA)
3927 Old Lee Hwy. #101B
Fairfax, VA 22030
Ph: 800-523-6154
Fax: 703-222-5816
Internet: <http://www.sprayfoam.org>

STEEL DOOR INSTITUTE (SDI/DOOR)
30200 Detroit Road
Westlake, OH 44145
Ph: 440-899-0010
Fax: 440-892-1404
E-mail: info@steeldoor.org
Internet: <http://www.steeldoor.org>

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)
1320 N. Courthouse Rd., Suite 200
Arlington, VA 22201
Ph: 703-907-7700
Fax: 703-907-7727
Internet: <http://www.tiaonline.org>

THE MASONRY SOCIETY (TMS)
105 South Sunset Street, Suite Q
Longmont, CO 80501-9215
Ph: 303-939-9700
Fax: 303-541-9215
E-mail: info@masonrysociety.org
<http://www.masonrysociety.org>

TILE COUNCIL OF NORTH AMERICA (TCNA)
100 Clemson Research Boulevard
Anderson, SC 29625
Ph: 864-646-8453
Fax: 864-646-2821
E-mail: info@tileusa.com
Internet: <http://www.tcnatile.com/>

U.S. ARMY CORPS OF ENGINEERS (USACE)
CRD-C DOCUMENTS available on Internet:
http://www.wbdg.org/ccb/browse_cat.php?c=68
Order Other Documents from:
USACE Publications Depot
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2803 52nd Avenue
Hyattsville, MD 20781-1102
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Fax: 301-394-0084
E-mail: pubs-army@usace.army.mil
Internet: <http://www.publications.usace.army.mil/>
or
<http://www.hnc.usace.army.mil/Missions/Engineering/TECHINFO.aspx>

U.S. DEPARTMENT OF AGRICULTURE (USDA)
Order AMS Publications from:
AGRICULTURAL MARKETING SERVICE (AMS)
Seed Regulatory and Testing Branch
801 Summit Crossing Place, Suite C
Gastonia, NC 28054-2193
Ph: 704-810-8871
Fax: 704-852-4189
E-mail: seed.ams@usda.gov
Internet: <http://www.ams.usda.gov/lsg/seed.htm>
Order Other Publications from:
U.S. Department of Agriculture, Rural Utilities Program
USDA Rural Development, Room 4051-S
Mail Stop 1510
1400 Independence Avenue SW
Washington, DC 20250-1510
Phone: (202) 720-9540
TTY: (800) 877-8339 (Federal Relay Service)
Fax: (202) 720-1725
Internet: http://www.rurdev.usda.gov/utilities_lp.html

U.S. DEPARTMENT OF DEFENSE (DOD)
Order DOD Documents from:
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Washington, DC 20301-1400
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Internet: <http://www.ntis.gov>
Obtain Military Specifications, Standards and Related Publications
from:
Acquisition Streamlining and Standardization Information System
(ASSIST)
Department of Defense Single Stock Point (DODSSP)
Document Automation and Production Service (DAPS)
Building 4/D
700 Robbins Avenue
Philadelphia, PA 19111-5094
Ph: 215-697-6396 - for account/password issues
Internet: <http://assist.daps.dla.mil/online/start/>; account
registration required
Obtain Unified Facilities Criteria (UFC) from:
Whole Building Design Guide (WBDG)
National Institute of Building Sciences (NIBS)
1090 Vermont Avenue NW, Suite 700
Washington, DC 20005
Ph: 202-289-7800
Fax: 202-289-1092
Internet: http://www.wbdg.org/references/docs_refs.php

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, DC 20004
Ph: 202-272-0167
Internet: <http://www2.epa.gov/libraries>
--- Some EPA documents are available only from:
National Technical Information Service (NTIS)

5301 Shawnee Road
Alexandria, VA 22312
Ph: 703-605-6050 or 1-688-584-8332
Fax: 703-605-6900
E-mail: info@ntis.gov
Internet: <http://www.ntis.gov>

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)
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Washington, DC 20554
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TTY: 888-835-5322
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Internet: <http://www.fcc.gov>
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710 North Capitol Street, NW
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Ph: 202-512-1800
Fax: 866-418-0232
E-mail: gpoweb@gpo.gov
Internet: <http://www.gpoaccess.gov/>

U.S. GENERAL SERVICES ADMINISTRATION (GSA)
General Services Administration
1275 First St. NE
Washington, DC 20417
Ph: 202-501-1231
Internet: <http://www.gsaelibrary.gsa.gov/ElibMain/home.do>
Obtain documents from:
Acquisition Streamlining and Standardization Information System
(ASSIST)
Internet: <https://assist.dla.mil/online/start/>; account
registration required

U. S. GREEN BUILDING COUNCIL (USGBC)
2101 L St NW, Suite 500
Washington, D.C. 20037
Ph: 800-795-1747
Internet: <http://www.usgbc.org>

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
8601 Adelphi Road
College Park, MD 20740-6001
Ph: 866-272-6272
Fax: 301-837-0483
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710 North Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800
Fax: 202-512-2104
E-mail: contactcenter@gpo.gov
Internet: <http://www.gpoaccess.gov>

UNDERWRITERS LABORATORIES (UL)
2600 N.W. Lake Road
Camas, WA 98607-8542
Ph: 877-854-3577
E-mail: CEC.us@us.ul.com
Internet: <http://www.ul.com/>
UL Directories available through IHS at <http://www.ihs.com>

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)
2711 LBJ Freeway, Suite 1000
Dallas, TX 75234
Ph: 972-243-3902
Fax: 972-243-3907
E-mail: info@uni-bell.org
Internet: <http://www.uni-bell.org>

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)
P.O. Box 23145
Portland, OR 97281
Ph: 503-639-0651
Fax: 503-684-8928
E-mail: info@wclib.org
Internet: <http://www.wclib.org>

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)
1500 SW First Ave., Suite 870
Portland, OR 97201
Ph: 503-224-3930
Fax: 503-224-3934
E-mail: info@wwpa.org
Internet: <http://www.wwpa.org>

WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)
330 N Wabash Avenue, Suite 2000
Chicago, IL 60611
Ph: 312-321-6802
E-mail: wdma@wdma.com
Internet: <http://www.wdma.com>

WOODWORK INSTITUTE (WI)
Level 30, HSBC Centre
580 George St
Sydney NSW 2000
GPO Box 4177
Sydney, NSW, Australia 2001
Ph: 61 2 8295 3100
Fax: 61 2 8295 4100
E-mail: feedback@wool.com
internet: <http://www.woolmark.com>

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

20-0075 Repair BEQ FC530

-- End of Section --

SECTION 01 45 10

QUALITY CONTROL

09/01

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 880	(1996) Criteria for Use in Evaluation of Testing Laboratories and Organizations for Examination and Inspection of Steel, Stainless Steel, and Related Alloys
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 3666	(2000) Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials
ASTM D 3740	(1999c) Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(2009) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
ASTM E 543	(1999) Evaluating Agencies that Perform Nondestructive Testing

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-02 Shop Drawings

Coordination Drawings;

SD-11 Closeout Submittals

Quality Control Plan (QC PLAN)

Submit a QC plan within 15 calendar days after receipt of Notice of Award.

1.3 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings. This is especially important due to the limited space availability above ceilings.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to COTR indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling, and wall

systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Mechanical and Plumbing Work: In addition to requirements in individual Sections, show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 6. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 7. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 8. Review: COTR and A/E will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If COTR determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, COTR will so inform Contractor, who shall make suitable modifications and resubmit.
- C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.

2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
7. Contractor's QC Manager and Project Superintendent must perform the final coordination review to ensure coordination amongst all disciplines prior to submitting to COTR for review and approval.

D. Coordination Digital Data Files: Prepare coordination digital data files according to requirements in Section 013300 "Submittal Procedures" and according to the following requirements:

1. File Preparation Format:
 - a. DWG or RVT, operating in Microsoft Windows operating system.
2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and PDF format.
3. Architect will furnish Contractor one set of digital data files (DWG format) of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to drawings.
 - b. Digital Data Software Program: Drawings are available in DWG format, operating in Microsoft Windows operating system.

1.4 INFORMATION FOR THE CONTRACTING OFFICER

Deliver the following to the Contracting Officer:

- a. Combined Contractor Production Report/Contractor Quality Control Report (1 sheet): Original and 1 copy, by 10:00 AM the next working day after each day that work is performed;
- b. QC Specialist Reports and Test Results: Originals and 1 copy, by

10:00 AM the next working day after each day that work is performed;

- c. Testing Plan and Log, 1 copy, at the end of each month;
- d. QC Meeting Minutes: 1 copy, within 2 calendar days of the meeting;
- e. Rework Items List: 1 copy, by the last working day of the month and;
- f. QC Certifications: As required by the paragraph entitled "QC Certifications".

1.5 QC PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. The QC program consists of a QC Organization, a QC Plan, attending a QC Plan meeting, attending a Coordination and Mutual Understanding Meeting, conducting QC meetings, performing three phases of control, performing submittal review, ensuring testing is performed, and preparing QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this Contract. The QC program shall cover construction operations on- site and off-site and shall be keyed to the proposed construction sequence.

1.6 QC ORGANIZATION

1.6.1 QC Manager

1.6.1.1 Duties

Provide a QC Manager at the work site to manage and implement the QC program. The QC Manager is required to attend the QC Plan meeting, attend the Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, perform submittal review, ensure testing is performed and prepare QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by the QC specialists. In addition to managing and implementing the QC program, the QC Manager may perform the duties of project superintendent.

1.6.1.2 Qualifications

An individual with a minimum of five years experience as a foreman, superintendent, inspector, QC Manager, project manager, or construction manager on similar size construction contracts which included the major trades that are part of this Contract.

Provide a separate QC Specialist at the work site for each of the areas of responsibilities for the following:

Electrical and Telecommunication Systems QC Specialists.

Provide ICC IBC Special Inspection Certification from the following specialist:

Telecommunications Systems Installation Specialist, (10) years minimum

experience in Telecommunication Systems Installation.

Area of responsibility:

Telecommunication Systems, all Division 27, Division 28, and Division 33
Outside Plant work.

Frequency of specialists is full time during systems installation and testing. QC Specialists are required to attend the Coordination and Mutual Understanding Meeting, QC meetings and be physically present at the construction site to perform the three phases of control and prepare documentation for each definable feature of work in their area of responsibility.

1.6.1.3 Construction Quality Management Training

In addition to the above experience and education requirements, the QC Manager shall have completed the course entitled "Construction Quality Management for Contractors." This course is periodically offered by the Navy and the Corps of Engineers. However, it is sponsored by both the AGC and the ABC of Charlotte, North Carolina. Call one of the following to sign up for the next available class:

The Army Corps of Engineers, Baltimore District;
(Offered in Baltimore, MD)
Contact: Corps of Engineers, Baltimore District
10 South Howard Street
Baltimore, MD 21201
Phone: 410-962-2323

The Associated General Contractors (AGC), Virginia Chapter
in Cooperation with the Army Corps of Engineers, Norfolk District, and
the Naval Facilities Engineering Command, Atlantic Division.
(Offered at rotating locations in Norfolk, Williamsburg, and Richmond)
Contact: AGC of Virginia
8631 Maylan Drive, Parham Park
Richmond, VA 23294
Phone: 804-346-3383

Carolinas Associated General Contractors (CACG)
Contact: CACG
1100 Euclid Avenue
Charlotte, NC 28203
Phone: 704-372-1450 (ext. 5248)

Associated Builders and Contractors (ABC), Carolinas Chapter
Contact: ABC, Carolinas Chapter
3705 Latrobe Drive
Charlotte, NC 28211
Phone: 704-367-1331
or: 877-470-4819

1.6.2 Alternate QC Manager Duties and Qualifications

Designate an alternate for the QC Manager at the work site to serve in the event of the designated QC Manager's absence. The period of absence may not exceed two weeks at one time, and not more than 30 workdays during a calendar year. The qualification requirements for the Alternate QC Manager shall be three years of experience in one of the specified

positions.

1.7 QC PLAN

1.7.1 Requirements

Provide for approval by the Contracting Officer, a QC plan submitted in a 3-ring binder with pages numbered sequentially that covers, both on-site and off-site work and includes, the following:

- a. A table of contents listing the major sections identified with tabs in the following order:
 - I. QC ORGANIZATION
 - II. NAMES AND QUALIFICATIONS
 - III. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL
 - IV. OUTSIDE ORGANIZATIONS
 - V. APPOINTMENT LETTERS
 - VI. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER
 - VII. TESTING LABORATORY INFORMATION
 - VIII. TESTING PLAN AND LOG
 - IX. PROCEDURES TO COMPLETE REWORK ITEMS
 - X. DOCUMENTATION PROCEDURES
 - XI. LIST OF DEFINABLE FEATURES
 - XII. PROCEDURES FOR PERFORMING THE THREE PHASES OF CONTROL
 - XIII. PERSONNEL MATRIX
 - XIV. PROCEDURES FOR COMPLETION INSPECTION
- b. A chart showing the QC organizational structure and its relationship to the production side of the organization.
- c. Names and qualifications, in resume format, for each person in the QC organization.
- d. Duties, responsibilities and authorities of each person in the QC organization.
- e. A listing of outside organizations such as, architectural and consulting engineering firms that will be employed by the Contractor and a description of the services these firms will provide.
- f. A letter signed by an officer of the firm appointing the QC Manager and stating that he/she is responsible for managing and implementing the QC program as described in this contract. Include in this letter the QC Manager's authority to direct the removal and replacement of non-conforming work.
- g. Procedures for reviewing, approving and managing submittals. Provide the names of the persons in the QC organization authorized to review and certify submittals prior to approval.
- h. Testing laboratory information required by the paragraphs entitled "Accredited Laboratories" or "Testing Laboratory Requirements", as applicable.
- i. A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.

- j. Procedures to identify, record, track and complete rework items.
- k. Documentation procedures, including proposed report formats.
- l. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks and requires separate control requirements. As a minimum, if approved by the Contracting Officer, consider each Section of the Specifications as a definable feature of work. However, at times, there may be more than one definable feature of work in each Section of the Specifications.
- m. A personnel matrix showing, for each section of the specification, who will perform and document the three phases of control, and who will perform and document the testing.
- o. Procedures for Identifying and Documenting the Completion Inspection process. Include in these procedures the responsible party for punch out inspection, prefinal inspection, and final acceptance inspection.

1.7.2 Preliminary Work Authorized Prior to Approval

The only work that is authorized to proceed prior to the approval of the QC plan is mobilization of storage and office trailers and surveying.

1.7.3 Approval

Approval of the QC plan is required prior to the start of construction. The Contracting Officer reserves the right to require changes in the QC plan and operations as necessary to ensure the specified quality of work. The Contracting Officer reserves the right to interview any member of the QC organization at any time in order to verify his/her submitted qualifications.

1.7.4 Notification of Changes

Notify the Contracting Officer, in writing, of any proposed change, including changes in the QC organization personnel, a minimum of seven calendar days prior to a proposed change. Proposed changes must be approved by the Contracting Officer.

1.8 QC PLAN MEETING

Prior to submission of the QC plan, meet with the Contracting Officer to discuss the QC plan requirements of this Contract. The purpose of this meeting is to develop a mutual understanding of the QC plan requirements prior to plan development and submission.

1.9 COORDINATION AND MUTUAL UNDERSTANDING MEETING

After submission of the QC Plan, but prior to the start of construction, meet with the Contracting Officer to discuss the QC program required by this Contract. The purpose of this meeting is to develop a mutual understanding of the QC details, including forms to be used for documentation, administration for on-site and off-site work, and the coordination of the Contractor's management, production and QC personnel with the Contracting Officer. As a minimum, the Contractor's personnel

required to attend shall include the project manager, project superintendent, and QC Manager. Minutes of the meeting shall be prepared by the QC Manager and signed by both the Contractor and the Contracting Officer.

1.10 QC MEETINGS

After the start of construction, the QC Manager shall conduct weekly QC meetings at the work site with the project superintendent and QC specialists. The QC Manager shall prepare the minutes of the meeting and provide a copy to the Contracting Officer within 2 working days after the meeting. The Contracting Officer may attend these meetings. The QC Manager shall notify the Contracting Officer at least 48 hours in advance of each meeting. As a minimum, the following shall be accomplished at each meeting:

- a. Review the minutes of the previous meeting;
- b. Review the schedule and the status of work:
 - Work or testing accomplished since last meeting
 - Rework items identified since last meeting
 - Rework items completed since last meeting;
- c. Review the status of submittals:
 - Submittals reviewed and approved since last meeting
 - Submittals required in the near future;
- d. Review the work to be accomplished in the next 2 weeks and documentation required. Schedule the three phases of control and testing:
 - Establish completion dates for rework items
 - Preparatory phases required
 - Initial phases required
 - Follow-up phases required
 - Testing required
 - Status of off-site work or testing
 - Documentation required;
- e. Resolve QC and production problems; and
- f. Address items that may require revising the QC plan:
 - Changes in QC organization personnel
 - Changes in procedures.

1.10.1 THREE PHASES OF CONTROL

The QC Manager shall perform the three phases of control to ensure that work complies with Contract requirements. The Three Phases of Control shall adequately cover both on-site and off-site work and shall include the following for each definable features of work: A definable feature of work is a task which is separate and distinct from other tasks and requires separate control requirements.

1.10.2 Preparatory Phase

Notify the Contracting Officer at least 48 hours in advance of each

preparatory phase. Conduct the preparatory phase with the superintendent, and the foreman responsible for the definable feature. Document the results of the preparatory phase actions in the daily Contractor Quality Control Report. Perform the following prior to beginning work on each definable feature of work:

- a. Review each paragraph of the applicable specification sections;
- b. Review the Contract drawings;
- c. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;
- d. Review the testing plan and ensure that provisions have been made to provide the required QC testing;
- e. Examine the work area to ensure that the required preliminary work has been completed;
- f. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;
- g. Review the safety plan and appropriate activity hazard analysis to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and
- h. Discuss construction methods

1.10.3 Initial Phase

Notify the Contracting Officer at least 48 hours in advance of each initial phase. When construction crews are ready to start work on a definable feature of work, conduct the initial phase with the QC Specialists, the superintendent, and the foreman responsible for that definable feature of work. Observe the initial segment of the definable feature of work to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily Contractor Quality Control Report. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each definable feature of work:

- a. Establish the quality of workmanship required;
- b. Resolve conflicts;
- c. Review the Safety Plan and the appropriate activity hazard analysis to ensure that applicable safety requirements are met; and
- d. Ensure that testing is performed by an approved laboratory.

1.10.4 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary until the completion of each definable feature of work and document in the daily Contractor Quality Control Report:

- a. Ensure the work is in compliance with Contract requirements;

- b. Maintain the quality of workmanship required;
- c. Ensure that testing is performed by an approved laboratory; and
- d. Ensure that rework items are being corrected.

1.10.5 Notification of Three Phases of Control for Off-Site Work

Notify the Contracting Officer at least two weeks prior to the start of the preparatory and initial phases.

1.11 SUBMITTAL REVIEW

Procedures for submittals are as described in Section entitled "Submittal Procedures."

1.12 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

1.12.1 Testing Laboratory Requirements

Provide an independent testing laboratory or establish a laboratory qualified to perform sampling and tests required by this Contract. When the proposed testing laboratory is not accredited by an acceptable accreditation program as described by the paragraph entitled "Accredited Laboratories", submit to the Contracting Officer for approval, certified statements signed by an official of the testing laboratory attesting that the proposed laboratory meets or conforms to the following requirements:

- a. Sampling and testing shall be under the technical direction of a Registered Professional Engineer (P.E) with at least 5 years of experience in construction material testing.
- b. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C 1077.
- c. Laboratories engaged in testing of bituminous paving materials shall meet the requirements of ASTM D 3666.
- d. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D 3740.
- e. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A 880. Laboratories shall meet the requirements of ASTM E 329.
- f. Laboratories engaged in nondestructive testing (NDT) shall meet the requirements of ASTM E 543.
- g. Laboratories engaged in hazardous materials testing shall meet the requirements of OSHA and EPA.

1.12.2 Accredited Laboratories

Acceptable accreditation programs are the National Institute of Standards

and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO) program and the American Association for Laboratory Accreditation (A2LA) program. Furnish to the Contracting Officer, a copy of the Certificate of Accreditation, Scope of Accreditation and latest directory of the accrediting organization for accredited laboratories. The scope of the laboratory's accreditation shall include the test methods required by the Contract.

1.12.3 Inspection of Testing Laboratories

Prior to approval of non-accredited laboratories, the proposed testing laboratory facilities and records shall be subject to inspection by the Contracting Officer. Records subject to inspection include equipment inventory, equipment calibration dates and procedures, library of test procedures, audit and inspection reports by agencies conducting laboratory evaluations and certifications, testing and management personnel qualifications, test report forms, and the internal QC procedures.

1.12.4 Capability Check

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

1.12.5 Test Results

Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Contracting Officer via the QC Manager. Furnish a summary report of field tests at the end of each month. Attach a copy of the summary report to the last daily Contractor Quality Control Report of each month.

1.13 QC CERTIFICATIONS

1.13.1 Contractor Quality Control Report Certification

Each Contractor Quality Control Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge, except as noted in this report".

1.13.2 Invoice Certification

Furnish a certificate to the Contracting Officer with each payment request, signed by the QC Manager, attesting that as-built drawings are current and attesting that the work for which payment is requested, including stored material, is in compliance with contract requirements.

1.13.3 Completion Certification

Upon completion of work under this Contract, the QC Manager shall furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested and is in compliance with the Contract".

1.14 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities.

1.14.1 Contractor Production Report

Reports are required for each day that work is performed and shall be attached to the Contractor Quality Control Report prepared for the same day. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Production Reports are to be prepared, signed and dated by the project superintendent and shall contain the following information:

- a. Date of report, report number, name of contractor, contract number, title and location of Contract and superintendent present.
- b. Weather conditions in the morning and in the afternoon including maximum and minimum temperatures.
- c. A list of Contractor and subcontractor personnel on the work site, their trades, employer, work location, description of work performed and hours worked.
- e. A list of job safety actions taken and safety inspections conducted. Indicate that safety requirements have been met including the results on the following:
 - (1) Was a job safety meeting held this date? (If YES, attach a copy of the meeting minutes.)
 - (2) Were there any lost time accidents this date? (If YES, attach a copy of the completed OSHA report.)
 - (3) Was crane/manlift/trenching/scaffold/hv electrical/high work/hazmat work done? (If YES, attach a statement or checklist showing inspection performed.)
 - (4) Was hazardous material/waste released into the environment? (If YES, attach a description of incident and proposed action.)
- f. A list of safety actions taken today and safety inspections conducted.
- g. A list of equipment/material received each day that is incorporated into the job.
- h. A list of construction and plant equipment on the work site including the number of hours used, idle and down for repair.
- i. Include a "remarks" section in this report which will contain pertinent information including directions received, problems

encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site.

1.14.2 Contractor Quality Control Report

Reports are required for each day that work is performed and for every seven consecutive calendar days of no-work and on the last day of a no-work period. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Quality Control Reports are to be prepared, signed and dated by the QC Manager and shall contain the following information:

- a. Identify the control phase and the definable feature of work.
- b. Results of the Preparatory Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work, the drawings and specifications have been reviewed, submittals have been approved, materials comply with approved submittals, materials are stored properly, preliminary work was done correctly, the testing plan has been reviewed, and work methods and schedule have been discussed.
- c. Results of the Initial Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work the preliminary work was done correctly, samples have been prepared and approved, the workmanship is satisfactory, test results are acceptable, work is in compliance with the Contract, and the required testing has been performed and include a list of who performed the tests.
- d. Results of the Follow-up Phase inspections held including the location of the definable feature of work. Indicate in the report for this definable feature of work that the work complies with the Contract as approved in the Initial Phase, and that required testing has been performed and include a list of who performed the tests.
- e. Results of the three phases of control for off-site work, if applicable, including actions taken.
- f. List the rework items identified, but not corrected by close of business.
- g. List the rework items corrected from the rework items list along with the corrective action taken.
- h. Include a "remarks" section in this report which will contain pertinent information including directions received, quality control problem areas, deviations from the QC plan, construction deficiencies encountered, QC meetings held, acknowledgement that as-built drawings have been updated, corrective direction given by the QC Organization and corrective action taken by the Contractor.

i. Contractor Quality Control Report certification.

1.14.3 Testing Plan and Log

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was conducted, the date the test results were forwarded to the Contracting Officer, remarks and acknowledgement that an accredited or Contracting Officer approved testing laboratory was used. Attach a copy of the updated "Testing Plan and Log" to the last daily Contractor Quality Control Report of each month.

1.14.4 Rework Items List

The QC Manager shall maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the item was originally discovered, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Contractor Rework Items List" to the last daily Contractor Quality Control Report of each month. The Contractor shall be responsible for including on this list items needing rework including those identified by the Contracting Officer.

1.14.5 As-Built Drawings

The QC Manager is required to review the as-built drawings required by Section 01 11 00, "Summary of Work", to ensure that as-built drawings are kept current on a daily basis and marked to show deviations which have been made from the Contract drawings. The QC Manager shall initial each deviation and each revision. Upon completion of work, the QC Manager shall furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

1.14.6 Report Forms

The following forms, which are attached at the end of this section, are acceptable for providing the information required by the paragraph entitled "Documentation". While use of these specific formats are not required, any other format used shall contain the same information:

- a. Combined Contractor Production Report and Contractor Quality Control Report (1 sheet), with separate continuation sheet
- b. Testing Plan and Log
- c. Rework Items List

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

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SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS

05/12

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-S-16165	(Rev E) Shielding Harnesses, Shielding Items and Shielding Enclosures for Use in the Reduction of Interference from Engine Electrical Systems
MIL-STD-461	(2015; Rev G) Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-462	(Rev D; Notice 4) Electromagnetic Interference Characteristics

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Generators of Hazardous Waste
40 CFR 263	Transporters of Hazardous Waste
40 CFR 264	Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Tables and Hazardous Materials Communications Regulations

49 CFR 178

Shipping Container Specification

1.2 Contractor Liabilities for Environmental Protection

Contractors shall complete and provide environmental training documentation for training required by Federal, State, and local regulations.

1.3 DEFINITIONS

1.3.1 Sediment

Soil and other debris that have eroded and have been transported by runoff water or wind.

1.3.2 Solid Waste

Rubbish, debris, garbage, and other discarded solid materials, except recyclables and hazardous waste as defined in paragraph entitled "Hazardous Waste," resulting from industrial, commercial, and agricultural operations and from community activities.

1.3.3 Sanitary Wastes

Wastes characterized as domestic sanitary sewage.

1.3.4 Rubbish

Combustible and noncombustible wastes such as non-recyclable paper and cardboard, crockery, and bones.

Recyclables includes: clean paper, cardboard, glass, plastics (No. 1 & 2), metal, and cans.

Non-recyclable paper and cardboard are defined as material that has become wet or contaminated with food or other residue that render it un-acceptable for recycling.

Treated wood/lumber is defined as wood that has been stained or treated to prevent rot, or composite wood products such as OSB, pressboard furniture, etc.

Untreated wood is defined as lumber, trees, stumps, limbs, tops, and shrubs.

1.3.5 Debris

Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair work, (excluding organic matter) leaves, pine straw, grass and shrub clippings.

1.3.6 Chemical Wastes

This includes salts, acids, alkalies, herbicides, pesticides, and organic chemicals.

1.3.7 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and

consumption of food.

1.3.8 Hazardous Waste

Hazardous substances as defined in 40 CFR 261 or as defined by applicable State and local regulations.

1.3.9 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

1.3.10 Landscape Features

Trees, plants, shrubs, and ground cover.

1.3.11 Lead Acid Battery Electrolyte

The electrolyte substance (liquid medium) within a battery cell.

1.3.12 Oily Waste

Petroleum products and bituminous materials.

1.3.13 Class I Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Sections 602 (a and b) of The Clean Air Act.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-06 Test Reports

Abrasive blasting

SD-11 Closeout Submittals

Solid waste disposal permit

Disposal permit for hazardous waste

Environmental training documentation

Permit to transport hazardous waste

Hazardous waste certification

1.4.1 Solid Waste Disposal Permit

Submit one copy of a State permit or license for the solid waste disposal facility. If the contract permits the use of the Base Landfill, request a letter from the Contracting Officer authorizing permission to dump on base; submit the letter to the Base Landfill Office. In lieu of the letter a copy of the contract must be delivered to the Landfill Office for review.

1.4.2 Disposal Permit for Hazardous Waste

Submit a copy of the applicable EPA and State permits, manifests, or licenses for transportation, treatment, storage, and disposal of hazardous waste by permitted facilities.

1.4.3 Permit to Transport Hazardous Waste

Submit one copy of the EPA or State permit license, or regulation for the transporter who will ship the hazardous waste to the permitted Treatment, Storage, and Disposal (TSD) facility.

1.4.4 Hazardous Waste Certification

Submit written certification that hazardous waste turned in for disposal was generated on Government property and is identified, packaged, and labeled in accordance with 40 CFR 261, 40 CFR 262, and 40 CFR 263.

1.5 ENVIRONMENTAL PROTECTION REGULATORY REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined in this Section. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including but not limited to water, air, solid waste, and noise pollution.

1.6 ADMINISTRATIVE REQUIREMENTS

1.6.1 Licenses and Permits

Obtain licenses and permits pursuant to "FAR 52.236-7, Permits and Responsibilities" except for those permits which will be obtained by the Contracting Officer.

For permits obtained by the Contracting Officer, whether or not required by the permit, perform inspections of the work in progress, and submit certifications to the applicable regulatory agency, via the Contracting Officer, that the work conforms to the contract and permit requirements. The inspections and certifications shall be provided through the services of a Professional Engineer, registered in the State where the work is being performed. As a part of the quality control plan, which is required to be submitted for approval by the quality control section, provide a subitem containing the name, P.E. registration number, address, and telephone number of the professional engineer(s) who will be performing the inspections and certifications for each permit listed above.

1.7 GENERAL ENVIRONMENTAL MANAGEMENT SYSTEM AND ENVIRONMENTAL AWARENESS

The Contractor shall familiarize himself with requirements of the attached "Marine Corps Base (MCB), Camp Lejeune, Contractor Environmental Guide."

1.8 CAMP LEJEUNE SANITARY LANDFILL INFORMATION SHEET

See attached "Camp Lejeune Sanitary Landfill Information Sheet" for hours of operation and other important information pertaining Landfill.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work. The Government retains ownership and control over historical and archaeological resources.

3.2 NOISE

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives will not be permitted without written permission from the Contracting Officer, and then only during designated times.

3.3 RESTRICTIONS ON EQUIPMENT

3.3.1 Electromagnetic Interference Suppression

- a. Electric motors must comply with MIL-STD-461 relative to radiated and conducted electromagnetic interference. A test for electromagnetic interference will not be required for motors that are identical physically and electrically to those that have previously met the requirements of MIL-STD-461. An electromagnetic interference suppression test will not be required for electric motors without commutation or sliprings having no more than one starting contact and operated at 3,600 revolutions per minute or less.
- b. Equipment used by the Contractor shall comply with MIL-S-16165 for internal combustion engines and MIL-STD-461 for other devices capable of producing radiated or conducted interference.
- c. Conduct tests for electromagnetic interference on electric motors and Contractor's construction equipment in accordance with MIL-STD-461 and MIL-STD-462. Test location shall be reasonably free from radiated and conducted interference. Furnish testing equipment, instruments, and personnel for making the tests; a test location; and other necessary facilities.

3.3.2 Radio Transmitter Restrictions

Conform to the restrictions and procedures for the use of radio transmitting equipment, as directed. Do not use transmitters without prior approval.

3.4 CONTROL AND DISPOSAL OF SOLID WASTES

Pick up and separate solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean.

3.4.1 Disposal of Metal Paint Cans

All metal paint cans shall be taken to Building 962 for recycling. The cans shall be empty and completely dry. The cans shall be triple rinsed and stenciled "Triple Rinsed" prior to turn in. The Contractor shall give the Government 72 hours advance notice prior to turn-in. Contractor is responsible for rinsing, stenciling, crushing, and deposting in Government owned receptable, located at Building 962.

3.4.2 Disposal of Rubbish and Debris

Rubbish and debris shall be taken off-base for disposal, unless specifically directed otherwise below:

Metals shall be taken to the DRMO disposal area at Lot 203, as specified.

<u>CATEGORY</u>	<u>CONSTRUCTION DEBRIS DISPOSAL - BASE SANITARY LANDFILL EXAMPLE/GENERAL INFORMATION FOR DEPOSIT IN THE LANDFILL</u>
Recyclable Cardboard	Breakdown corrugated cardboard boxes and deliver to the Base Recycling Center located at Building 982. If base personnel rejects the cardboard, take cardboard for off-base disposal.
Recyclable Wood Pallets	Deliver usable pallets to the Base Recycling Center located at Building 982. If base personnel rejects the pellets, take pallets for off-base disposal.
Organic Matter	Organic matter will not be accepted at the landfill.
*****	Weigh each and every vehicle delivering debris upon entrance and exit. Cover debris.
Metals	Metals will not be accepted at the landfill. Remove metals from each and every category before delivery to landfill. (Example: Remove hardware from doors and windows.)
	Dispose of metal construction debris at Defense Reutilization Maintenance Office (DRMO).
	Aluminum, brass, copper, lead, other metal, electrical wiring, cable (cut in 3 foot or less sections)
Treated & Untreated Wood/Lumber	Treated & untreated wood/lumber will not be accepted at the landfill.
Concrete	Concrete will not be accepted at the landfill.
Construction Material	Construction material should be managed and placed in a designated area. Area shall be kept clean of debris and all material removed at the end of the project.
Solid Waste	Separate each category of solid waste to enhance recycling.
Hazardous Material	This project involves demolition, renovation/repair and/or construction activities; therefore, hazardous material (such as paints, solvents, thinners, adhesives, etc) may be used during the execution of this project. The contractor

<u>CATEGORY</u>	CONSTRUCTION DEBRIS DISPOSAL - BASE SANITARY LANDFILL EXAMPLE/GENERAL <u>INFORMATION FOR DEPOSIT IN THE LANDFILL</u>
Solid Waste Report	<p>will be required to appropriately manage the hazardous material and provide secondary containment.</p> <p>All solid waste generated and recycled will be weighed. Contractor will report the amount of solid waste disposed and recycled at the end of the project to EMD's Solid Waste Manager or the Pollution Prevention Manager via the OICC.</p> <p>Tonnage information for all materials delivered to the Base Landfill is available at the Landfill Office. Submit a written request to the Landfill Manager, specifying the desired information.</p>
Recycling of Construction Debris	<p>Recyclable material (ex. Scrap metal/aluminum/brass/copper/lead, and other metal) may be recycled through Defense Utilization Maintenance Office) DRMO using a 1348-1a with the following information (Proceeds for the sale of recyclable material are to go to the Qualified Recycling financial account - 17F3875 27RM 00767001 0 000027 3c 000000 06700198004). For additional information contact the Base Recycling Coordinator 910-451-4214.</p>
Electrical Equipment	<p>Before demolition or removal of electrical equipment from the Base - Contractor shall contact Base High Voltage Shop Supervisor at (910) 451-2790, to allow for first right of refusal of electrical equipment such as: ATS, transformers, and generators. Electrical equipment will not be accepted at landfill.</p>

3.4.3 Disposal Off-Base

- a. Provide 24-hour advance written notice to the Contracting Office of Contractor's intention to dispose of off base.
- b. Disposal at sites or landfills not holding a valid State of North Carolina permit is specifically prohibited. The prohibition also applies to sites where a permit may have been applied for but not yet obtained.
- c. Off-base disposal of construction debris outside the parameters of this paragraph at site without State permits and/or not in accordance with regulatory requirements shall require the Contractor at his own expense to remove, transport and relocate the debris to a State approved site. The Contractor shall also be required to pay any fines, penalties, or fees related to the illegal disposal of construction debris

3.5 CONTROL AND DISPOSAL OF HAZARDOUS WASTE

3.5.1 Hazardous Waste Generation

Handle generated hazardous waste in accordance with 40 CFR 262.

3.5.2 Hazardous Waste Storage

Store hazardous waste in containers in accordance with 49 CFR 178. Identify hazardous waste in accordance with 40 CFR 261 and 40 CFR 262. Identify hazardous waste generated within the confines of the station by the station's EPA generator identification number.

3.5.3 Spills of Oil and Hazardous Materials

Take precautions to prevent spills of oil and hazardous material. In the event of a spill, immediately notify the Contracting Officer. Spill response shall be in accordance with 40 CFR 300 and applicable State regulations.

3.5.4 Lead-Acid Batteries

Dispose of lead-acid batteries that are not damaged or leaking at a State-approved battery recycle or at a permitted or interim status hazardous waste TSD facility. For lead-acid batteries that are leaking or have cracked casings, dispose of the electrolyte solution using one of the following alternatives:

- a. An industrial waste water treatment plant, if available and approved by the Contracting Officer for disposing of lead-acid battery electrolyte.
- b. Dispose of the lead-acid battery electrolyte at a permitted or interim status hazardous waste TSD facility.

The management and disposal of waste lead-acid batteries and electrolyte shall comply with requirements for management and disposal of hazardous wastes.

3.5.5 Mercury Control

Prior to starting work, remove thermostats, switches, and other components that contain mercury. Upon removal, place items containing mercury in doubled polyethylene bags, label, and turn over to the Contracting Officer for disposal.

3.5.6 Petroleum Products

Protect against spills and evaporation during fueling and lubrication of equipment and motor vehicles. Dispose of lubricants to be discarded and excess oil.

3.6 DUST CONTROL

Keep dust down at all times, including nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not shake bags of cement, concrete mortar, or plaster unnecessarily.

3.6.1 Abrasive Blasting

3.6.1.1 Blasting Operations

The use of silica sand is prohibited in abrasive blasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive agent, paint chips, and other debris in accordance with the requirements specified. Perform work involving removal of hazardous material in accordance with 29 CFR 1910.

3.6.1.2 Disposal Requirements

Collect dust, abrasive, paint, and other debris resulting from abrasive blasting operations and store in 55 gallon drums with watertight lids. Take a representative sample of this material, and test for EP toxicity with respect to lead, chromium, and cadmium content. The sampling and testing shall be performed in accordance with 40 CFR 261. Handle debris resulting from the abrasive blasting operations as a hazardous material, and dispose of in accordance with 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Transport hazardous material by a transporter licensed and permitted for transportation of hazardous materials. Dispose of hazardous material in an EPA-approved and permitted facility specifically designated for hazardous waste disposal.

3.7 QUARANTINE FOR IMPORTED FIRE ANT (4/82)

Onslow, Jones, and Cartaret Counties and portions of Duplin and Craven Counties have been declared a generally infested area by the United States Department of Agriculture (USDA) for the imported fire ant. Compliance with the quarantine regulations established by this authority as set forth in USDA Publication 301.81 of 31 December 1992, is required for operations hereunder. Pertinent requirements of the quarantine for materials originating on the Camp Lejeune reservation, the Marine Corps Air Station

(Helicopter), New River and the Marine Corps Air Station, Cherry Point, which are to be transported outside Onslow County or adjacent suppression areas, include the following:

- a. Certification is required for the following articles and they shall not be moved from the reservation to any point outside Onslow County and adjacent designated areas unless accompanied by a valid inspection certificate issued by an Officer of the Plant Protection and Quarantine Program (PPQ) of the U.S. Department of Agriculture.
 - (1) Bulk soil
 - (2) Used mechanized soil-moving equipment. (Used mechanized soil-moving equipment is exempt if cleaned of loose noncompacted soil).
 - (3) Other products, articles, or means of conveyances, if it is determined by an inspector that they present a hazard of transporting spread of the imported fire ant and the person in possession thereof has been so notified.
- b. Authorization for movement of equipment outside the imported fire and regulated area shall be obtained from USDA, Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ), Box 28, Goldsboro, North Carolina, 27533-0028, Attn: Mr. William Scroggins or Mr. Frank Best, telephone (919) 735-1941. If Mr. Scroggins or Mr. Best are not available, contact Mr. Jim Kelley at (910) 815-4667, the supervisor's office in Wilmington. Requests for inspection shall be made sufficiently in advance of the date of movement to permit arrangements for the services of authorized inspectors. The equipment shall be prepared and assembled so that it may be readily inspected. Soil on or attached to equipment, supplies, and materials shall be removed by washing with water or such other means as necessary to accomplish complete removal. Resulting spoil shall be wasted as necessary and as directed.

ANNUAL REPORT OF PRODUCTS CONTAINING RECOVERED MATERIALS

Page 1 of 3

Contractor shall submit data annually (By 1 December) for the following products used during the previous fiscal year (1 October - 30 September) as required by 6002 of the Solid Waste Disposal Act as ammended by Resource Conservation and Recovery Act (RCRA):

Contract Number: _____ Fiscal Year: _____

MATERIAL	UNIT	QUANTITY (CRM)	TOTAL QUANTITY
A. <u>Insulation</u>			
1. Loose fill	Ft3		
2. Blanket or batt	Ft2		
3. Board	Ft2		
4. Spray-in-place	m3		
5. Other			
B. <u>Cement and Concrete</u>	yd3		
C. <u>Paper and Paper Products</u>			
1. Copy Paper	Box		
2. Printing/Writing Paper	Box		
3. Corrugated and fiberboard boxes	Box		
4. Folding boxboard and cartons	Box		
5. Stationary, office papers, envelopes, and computer paper	\$Amt		
6. Toilet tissue, paper towels, fasial tissue, paper napkins, doilies and industrial wipes	\$Amt		
7. Brown papers and coarse papers	Box		
8. Other			

APPENDIX A

MATERIAL	DEFINITION
1. Quantity (CRM)	Quantity used containing recovered materials.
2. Total Quantity	Quantity used containing recovered materials plus quantity used not containing recovered materials.
3. Unit	Ft3 (cubic feet), Ft2 (square feet), m3 (cubic meters), yd3 (cubic yards), box (number of boxes used), \$ Amt (dollar value of material used)
4. Loose-Fill Insulation	Includes, but is not limited to..."cellulose fiber, mineral fibers (fiberglass and rock wool), vermiculite, and perlite.
5. Blanket or Batt Insulation	Includes, but is not limited to... "mineral fibers (fiberglass and rock wool)."
6. Board Insulation	This category refers to sheathing, roof decking, and wood panel insulation. It includes, but is not limited to... "cellulose fiber fiberboard, perlite composite board, polyurethane, polyisocyanurate, polystyrene, phenolics, and composites."
7. Spray-in-place Insulation	Includes, but is not limited to... "foam-in-place polyurethane and polyisocyanurate, and spray-on cellulose."
8. Cement or Concrete Containing Recovered Materials, Cement, or Concrete Containing Fly Ash	
9. Copy Paper	This item refers to... "any grade of paper suitable for copying by the xerographic method."
10. Printing & Writing Paper	This item refers to... "paper designed for printing, other than newsprint, such as offset or book paper," and... "paper suitable for pen and ink, pencil, typewriter or printing."

APPENDIX A

MATERIAL	DEFINITION
11. Corrugated & Fiberboard Boxes	Corrugated boxes refer to... "boxes made of corrugated paperboard, which, in turn, is made from a fluted corrugating medium pasted to two flat sheets of paperboard (linerboard)." Fiber or fiberboard boxes refer to... "boxes made from containerboard, either solid fiber or corrugated paperboard (general term); or boxes made from solid paperboard of the same material throughout."
12. Folding Boxes and Cartons	This item refers to... "a paperboard suitable for the manufacture of folding cartons."
13. Stationery, Office Papers, Envelopes, and Manifold Business Forms	This item is considered self-explanatory, however, if questions arise refer to 40 CFR 250.4 for definitions of any of these items.
14. Toilet Tissue, Paper Towels, Facial Tissue, Paper Napkins, Doilies, and Industrial Wipes	This item is considered self-explanatory, however, if questions arise refer to 40 CFR 250.4 for definitions of any of these items.
15. Brown Papers, and Coarse Papers	Brown papers refer to... "papers usually made from unbleached kraft pulp and used for bags, sacks, wrapping paper, and so forth." Coarse papers refer to... "papers used for industrial purposes, as distinguished from those used for cultural or sanitary purposes."
16. Other	Any other type of paper not included in any of the above categories.

APPENDIX A

-- End of Section --

SECTION 01 78 00

CLOSEOUT PROCEDURES

05/13

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-10, Operation and Maintenance Data

Equipment/product warranty list

Submit Data Package 1 in accordance with Section 01 78 23, "Operation and Maintenance Data."

SD-11 Closeout Submittals

As-built drawings

Record of materials

Maximo requirements

Complete Submittal Package 2 CD/DVD's

Equipment/product warranty tag

1.2 PROJECT RECORD DOCUMENTS

As-Built Drawings will be submitted as specified in 1.2.1 along with GIS Deliverables which will be created and submitted as specified in Section 01 78 30, DIGITAL DATA DELIVERABLES (GIS).

1.2.1 As-Built Drawings

"FAC 5252.236-9310, Record Drawings." As-built drawings will be submitted in redline mark-up format.

1.2.2 As-Built Record of Materials

Furnish a record of materials.

Where several manufacturers' brands, types, or classes of the item listed have been used in the project, designate specific areas where each item was used. Designations shall be keyed to the areas and spaces depicted on the contract drawing. Furnish the record of materials used in the following format:

MATERIALS DESIGNATION	SPECIFICATION	MANUFACTURER	MATERIALS USED (MANUFACTURER'S DESIGNATION)	WHERE USED
_____	_____	_____	_____	_____

1.3 MAXIMO REQUIREMENTS

Submit maximo requirements as specified in Section 23 03 00.00 20.

1.4 EQUIPMENT/PRODUCT WARRANTIES

1.4.1 Equipment/Product Warranty List

Furnish to the Contracting Officer a bound and indexed notebook containing written warranties for equipment/products that have extended warranties (warranty periods exceeding the standard one-year warranty) furnished under the contract, and prepare a complete listing of such equipment/products. The equipment/products list shall state the specification section applicable to the equipment/product, duration of the warranty therefor, start date of the warranty, ending date of the warranty, and the point of contact for fulfillment of the warranty. The warranty period shall begin on the same date as project acceptance and shall continue for the full product warranty period. Execute the full list and deliver to the Contracting Officer prior to final acceptance of the facility.

1.4.2 Equipment Warranty Tags and Guarantor's Local Representative

Furnish with each warranty the name, address, and telephone number of the guarantor's representative nearest to the location where the equipment and appliances are installed. The guarantor's representative, upon request of the station representative, shall honor the warranty during the warranty period, and shall provide the services prescribed by the terms of the warranty. At the time of installation, tag each item of warranted equipment with a durable, oil- and water-resistant tag approved by the Contracting Officer. Attach tag with copper wire and spray with a clear silicone waterproof coating. Leave the date of acceptance and QC's signature blank until project is accepted for beneficial occupancy. Tag shall show the following information:

EQUIPMENT/PRODUCT WARRANTY TAG

Type of Equipment/Product _____
 Warranty Period _____ From _____ To _____
 Contract No. _____
 Inspector's Signature _____ Date Accepted _____

Construction Contractor:

Name: _____
 Address: _____
 Telephone: _____

Warranty Contact: _____

Name: _____
 Address: _____
 Telephone: _____

STATION PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE

1.5 MECHANICAL TESTING AND BALANCING

All contract requirements shall be fully completed, including all testing, prior to contract completion date. In addition, all contract requirements shall be fully completed, including testing and inspection, prior to contract completion date, except as noted otherwise.

1.6 COMPLETE SUBMITTAL PACKAGE

Contractor shall make electronic copies of all submittals, including the approved transmittal sheets, and provide two (2) CD/DVD's containing all submittals for the project.

The CD/DVD's shall be marked "Complete Submittal Package - Contract # 20-0075 Repair BEQ FC530."

1.7 CLEANUP

Leave premises "broom clean." Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Clean filters of operating equipment. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

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SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

07/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E 1971 (2005) Stewardship for the Cleaning of Commercial and Institutional Buildings

1.2 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system, stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The subcontractors shall compile and prepare data and deliver to the Contractor prior to the training of Government personnel. The Contractor shall compile and prepare aggregate O&M data including clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.2.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.2.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Commissioned items without a specified data package requirement in the individual technical sections shall use Data Package 3.

1.2.3 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

1.3 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.3.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.3.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.3.1.2 Operator Prestart

Include procedures required to install, set up, and prepare each system for use.

1.3.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.3.1.4 Normal Operations

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

1.3.1.5 Emergency Operations

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.3.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

1.3.1.7 Environmental Conditions

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.3.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.3.2.1 Lubrication Data

Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":

- a. A table showing recommended lubricants for specific temperature ranges and applications.
- b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
- c. A Lubrication Schedule showing service interval frequency.

1.3.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

1.3.2.3 Cleaning Recommendations

Provide environmentally preferable cleaning recommendations in accordance with ASTM E 1971.

1.3.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.3.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.3.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.3.3.3 Maintenance and Repair Procedures

Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.3.3.4 Removal and Replacement Instructions

Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.3.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.3.4 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

1.3.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.3.5.1 Product Submittal Data

Provide a copy of all SD-03 Product Data submittals required in the applicable technical sections.

1.3.5.2 Manufacturer's Instructions

Provide a copy of all SD-08 Manufacturer's Instructions submittals required in the applicable technical sections.

1.3.5.3 O&M Submittal Data

Provide a copy of all SD-10 Operation and Maintenance Data submittals required in the applicable technical sections.

1.3.5.4 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of

equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog

1.3.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

1.3.5.6 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.3.5.7 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.3.5.8 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms.

1.3.5.9 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.4 TYPES OF INFORMATION REQUIRED IN CONTROLS O&M DATA PACKAGES

Include Data Package 5 and the following for control systems:

- a. Narrative description on how to perform and apply all functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.
- b. Full as-built sequence of operations.
- c. Copies of all checkout tests and calibrations performed by the Contractor (not Cx tests).

1.5 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.5.1 Data Package 1

- a. Safety precautions
- b. Cleaning recommendations
- c. Maintenance and repair procedures
- d. Warranty information
- e. Contractor information
- f. Spare parts and supply list

1.5.2 Data Package 2

- a. Safety precautions
- b. Normal operations
- c. Environmental conditions
- d. Lubrication data
- e. Preventive maintenance plan and schedule
- f. Cleaning recommendations
- g. Maintenance and repair procedures
- h. Removal and replacement instructions
- i. Spare parts and supply list
- j. Parts identification
- k. Warranty information
- l. Contractor information

1.5.3 Data Package 3

- a. Safety precautions
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Environmental conditions
- g. Lubrication data
- h. Preventive maintenance plan and schedule
- i. Cleaning recommendations

- j. Troubleshooting guides and diagnostic techniques
- k. Wiring diagrams and control diagrams
- l. Maintenance and repair procedures
- m. Removal and replacement instructions
- n. Spare parts and supply list
- o. Product submittal data
- p. O&M submittal data
- q. Parts identification
- r. Warranty information
- s. Testing equipment and special tool information
- t. Testing and performance data
- u. Contractor information

1.5.4 Data Package 4

- a. Safety precautions
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Operator service requirements
- g. Environmental conditions
- h. Lubrication data
- i. Preventive maintenance plan and schedule
- j. Cleaning recommendations
- k. Troubleshooting guides and diagnostic techniques
- l. Wiring diagrams and control diagrams
- m. Maintenance and repair procedures
- n. Removal and replacement instructions
- o. Spare parts and supply list
- p. Corrective maintenance man-hours

- q. Product submittal data
- r. O&M submittal data
- s. Parts identification
- t. Warranty information
- u. Personnel training requirements
- v. Testing equipment and special tool information
- w. Testing and performance data
- x. Contractor information

1.5.5 Data Package 5

- a. Safety precautions
- b. Operator prestart
- c. Start-up, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Environmental conditions
- f. Preventive maintenance plan and schedule
- g. Troubleshooting guides and diagnostic techniques
- h. Wiring and control diagrams
- i. Maintenance and repair procedures
- j. Removal and replacement instructions
- k. Spare parts and supply list
- l. Product submittal data
- m. Manufacturer's instructions
- n. O&M submittal data
- o. Parts identification
- p. Testing equipment and special tool information
- q. Warranty information
- r. Testing and performance data
- s. Contractor information

PART 2 PRODUCTS

Not Used

20-0075 Repair BEQ FC530

PART 3 EXECUTION

Not Used

-- End of Section --

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SECTION 01 78 30

DIGITAL DATA DELIVERABLES (GIS)

09/12

PART 1 GENERAL

1.1 OBJECTIVE

The primary objective of this section is to provide detailed specifications for the collection and creation of Geographic Information System (GIS) data to ensure that all GIS data delivered is compatible and will add value to MCB Camp Lejeune's Installation Geospatial Information and Services (IGI&S) repository MCAS Cherry Point's Installation Geospatial Information and Services (IGI&S) repository.

1.1.1 Point of Contact for MCB Camp Lejeune

The Point of Contact (POC) for assistance in preparation of GIS deliverables is:

NAVFAC MIDLANT
Officer In Charge Of Construction
(Construction Manager)
1005 Michael Drive
Camp Lejeune, NC 28547-2521
(910) 451-2581

1.1.2 Point of Contact for MCAS Cherry Point

The Point of Contact (POC) for assistance in preparation of GIS deliverables is:

MCAS Cherry Point Facilities Systems Service Office
GIS Section
chpt.facssoomb@usmc.mil

1.2 1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00
SUBMITTAL PROCEDURES:

SD-11 Closeout Submittals

GIS Data Deliverables

1.3 COLLECTION AND CREATION OF GEOSPATIAL DATA

Prior to data collection and creation the contractor shall provide the Government Project Manager a Technical Approach Plan for approval which describes the contractor's plan to collect and create GIS Data as specified in this section.

1.3.1 Technical Approach Plan

The Technical Approach Plan will contain the following:

- a. How features will be collected utilizing Global Positioning System (GPS) technology
- b. Which features, as specified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES", will be located, GPS and created
- c. Source of attribute data
- d. Steps taken to create personal Geodatabase e. What GIS data will be delivered

1.3.2 Geospatial Data Collection

All questions regarding the Specification For Digital Data - GIS Deliverables shall be directed to MCB Camp Lejeune I&E, PWD GIS Section MCAS Cherry Point I&E, PWD GIS Section, via the Government Project Manager. Specific Tasks are as follows:

- a. Contractor is responsible for the collection and creation of geospatial data for newly constructed or replaced utilities and infrastructure features that fall within the realm of this specification.
- b. Utilize GPS technology to locate and create GIS data and deliver only features that are relevant to this contract as specified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES".
- c. Follow instructions in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" which defines the following:
 1. GIS feature requirements.
 2. The manner in which the data will be collected in GPS.
 3. The manner in which GIS data will be created.
 4. Required Attribute data.
 5. Other instructions pertaining to GIS data.

1.3.3 Data Collection requirements

Survey Grade and Sub-Foot GPS Geospatial Data Collection requirements:

- a. GPS data shall be completed in accordance with the "Statewide

Global Positioning System (GPS) Data Collection and Documentation Standards, Version 3" (or higher version if available at the time of this project) as prepared by the Statewide Mapping Advisory Committee and adopted by the North Carolina Geographic Coordinating Council in May 2006. Copies of these standards can be found on the Internet at: www.ncgicc.org.

- b. Only bench marks included in the North Carolina Geodetic Survey Base Station Network shall be used for mapping grade GPS data collection.
- c. Mission planning is essential and contractor should utilize lowest possible PDOP values.
- d. Geographic data shall be collected and created into the Universal Transverse Mercator (UTM) coordinate system.
 - 1. North American Datum (NAD) 1983 / UTM Zone 18N.
- e. Spatial accuracy requirements for Survey and Sub-Foot grade data collection are as follows:
 - Sub-Foot requirements
 - 1. All points shall be within + 12 inches
 - 2. 95% accuracy rate for all points.
 - Survey Grade requirements
 - 1. All points shall be within + 1 centimeter
 - 2. 98% accuracy rate for all points
- f. Every effort shall be made to capture feature locations without using offsets.
 - 1. Offsets will be noted in final report and user_flag field for which each feature it applies, unless otherwise specified.

1.3.4 Geospatial Data Standards

The IGI&S repository model is based on the Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) with modifications.

- a. Copies of the SDSFIE may be obtained from the Solutions and Technology for the Advancement and Refinement of SDSFIE (STARS) Team Internet homepage at <http://www.sdsfieonline.org/>.
- b. Due to on-going government modifications to MCB Camp Lejeune's MCAS

Cherry Point's IGI&S repository the contractor shall ensure the schema of the final product is in compliance and all data will be created and delivered utilizing MCB Camp Lejeune's MCAS Cherry Point's most current IGI&S repository schema.

- 1. The contractor shall request an additional template prior to

delivery to be used for the final delivery of data.

2. Final report will include date of last data request for IGI&S schema and geospatial data.

1.3.5 Government Provided Geospatial Data

MCB Camp Lejeune's MCAS Cherry Point's **IGI&S repository's schema and geospatial data shall be obtained via the Government Project Manager before any data is collected or created.** The Project Manager, upon request, shall furnish the contractor with a Geospatial data request package. The contractor shall:

- a. Request only GIS data that is pertinent to the contract. b. Request shall include the following information:
 1. Contract Number and Title.
 2. Contractor's Name, Address, Phone Number, Email and Point of Contact.
 3. Summary of Project.
 4. Contract Specification.
 5. Expected Delivery date and features.

1.3.6 New Feature Class Requirements

When developing a new feature class, the Contractor shall develop the initial structure consistent with the most current version of SDSFIE.

- a. If further modifications to the database structure are required, the Contractor will consult with the Government Project Manager for direction and final approval.
- b. All new feature data class shall be created in compliance with SDSFIE noted on the final report.

1.3.7 Collection of Geospatial data

- a. Utility data, as identified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" will be collected utilizing Survey Grade GPS data collection methods.
- b. Prior to GPS efforts, buried underground utilities shall be located in order to GPS accurate location.
- c. Other infrastructure data, as identified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" shall be collected utilizing Sub-Foot GPS data collection methods.
- d. GPS data and collection data files shall be included with every phase of delivery.

1.3.8 Creation of Geospatial Data

Data will be created in a Personal Geodatabase using ArcGIS 9.3 or higher if a higher version is being used by the government at the time of this

project.

Contractor shall verify the ArcGIS version, via the Government Project Manager, at the commencement of this contract.

Geodatabase Spatial Reference Properties shall include the following:

- a. North American Datum (NAD) 1983 / UTM Zone 18N. b. x,y domain precision of 1000.

1.3.9 Data Format and Structure

To ensure that all Geospatial data created can be loaded and add value to MCB Camp Lejeune's MCAS Cherry Point's IGI&S repository; data will be created in such a way that the delivered file personal geodatabase mirrors the IGI&S repository. This includes, but is not limited to the following:

- a. Geospatial database table structure. b. Domain(s) configuration.
 - 1. SDSFIE domains have been modified by MCB Camp Lejeune MCAS Cherry Point for operational purposes, it is the contractor's responsibility to request and utilize associated domain structure to ensure deliverable will load into the geodatabase.
- c. Required attribute data as specified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" shall be obtained via contract specifications, plans and on as-built drawings.
 - 1. Actual field data always supersedes drawings.
- c. The contractor may have to research and verifying existing as-built data in the Technical Records Section located at the Public Works Building, MCB Camp Lejeune MCAS Cherry Point.
- d. **The GIS Data Deliverable does not replace the requirements for as-built drawings and or files for this contract.**

1.3.10 GIS Topology Rules

All data must be created using GIS topology rules for polygons, points and lines, such as, but not limited to the following examples:

- a. Polygons, Polylines and points rules, please reference illustrating topology rules in ArcGIS at www.esri.com.
- b. Polygons must not have slivers.
- c. All utility or infrastructure system data, which is, but not limited to, transportation system and electrical, water, steam distribution, and wastewater collection etc., will be created using GIS spatially connectivity rules which specifies that vertex, edge and endpoints be snapped to features within the system.
 - 1. Features will be snapped to the appropriate item.
 - 2. Data will be created to represent the real world, for example, direction of flow, i.e., water, sewer and

transportations systems will be drawn and created in the direction of flow.

3. Utility systems will be created from source to sink, etc.
4. Abandoned In Place (AIP) utility lines will be located and updated in the current utility line feature data set and identified as AIP in the attribute table.
5. Polylines will be connected by nodes, i.e., fittings, valves, street connections and other natural occurring items within the data.
6. Demolished Lines are to be delivered in a feature data set, which appropriately reflects the utility.

1.3.11 Creation of Geographic Data Documentation (METADATA)

For each digital file delivered containing geographic information the Contractor shall provide documentation consistent with the Federal Geographic Data Committee (FGDC) Content Standards for Digital Geospatial Metadata (CSDGM). Both 'Mandatory' and 'Mandatory-if-Applicable' fields shall be completed for each geographic data set.

Metadata generation tools included in the ArcGIS suite of software shall be used in the production of the required metadata in XML format. If neither of these tools is used, the Contractor must insure that the metadata is delivered in a format that can be easily translated to the XML format. Copies of the FGDC metadata standard can be obtained on the Internet at <http://www.fgdc.gov>.

The documentation shall include, but not be limited to, the following:

- a. The name and description of the data set/data layer.
- b. The source of the data and any related data quality information such as positional accuracy and time period of content.
- c. Descriptions of the receiver and other equipment used during collection and processing, base stations used for differential corrections, software used for performing differential corrections, estimated horizontal and vertical accuracies obtained, and conversion routines used to translate the data into final geographic data delivery format.
- d. Type of data layer (point, line, polygon, etc.)
- e. Field names of all attribute data and a description of each field name.
- f. Definition of all codes used in the data fields.
- g. Ranges of numeric fields and the meaning of these numeric ranges.
- h. The creation date of the data layer and the name of the person or company who created it.
- i. A point of contact shall be provided to answer technical questions.

1.3.12 Final Report

Final report will also be required with the following supplement information:

- a. Specific procedures and list of equipment, software and versions that was utilized for the GPS data collection and creation of geospatial data.
- b. Any offsets.
- c. Modifications to the geodatabase to include any new feature data class.
- d. Source that was utilized for all required attributes.
- e. Miscellaneous information that the contractor deems significant.
- f. A Technical Point of Contact.
- g. GPS data controller files.

1.3.13 GIS Submittals GIS Data Deliverables

Submit GIS data deliverables for review and approval by the MCB Camp Lejeune, MCAS Cherry Point Public Works GIS section.

- a. Reports will be submitted in the following formats and or versions. Contractor shall verify required version(s) of software, via the Government Project Manager, at the commencement of this contract.
 1. Microsoft Office 2003 or higher upon verification.
 2. Adobe Portable Document Format (PDF).
- b. All GIS data will be provided in a ArcGIS file personal geodatabase as specified.
- c. Media for Geospatial Data Deliverables: Geographic data shall be delivered on a compact disk read-only memory (CD-ROM) -or- digital versatile disk read-only memory (DVD-ROM).
- d. Map submittals shall accompany each geospatial deliverable.
 1. Include ANSI C map for each project / area.
 2. Data should be labeled and attributed per specification.

1.3.14 Ownership

All digital files, final hard-copy products, GPS raw data, source data acquired for this project, and related materials, including that furnished by the Government, shall become the property of MCB Camp Lejeune MCAS Cherry Point and will not be issued, distributed, or published by the Contractor.

1.3.15 Geographic Data Review

- a. The digital geographic maps, GPS collection files and related data, all working text and documents and file personal geodatabase shall be included for review in the draft and final contract submittals.
- b. The contract shall submit a preliminary review of data between 15-25 percent to ensure specifications are being met.
- c. The data will be analyzed for discrepancies in subject content, correct format in accordance with these specifications, and compatibility with MCB Camp Lejeune's MCAS Cherry Point's IGI&S repository schema.
- d. Failure for non-compliance of the specifications outlined in this document will result in non-acceptance of data deliverables.

1.4 ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES

1.4.1 Infrastructure

GPS and collect attribute data as specified in the Collection and Creation of Geospatial data section for each feature listed with Sub-foot GPS accuracy and enter attribute data in compliance with the IGI&S database.

1.4.1.1 1.4.1.1 Structures: CLJN.structure_existing_area CPT.structure_existing_area

GPS Structure and collect the following attributes:

- a. Subtype ID
- b. Building ID (building number)
- c. Structure Status
- d. Number of Levels
- e. Structure Use 2: Populate "Residential" if structure is a residential unit
- f. Building No (building number)
- g. Facility No (building number)
- h. Material
- i. Drawing Number
- j. Contract Number
- k. Date Acquired
- l. Data Source

1.4.1.2 Floor Outline: CLJN.building.floor_outline (Polyline) CPT.building.floor_outline (Polyline)

All new and renovated buildings will be required to have a "clean floor plan" for each floor level that will be delivered in GIS format. Each level will represent one feature and provide the following: walls, doors, windows, closet, crawlspace, head facility, stairwells, etc.

Create feature and update the following attributes:

- a. Building ID: (building number)
- b. Floor Name
- c. Drawing Number
- d. Contract Number:

e. Data Source

1.4.1.3 Slabs: CLJN.slab_area CPT.slab_area

GPS and collect the following attributes:

- a. Structure ID: (Facility Number, if applicable)
- b. Feature Description
- c. Structure Material
- d. Structure Condition
- e. Built Date
- f. Drawing Number
- g. Contract Number
- h. Data Source

1.4.2 Transportation

Attribute data requirements for Transportation: The following attributes shall be collected for each infrastructure data class: Collect GPS data for all features listed with Sub-Foot accuracy.

1.4.2.1 Road Centerline: CLJN.road_centerline CPT.road_centerline

GPS and collect the following attributes:

- a. Category
- b. Road Name
- c. Paved: Paved/Unpaved
- d. Date Acquired
- e. Surface Type
- f. Drawing Number
- g. Contract Number
- h. Data Source
- i. Use

1.4.2.2 Road Area: CLJN.road_area CPT.road_area

GPS and collect the following attributes:

- a. Road Segment
- b. Paved
- c. Divided: Yes/No
- d. Number of Lanes
- e. Date Acquired
- f. Surface Type
- g. Drawing Number
- h. Contract Number
- i. Data Source
- j. Road Name

1.4.2.3 Curb line: CLJN.curb_line CPT.curb_line

GPS and collect the following attributes:

- a. Curb Material
- b. Description
- c. Drawing Number
- d. Contract Number
- e. Data Source

1.4.2.4 Driveways: CLJN.vehicle_driveway_area CPT.vehicle_driveway_area

GPS and collect the following attributes:

- a. Paved or Unpaved
- b. Surface Material
- c. Date Acquired
- d. Drawing Number
- e. Contract Number
- f. Data Source

1.4.2.5 Parking Lots: CLJN.vehicle_parking_area CPT.vehicle_parking_area

GPS and collect the following attributes:

- a. Parking ID: Building that is associated with this feature
- b. Paved Description
- c. Total Spaces
- d. Lighting
- e. Drawing Number
- f. Contract Number
- g. Data Source
- h. Surface Type
- i. Park Use
- j. Feature Name
- k. Striping

1.4.2.6 Bridge: CLJN.road_bridge_area CPT.road_bridge_area

GPS and collect the following attributes:

- a. Bridge ID: Facility Number
- b. Number of Lanes
- c. Bridge Material Type
- d. Bridge Type
- e. Capacity
- f. Drawing Number
- g. Contract Number
- h. Data Source

1.4.2.7 Pedestrian Sidewalks: CLJN.pedestrian_sidewalk_area
CPT.pedestrian_sidewalk_area

GPS and collect the following attributes:

- a. Material
- b. Use
- c. Status
- d. Drawing Number
- e. Contract Number
- f. Data Source
- g. Date Acquired

1.4.3 Improvement General

Attribute data requirements for Improvement General: The following attributes shall be collected for each infrastructure data class:
Collect GPS data for all features listed with Sub-Foot accuracy.

1.4.3.1 Fence: CLJN.fence_line CPT.fence_line

GPS and collect the following attributes:

- a. Material: Chain Link, Wood, etc.
- b. Drawing Number
- c. Contract Number
- d. Data Source
- e. RECLIN ID: Facility Number
- f. Date Acquired

1.4.3.2 Gates: CLJN.gate_line CPT.gate_line

GPS and collect the following attributes:

- a. Material
- b. Feature Height
- c. Drawing Number
- d. Contract Number
- e. Data Source
- f. Gate ID: Facility ID
- g. Date Acquired

1.4.3.3 Walls: CLJN.wall_line CPT.wall_line

GPS and collect the following attributes:

- a. Material
- b. Feature Height
- c. Drawing Number
- d. Contract Number
- e. Data Source
- f. Facility ID:
- g. Date Acquired

1.4.3.4 Recreation Trails: CLJN.recreation_trail_centerline
CPT.recreation_trail_centerline

GPS and collect the following attributes:

- a. Subtype
- b. Trail Description
- c. Paved
- d. Date Acquired
- e. Drawing Number
- f. Contract Number
- g. Data Source
- h. Trail ID
- i. Trail Name

1.4.3.5 Miscellaneous Recreation Area
Playground: CLJN.playground_area CPT.playground_area

GPS and collect the following attributes:

- a. Playground ID: Facility Number
- b. Feature Description:

- c. Drawing Number
- d. Contract Number
- e. Data Source

1.4.3.6 Swimming Pool: CLJN.swimming_pool_area CPT.swimming_pool_area

GPS and collect the following attributes:

- a. Swimming Pool ID
- b. Feature Description
- c. Drawing Number
- d. Contract Number
- e. Data Source

1.4.3.7 Athletic Court: CLJN.athletic_court_area CPT.athletic_court_area

GPS and collect the following attributes:

- a. Court ID
- b. Court Type
- c. Court Name
- d. Date Acquired
- e. Drawing Number
- f. Contract Number
- g. Data Source
- h. Court Desc

1.4.3.8 Athletic Field: CLJN.athletic_field_area CPT.athletic_field_area

GPS Structures and collect the following attributes:

- a. Field ID: Facility Number
- b. Field Description
- c. Date Acquired
- d. Field Type
- e. Contract Number
- f. Drawing Number
- g. Data Source
- h. Field Name

1.4.4 Environmental Storage Tanks

Attribute data requirements for Environmental Storage Tanks: The following attributes shall be collected for each infrastructure data class: Collect GPS data for all features listed with Survey Grade accuracy.

1.4.4.1 Underground Storage Tanks: CLJN.underground_storage_tank_point CPT.underground_storage_tank_point

GPS and collect the following attributes:

- a. ENVUST ID for Under Ground Storage Tank
- b. Hazsite ID
- c. EH Tank: Fuel Type
- d. Facility Number
- e. X Coordinates
- f. Y Coordinates
- g. Installation Date

- h. Drawing Number
- i. Contract Number
- j. Data Source
- k. Product D
- l. Narrative
- m. Serial Number
- n. Tank Sys D
- o. Status
- p. Regulated
- q. Volume
- r. Volume U D

1.4.4.2 Aboveground Storage Tanks: CLJN.aboveground_storage_tank_site
CPT.aboveground_storage_tank_site

GPS and collect the following attributes:

- a. ENVASt ID for Above Ground Storage Tank
- b. Hazsite ID
- c. EH Tank
- d. Facility Number
- e. X Coordinates
- f. Y Coordinates
- g. Installation Date
- h. Drawing Number
- i. Contract Number
- j. Data Source
- k. Product D
- l. Narrative
- m. Serial Number
- n. Tank Sys D
- o. Status
- p. Regulated
- q. Volume
- r. Volume U D

1.4.5 Other Features

Other Infrastructure Features:

All newly constructed features require GIS deliverables. If a particular utility is being installed and has been omitted from this specification, the feature shall be deliverable under these guidelines. At a minimum the following will be required;

- a. Subtype ID
- b. Facility ID
- c. Installation Date
- d. Type/Description
- e. Material
- f. Drawing Number
- g. Contract Number
- h. Data Source
- i. Date Acquired

1.4.6 Utilities

Locate underground utilities, GPS and collect attribute data as specified in the Collection and Creation of Geospatial data section for each feature

listed with survey grade accuracy and enter attribute data in compliance with the IGI&S database.

Please note: All utility lines that can be currently located in MCB Camp Lejeune's MCAS Cherry Point's GIS geodatabase that are to be demolished/removed within the specifications of this contract will be used to update the demolished line feature data set for that class. The existing spatial and non-spatial data will be copied into the demolished feature class. This information does not include Abandoned in Place (AIP) lines. Abandoned lines shall remain in the existing data feature class and be attributed AIP.

1.4.7 Electrical Distribution

Please Note: MCB, Camp Lejeune's Complete Circuit ID list is available. Please contact Government Project Manager for list which is provided by our Electrical Distribution shop in Public Works, MCB Camp Lejeune.

The following attributes shall be collected for each utility data class: Collect GPS data for all features listed with survey grade accuracy.

1.4.7.1 Demolished Electrical Lines: CLJN.demolished_cable_line CPT.demolished_cable_line

Existing attribute information will be copied into the demolished feature class: Please add the following attribute data once updated.

- a. Date
- b. Drawing Number
- c. Contract Number
- d. Data Source

1.4.7.2 Electrical Lines: CLJN.electrical_cable_line CPT.electrical_cable_line

Locate all Electrical Line data and collect the following attributes:

- a. Subtype Identifier
- b. Disposition
- c. Subtype
- d. Date Acquired
- e. Conduit Size
- f. Number of Phases
- g. Insulation Material
- h. Voltage
- i. Size of Units
- j. Substation ID
- k. Circuit ID
- l. Contract Number
- m. Drawing Number
- n. Data Source

1.4.7.3 Electrical Meter: CLJN.electrical_meter_point CPT.electrical_meter_point

Locate, GPS and collect the following attributes:

- a. Meter ID

- b. Voltage
- c. KW Rate
- d. Number of Phases
- e. Model Number
- f. Date Acquired
- g. Facility ID
- h. Substation ID
- i. Circuit ID
- j. X Coordinates
- k. Y Coordinates
- l. Contract Number
- m. Drawing Number
- n. Data Source

1.4.7.4 Electrical Transformer: CLJN.elect_transformr_bank_point
CPT.elect_transformr_bank_point

Locate, GPS and collect the following attributes:

- a. Subtype
- b. Date Installed
- c. Primary Voltage
- d. Secondary Voltage
- e. Number of Transformers
- f. Total KVA
- g. Substation ID
- h. Circuit ID
- i. KVA Information
- j. X Coordinates
- k. Y Coordinates
- l. Contract Number
- m. Drawing Number
- n. Data Source

1.4.7.5 Electrical Poles: CLJN.utility_pole_tower_point
CPT.utility_pole_tower_point

Locate, GPS and collect the following attributes:

- a. Pole No
- b. Date Acquired
- c. Condition
- d. Type
- e. Material
- f. Pole Height
- g. Units of Measure
- h. Circuit ID
- i. X Coordinates
- j. Y Coordinates
- k. Contract Number
- l. Drawing Number
- m. Data Source

1.4.7.6 Exterior Lighting: CLJN.exterior_lighting_point
CPT.exterior_lighting_point

Locate, GPS and collect the following attributes:

- a. Light Type

- b. X Coordinates
- c. Y Coordinates
- d. Sensor
- e. Watts
- f. Voltage
- g. Circuit ID
- h. Contract Number
- i. Drawing Number
- j. Date Acquired
- k. Data Source

1.4.7.7 Electrical Switch: CLJN.electrical_switch_point
CPT.electrical_switch_point

Locate, GPS and collect the following attributes:

- a. Subtype ID
- b. Switch ID
- c. Disposition
- d. Installation Type
- e. Switch Status
- f. Voltage
- g. Circuit ID
- h. X Coordinates
- i. Y Coordinates
- j. Contract Number
- k. Drawing Number
- l. Data Source

1.4.7.8 Electrical Regulator: CLJN.electrical_regulator_point
CPT.electrical_regulator_point

Locate, GPS and collect the following attributes:

- a. Electrical Regulator ID
- b. Disposition
- c. Regulator Type
- d. Regulator Use
- e. Primary Volts
- f. Secondary Volts
- g. Number of Taps
- h. KV Rate
- i. Fuse Type
- j. Manufacturer
- k. Model Number
- l. Circuit ID
- m. X Coordinates
- n. Y Coordinates
- o. Contract Number
- p. Drawing Number
- q. Data Source

1.4.7.9 Electrical Manholes: CLJN.electrical_junction_point
CPT.electrical_junction_point

Locate, GPS and collect the following attributes:

- a. Subtype ID
- b. Type

- c. Number of Cables
- d. Rim Elevation
- e. Units of Elevation
- f. Diameter
- g. Diameter Units
- h. X Coordinates
- i. Y Coordinates
- j. Substation ID
- k. Contract Number
- l. Drawing Number
- m. Data Source

1.4.7.10 Electrical Generators: CLJN.electrical_generator_point
CPT.electrical_generator_point

Locate, GPS and collect the following attributes:

- a. Generator ID
- b. Disposition
- c. KVA
- d. KW Rate
- e. Voltage
- f. Fuel Type
- g. Manufacturer
- h. Model
- i. Serial Number
- j. Circuit ID
- k. X Coordinates
- l. Y Coordinates
- m. Facility ID
- n. Contract Number
- o. Drawing Number
- p. Data Source

1.4.7.11 Substation: CLJN.electrical_substation_point
CPT.electrical_substation_point

Locate, GPS and collect the following attributes:

- a. Disposition
- b. Capacity Rate
- c. Capacity Measure
- d. Voltage In
- e. Voltage Out
- f. Voltage
- g. Number of transformer
- h. Number of Spares
- i. Number of Circuits
- j. X Coordinates
- k. Y Coordinates
- l. Contract Number
- m. Drawing Number
- n. Data Source
- o. Date Acquired

1.4.8 Heating and Cooling Systems

The following attributes shall be collected for each utility data class:
Collect GPS data for all features listed with survey grade accuracy.

1.4.8.1 Boiler: CLJN.heat_cool_boiler_site CPT.heat_cool_boiler_site - If Required

Locate, GPS and collect the following attributes:

- a. Date Acquired
- b. Disposition
- c. Type
- d. Capacity Heat
- e. Capacity Units
- f. Building ID: Facility Number where Boiler Resides
- g. X Coordinates
- h. Y Coordinates
- i. Contract Number
- j. Drawing Number
- k. Data Source

1.4.8.2 Fitting: CLJN.heat_cool_fitting_point CPT.heat_cool_fitting_point

Georeference fitting data and collect the following attributes:

- a. Subtype ID
- b. Date Acquired
- c. Material
- d. Size
- e. Units
- f. Line Diameter
- g. Diameter in Units
- h. X Coordinates
- i. Y Coordinates
- j. Contract Number
- k. Drawing Number
- l. Data Source

1.4.8.3 Valves: CLJN.heat_cool_valve_point CPT.heat_cool_valve_point

Locate, GPS and collect the following attributes:

- a. Date Acquired
- b. Size
- c. Size Units
- d. Elevation
- e. Elevation Units
- f. Project ID
- g. X Coordinates
- h. Y Coordinates
- i. Contract Number
- j. Drawing Number
- k. Data Source

1.4.8.4 Manholes: CLJN.heat_cool_junction_point CPT.heat_cool_junction_point

Locate, GPS and collect the following attributes:

- a. Subtype ID
- b. Number of Valves
- c. Number of Pipes

- d. Width
- e. Length
- f. Diameter
- g. Units for Measurements
- h. Rim Elevations
- i. Ground Elevation
- j. Contract Number
- k. Drawing Number
- l. X Coordinates
- m. Y Coordinates
- n. Data Source

1.4.8.5 Chiller and Steam Line: CLJN.heat_cool_line CPT.heat_cool_line

Locate, GPS and collect the following attributes:

- a. Subtype ID: Condensate, Steam, Chiller
- b. Date Acquired
- c. Disposition
- d. Use: Underground, Overhead, Abandoned
- e. Material
- f. Size
- g. Length
- h. Size Units
- i. Ground Elevation
- j. Invert Elevation
- k. Units for Elevation
- l. Taped: Yes/No
- m. Building ID: If service line indicate Building
- n. Insulation Material
- o. Size of Insulation
- p. Size Units
- q. Contract Number
- r. Drawing Number
- s. Data Source

1.4.8.6 Demolished Steam Line: CLJN.demolished_heat_cool_line
CPT.demolished_heat_cool_line

Existing attribute information will be copied into the demolished feature class: Please add the following attribute data once updated.

- a. Date
- b. Drawing Number
- c. Contract Number
- d. Data Source

1.4.9 Storm Sewer

1.4.9.1 Storm Sewer Lines: CLJN.storm_sewer_line CPT.storm_sewer_line

Locate, GPS and collect the following attributes:

- a. Date Acquired
- b. Use
- c. Type
- d. Material
- e. Size
- f. Diameter Units

- g. Elevation
- h. Elevation Units
- i. Contract Number
- j. Drawing Number
- k. Data Source

1.4.9.2 Storm Sewer Drainage Line: CLJN.storm_sewer_open drainage_line
CPT.storm_sewer_open drainage_line

Locate, GPS and collect the following attributes:

- a. Date Acquired
- b. Disposition
- c. Contract Number
- d. Drawing Number
- e. Data Source

1.4.9.3 Manhole: CLJN.storm_sewer_junction_point
CPT.storm_sewer_junction_point

Locate, GPS and collect the following attributes:

- a. Subtype
- b. X Coordinates
- c. Y Coordinates
- d. Contract Number
- e. Drawing Number
- f. Data Source

1.4.9.4 Inlet: CLJN.storm_sewer_inlet_point CPT.storm_sewer_inlet_point

Locate, GPS and collect the following attributes: Contract shall verify
SWPPP GPS inlet and add to this feature.

- a. Subtype
- b. Date Acquired
- c. X Coordinates
- d. Y Coordinates
- e. Contract Number
- f. Drawing Number
- g. Data Source

1.4.9.5 Outfall: CLJN.storm_sewer_outfall_point
CPT.storm_sewer_outfall_point

Locate, GPS and collect the following attributes:

- a. Subtype Domain
- b. Date Acquired
- c. Basin ID: Contractor shall utilize existing data and
coordinate Basin_ID with data manager.
- d. User Flag
- e. X Coordinates
- f. Y Coordinates
- g. Contract Number
- h. Drawing Number
- i. Data Source

1.4.9.6 Ponds, Basins, & Treatment Measures:

CLJN.storm_sewer_reservoir_areas CPT.storm_sewer_reservoir_areas

Locate, GPS and collect the following attributes:

- a. Date Acquired
- b. Project ID
- c. Permit ID: SW8 XXXXXX
- d. Size
- e. Facility ID
- f. Installation ID
- g. Drawing Number
- h. Data Source

1.4.10 Wastewater Collection

The following attributes shall be collected for each utility data class:
Collect GPS data for all features listed with survey grade accuracy.

1.4.10.1 Wastewater Lines: CLJN.wastewater_line CPT.wastewater_line

Locate, GPS and collect the following attributes:

- a. Pipe ID: By Manhole Number
- b. Date Acquired
- c. Use
- d. Material
- e. Size of Diameter
- f. Units
- g. Invert Elevation 1
- h. Invert Elevation 2
- i. Elevation Units
- j. Slope
- k. Slope Units
- l. Building ID: If building/facility service line indicate Building number that the line services
- m. Contract Number
- n. Drawing Number
- o. Data Source
- p. Subtype

1.4.10.2 Demolished Lines: CLJN.demolished_wastewater_line
CPT.demolished_wastewater_line

Existing attribute information will be copied into the demolished feature class: Please add the following attribute data once updated.

- a. Date
- b. Drawing Number
- c. Contract Number
- d. Data Source

1.4.10.3 Fitting: CLJN.wastewater_fitting_point
CPT.wastewater_fitting_point

Georeference Fitting data and collect the following attributes:

- a. Subtype ID
- b. Date Acquired

- c. Type
- d. Material
- e. Size of Diameter
- f. Units
- g. User Flag: Named Area
- h. Contract Number
- i. Drawing Number
- j. X Coordinates
- k. Y Coordinates
- l. Data Source

1.4.10.4 Valves: CLJN.wastewater_valve_point CPT.wastewater_valve_point

Locate, GPS and collect the following attributes:

- a. Valves ID: Manhole Number associated with valve
- b. Date Acquired
- c. Valve Style/Group
- d. Valve Use
- e. Size in Diameter
- f. Valve Elevation
- g. Units of Elevation
- h. X Coordinates
- i. Y Coordinates
- j. Manhole ID
- k. Contract Number
- l. Drawing Number
- m. Data Source

1.4.10.5 Manholes: CLJN.wastewater_junction_point
CPT.wastewater_junction_point

Locate, GPS and collect the following attributes:

- a. Subtype ID: Manhole
- b. Manhole ID: Each section of the base has a unique numbering system for manholes; please see Public Work, GIS office for details.
- c. Use
- d. Type
- e. Material
- f. Number of Pipes in manhole
- g. Rim Elevation
- h. Invert Elevation
- i. Elevation Units
- j. Manhole Diameter
- k. Diameter Units
- l. X Coordinates
- m. Y Coordinates
- n. Date Acquired
- o. Contract Number
- p. Drawing Number
- q. Data Source

1.4.10.6 Vent: CLJN.wastewater_vent_point CPT.wastewater_vent_point

Locate, GPS and collect the following attributes:

- a. Date Acquired

- b. Valve Style/Type
- c. Use
- d. Size in Diameter
- e. Units in Diameters
- f. X Coordinates
- g. Y Coordinates
- h. Subtype ID
- i. Containment Type
- j. Contract Number
- k. Drawing Number
- l. Data Source

1.4.10.7 Pump Stations: CLJN.wastewater_pump_point
CPT.wastewater_pump_point

Locate, GPS and collect the following attributes:

- a. Pump Station ID: Facility Number
- b. Date Acquired
- c. Use
- d. Type
- e. Cooling Method
- f. Rated Outflow Volume
- g. Flow Unit Measure Code
- h. X Coordinates
- i. Y Coordinates
- j. Number of Pumps
- k. Contract Number
- l. Drawing Number
- m. Data Source

1.4.10.8 Oil Water Separators: CLJN.wstewat_oil_wat_separatr_point
CPT.wstewat_oil_wat_separatr_point

Locate, GPS and collect the following attributes:

- a. Oil Water Separator ID: Facility Number
- b. Date Acquired
- c. Type
- d. Separator Process
- e. Separator Volume
- f. Volume Units of Measure
- g. Grit Chamber
- h. Flow Capacity
- i. Flow Units
- j. X Coordinates
- k. Y Coordinates
- l. Contract Number
- m. Drawing Number
- n. Data Source

1.4.10.9 Grease Trap: CLJN.wastewater_grease_trap_point
CPT.wastewater_grease_trap_point

Locate, GPS and collect the following attributes:

- a. Trap Identification: Nearest Facility use Number
- b. Type of Trap
- c. Material

- d. Capacity
- e. Capacity Units
- f. Manhole
- g. Total Number of Laterals
- h. Flow Rate
- i. Flow Units
- j. Building ID: Facility Number On Associated Building
- k. X Coordinates
- l. Y Coordinates
- m. Contract Number
- n. Drawing Number
- o. Data Source

1.4.10.10 Septic Tank: CLJN.wastewater_septic_tank_point
CPT.wastewater_septic_tank_point

Locate, GPS and collect the following attributes:

- a. Date Acquired
- b. Disposition
- c. Tank capacity
- d. Contract Number
- e. Drawing Number
- f. Data Source

1.4.11 Water Distribution

The following attributes shall be collected for each utility data class:
Collect GPS data for all features listed with survey grade accuracy.

1.4.11.1 Water Lines: CLJN.water_line CPT.water_line

Locate, GPS and collect the following attributes:

- a. Date Acquired
- b. Use of Line
- c. Disposition
- d. Material
- e. Size
- f. Size Units
- g. Pipe Length
- h. Unit for Length Dimension
- i. Taped
- j. Source
- k. All Invert Elevation information
- l. Units of Measures
- m. Contract Number
- n. Drawing Number
- o. Data Source
- p. Subtype

1.4.11.2 Demolished Line: CLJN.demolished_water_line
CPT.demolished_water_line

Existing attribute information will be copied into the demolished feature class: Please add the following attribute data once updated.

- a. Date
- b. Drawing Number

- c. Contract Number
- d. Data Source

1.4.11.3 Water Meter: CLJN.water_meter_point CPT.water_meter_point

Locate, GPS and collect the following attributes:

- a. Meter ID
- b. Date Acquired
- c. Type
- d. Installation Type
- e. Building ID: Facility Number - If attached to Building
- f. X Coordinates
- g. Y Coordinates
- h. Contract Number
- i. Drawing Number
- j. Data Source

1.4.11.4 Water Tank: CLJN.water_tank_point CPT.water_tank_point

Locate, GPS and collect the following attributes:

- a. Tank ID: Facility Number
- b. Date Acquired
- c. Disposition
- d. Tank Use
- e. Tank Status
- f. Tank Width
- g. Tank Length
- h. Tank Diameter
- i. Ground Elevation
- j. Tank Volume
- k. Unit of measure in Gallons
- l. Top Elevation
- m. Overflow Elevation
- n. Pressure High
- o. Pressure Low
- p. X Coordinates
- q. Y Coordinates
- r. Contract Number
- s. Drawing Number
- t. Data Source

1.4.11.5 Water Valve: CLJN.water_valve_point CPT.water_valve_point

Locate, GPS and collect the following attributes:

- a. Date Acquired
- b. Disposition
- c. Use: Valve
- d. Valve Status
- e. Size
- f. Size Units
- g. Valve Elevation
- h. Ground Elevation
- i. Size Unit
- j. Manhole ID
- k. X Coordinates
- l. Y Coordinates

- m. Contract Number
- n. Drawing Number
- o. Data Source
- p. Subtype

1.4.11.6 Water Fitting: CLJN.water_fitting_point CPT.water_fitting_point

Georeference and collect the following attributes:

- a. Date Acquired
- b. Disposition
- c. Type
- d. Material
- e. Size
- f. Size Units
- g. Contract Number
- h. Drawing Number
- i. Data Source

1.4.11.7 Water Well: CLJN.potable_water_well_point
CPT.potable_water_well_point

Locate, GPS and collect the following attributes:

- a. Well ID: Facility Number
- b. Use: Potable, Non-Potable
- c. Well Status
- d. Station ID: Building Number
- e. Date Acquired
- f. X Coordinates
- g. Y Coordinates
- h. Tank ID: Water Tank Facility Number for which well feeds
- i. Contract Number
- j. Drawing Number
- k. Data Source

1.4.11.8 Water Manhole: CLJN.water_junction_point
CPT.water_junction_point

Locate, GPS and collect the following attributes:

- a. Subtype
- b. Use
- c. Type
- d. Material
- e. Number Valves
- f. Number Pipes
- g. Installation Date
- h. Size Diameter
- i. Unit Diameter
- j. X Coordinates
- k. Y Coordinates
- l. Contract Number
- m. Drawing Number
- n. Data Source

1.4.11.9 Fire Hydrant: CLJN.water_fire_connection_point
CPT.water_fire_connection_point

Locate, GPS and collect the following attributes:

- a. Hydrant ID: TBD by Fire Department
- b. Date Acquired
- c. Disposition
- d. Valve Connector Type
- e. Valve Size
- f. Inlet Diameter
- g. Units of measure
- h. X Coordinates
- i. Y Coordinates
- j. Contract Number
- k. Drawing Number
- l. Data Source

1.4.11.10 NON Potable Water Well: CLJN.non-potable_water_well_point
CPT.non-potable_water_well_point

Locate, GPS and collect the following attributes:

- a. Well ID: Facility Number
- b. Use
- c. Well Status
- d. Station ID: Building Number
- e. Date Acquired
- f. X Coordinates
- g. Y Coordinates
- h. Tank ID: Water Tank Facility Number
- i. Contract Number
- j. Drawing Number
- k. Data Source

1.4.11.11 Other Utility Features

Failure to follow the specification outlined in this document will result in non-acceptance of data deliverable.

Geospatial data delivery does not replace as-built requirements. All newly constructed features require GIS deliverables.

- a. Facility ID
- b. Installation Date
- c. Type/Description
- d. Material
- e. Size
- f. Drawing Number
- g. Contract Number
- h. Data Source

1.4.12 Alternative Energy

1.4.12.1 Geothermal Wells CLJN.geothermal wells CPT.geothermal wells

Locate, GPS and collect the following attributes:

- a. Bldg_ID

- b. X Coordinates
- c. Y Coordinates
- d. Well_ID
- e. Depth
- f. Units
- g. Status
- h. Bentonite
- i. Casing
- j. Construction
- k. Installation Contract #
- l. Contract Number
- m. Drawing Number
- n. Data Source

1.4.12.2 Water Wells associated with Geothermal Pumping System
CLJN.water wells associated with geothermal pumping system CPT.water wells
associated with geothermal pumping system

Locate, GPS and collect the following attributes:

- a. Well ID: Facility Number
- b. Use:
- c. Well Status
- d. Station ID: Building Number
- e. Date Acquired:
- f. X Coordinates
- g. Y Coordinates
- h. Tank ID: Water Tank Facility Number
- i. Contract Number
- j. Drawing Number
- k. Data Source:

1.4.12.3 Water Lines associated with Geothermal Pumping System (Hybrid
Geothermal Loop) CLJN.water lines associated with geothermal pumping
system CPT.water lines associated with geothermal pumping system

Locate, GPS and collect the following attributes:

- a. Date Acquired
- b. Use of Line
- c. Disposition
- d. Material
- e. Size
- f. Size Units
- g. Pipe Length
- h. Unit for Length Dimension
- i. Taped
- j. Source
- k. All Invert Elevation Information
- l. Units of Measures
- m. Contract Number
- n. Drawing Number
- o. Data Source
- p. Subtype

1.4.12.4 Water Valve associated with Geothermal Pumping System
CLJN.water valve associated with geothermal pumping system CPT.water valve
associated with geothermal pumping system

Locate, GPS and collect the following attributes:

- a. Date Acquired:
- b. Disposition
- c. Use: Valve
- d. Valve Status
- e. Size
- f. Size Units
- g. Valve Elevation
- h. Ground Elevation
- i. Size Unit
- j. Manhole ID
- k. X Coordinates
- l. Y Coordinates
- m. Contract Number
- n. Drawing Number
- o. Data Source
- p. Subtype

1.4.12.5 Water Fitting associated with Geothermal Pumping System
CLJN.water fitting associated with geothermal pumping system CPT.water
fitting associated with geothermal pumping system

Locate, GPS and collect the following attributes:

- a. Date Acquired
- b. Disposition
- c. Type
- d. Material
- e. Size
- f. Size Units
- g. Contract Number
- h. Drawing Number
- i. Data Source

1.4.13 Natural Gas Line

Locate, GPS and collect the following attributes:

- a. Date Acquired
- b. Disposition
- c. Material
- d. Size
- e. Size Units
- f. Pipe Length
- g. Taped
- h. Source
- i. All Invert Elevation Information
- j. Units of Measures
- k. Contract Number
- l. Drawing Number
- m. Data Source
- n. Subtype

1.4.13.1 Natural Gas Valve

Locate, GPS and collect the following attributes:

- a. Date Acquired:
- b. Use:
- c. Size
- d. Size Units
- e. Valve Elevation
- f. Ground Elevation
- g. Size Unit
- h. X Coordinates
- i. Y Coordinates
- j. Contract Number Drawing Number
- k. Data Source
- l. Subtype

1.4.12 Non-Compliance

Failure to follow the specification outlined in this document will result in non-acceptance of data deliverable.

Geospatial data delivery does not replace as-built requirements.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 78 30.00 22

GIS DATA DELIVERABLES

5/22

PART 1 GENERAL

1.1 OBJECTIVE

The primary objective of this section is to provide detailed specifications for collection and delivery of geospatial data commonly referred to as Geographic Information System (GIS) data. Additionally, this section shall provide guidance to ensure that all GIS data delivered is compatible and will add value to the Marine Corps Base (MCB) Camp Lejeune Installation Geospatial Information and Services (IGI&S) GEOdatabase.

Failure to comply with the specifications outlined in this document will result in non-acceptance of data deliverables.

1.1.1 Point of Contact for MCB Camp Lejeune

The Points of Contact (POC) for assistance in preparation of GIS deliverables are as follows:

Resident Officer In Charge Of Construction
Construction Manager (CM)
1005 Michael Drive
Camp Lejeune, NC 28547-2521
(910) 451-2581 (Main Number)

Public Works Assigned
GIS Data Manager
1005 Michael Road
Camp Lejeune, NC 28547-2521
(910) 000-0000 ext 0000 TBD
Lejeune_PWD_GIS@usmc.mil

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES 01 33 00.05 20 CONSTRUCTION SUBMITTAL PROCEDURES:

SD-11 Closeout Submittals

GIS Data Deliverables; G

1.3 GOVERNMENT GEOSPATIAL DATA, SCHEMA, AND DOMAINS

Geo-spatial data is based on the Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) GEOFidelis Data Model. Because there are recurring business driven modifications and or adaptations within the SDSFIE schema, provide all spatial and non-spatial data in the most current version by the USMC utilized at the time of delivery.

1.3.1 Data Request Package Requirements

Request the existing GIS Data, Schema and Domain Properties by utilizing a Data Request Package (DRP), which is supplied via the government sponsor.

- a. The DRP should be submitted prior to the start of data collection efforts and again 4 weeks prior to data delivery to ensure that GIS data has been created and will be delivered utilizing the most up to date SDSFIE schema.

1.3.1.1 Instruction for submitting a Geospatial DRP to the CM or the Project Manager (PM)

- a. Each CM or PM will provide DRP forms upon request from the contractor. Complete the request and include all information as instructed on the data request form.
- b. Request only GIS data, schema and domains for feature classes that are relevant to the contract and within the boundary of project area and provide justifications as necessary.
- c. Attach the Scope of Work, which is defined by this GIS DATA DELIVERABLES section for each DPR submittal.
- d. Return the DRP to the CM or PM for sponsorship and submittal as instructed with required attachments and justifications for submittal.
- e. Incomplete forms may delay receipt of the requested GIS data.
- f. GIS data deliverables do not supplement or replace as-built drawings.

1.3.2 Data Collection and Utility Locates

- a. Utilize the most up to date SDSFIE Schema when delivering GIS Data.
- b. Prior to GPS efforts all underground utilities are to be located utilizing a utility locating service in order to obtain and verify accurate feature locations.
- c. Actual conditions in the field always supersede drawings. Locate and field verify all features to ensure location is correctly recorded.
- d. Data will be created to represent the real world, for example, water, sewer, and transportations systems will be connected. All segments will be created from source to sink in the direction of flow.
- e. Research may be required to collect data. Verification of existing data which is located [in the Technical Records in the Public Works Department at 1005 Michael Street, MCB Camp Lejeune](#).
- f. Infrastructure data, as identified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" may be collected utilizing Sub-Foot or better GPS data collection methods.
- g. Utility data, as identified in paragraph "ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES" will be collected utilizing Survey Grade GPS data collection methods.

1.3.3 Attribute Data Requirements

- a. All attributes will be populated in accordance with paragraph ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR SPECIFIC FEATURES and will be

obtained via contract specifications, plans and record drawings.

- b. Demolished / Removed Real Property data will be captured, attributed and delivered in the Disposal feature classes which include Disposal Facility Area, Disposal Facility Line and Disposal Facility Point.
- c. Demolished / Removed UTILITY data will be captured, attributed and delivered by creating a new feature class which will consists of adding DEMO to the feature's naming convention for each feature, such as, but not limited to the following examples; DEMO.WastUtilNode_SPump (point), DEMO.Feat_SwRetentionBasinArea, (polygon), and DEMO.WastUtilSegment (polyline)
 - 1. The Contractor will be responsible for properly delivering demolished features with the current attributes associated with the feature and additionally updating the new contract number, date of demolition, and optional status.
- d. Spatial and non-spatial data may be copied from existing data, with the exception of specific attributes. Potable water wells are an exception to this rule and shall remain in the feature class and attributed as Removed or AIP.
- e. Abandoned In Place (AIP) utility lines will be located and updated in the current feature data set and be attributed as AIP as required.

1.3.4 GIS Topology Rules for Geospatial Data

All data must be created using GIS topology rules for polygons, points and lines, such as, but not limited to the following examples:

- a. Utility and transportation systems will be created from source to sink.
- b. All utilities shall be drawn in the direction of flow with no breaks in polyline except for fittings, manholes and other features nodes within the feature Dataset.
- c. All utility or infrastructure system data, which is, but is not limited to, transportation system and electrical, water, thermal distribution, and wastewater collection, etc., will be created using GIS spatial connectivity rules which specify that vertex, edge and endpoints be snapped to features within the system.
- d. All polygons will be closed without slivers and be topologically correct.
- e. All polylines will be topologically correct, and should be connected to avoid undershoots, overshoots and dangles and will cross only if they share a point in common, at least one of which is not an endpoint.
- f. For all Polygons, Polylines and points rules; please reference illustrating topology rules in ArcGIS at www.esri.com.

1.3.5 Global Positioning System (GPS) Data Collection

Utilize field survey GPS data collected by means of non-recreational GPS equipment

- a. Only bench marks included in the [North Carolina](#) Geodetic Survey Base Station Network are to be used for GPS data collection.
- b. Mission planning is essential. Utilize the best Position Dilution of Precision (PDOP) values for data accuracy.
- c. Mission planning for GPS collection should be conducted when positional dilution of precision (PDOP) value is 4 or less.
- d. Spatial accuracy requirements
 - 1. Survey and Sub-Foot GPS grade data collection requirements are as follows:
 - i. Sub-Foot requirements:
 - 1) All points shall be within plus or minus 12 inches
 - 2) 95 percent accuracy rate for all points.
 - ii. Survey Grade requirements:
 - 1) All points shall be within plus or minus 1 centimeter
 - 2) 98 percent accuracy rate for all points
- e. Make every effort to capture feature locations without using Offsets. All Offsets will be noted in the Final Report for each feature. Deliver report in PDF format.
 - 1. Resubmittal of data will be required if PDOP planning was not observed per this specification.

1.3.6 Coordinate System Requirements

The data must be collected in the following Spatial Reference / Coordinate System for each feature for all MCB Camp Lejeune and surrounding bases:

- 1. [Transverse Mercator \(UTM\) Zone 18N](#)
 - a. [GRS 1980 spheroid](#)
 - b. [North American Datum 1983 \(NAD83\) horizontal datum](#)
 - c. [North American Vertical Datum 1988 \(NAVD88\) vertical datum.](#)
- 2. [Domain precision of 1000 which will result in a database accuracy of 1/1000 m](#)

1.3.7 Formats and Version Guidelines

All data deliverables shall be presented in the following formats and/or versions.

- a. GIS data will be provided in an ArcGIS 10.8 or higher if a higher version is being used by the Government at the time of this project.

Verify the ArcGIS version, via the CM or PM at the commencement of this contract.

- b. Microsoft Windows 10 operating system, unless otherwise approved by the Government.
- c. All reports and maps will be delivered as a hard copy and in a searchable Adobe Portable Document Format (PDF).

1.3.8 GIS Deliverable Submittal Requirements

All GIS Submittals will be submitted to the CM or PM and then analyzed by Government GIS personnel prior to final approval. Failure to comply with the specifications outlined in this document will result in non-acceptance of GIS data deliverables.

- a. Prior to any spatial and non-spatial development, provide the Government with a technical approach document, in PDF format, for review and approval. The Technical Approach document will describe in detail the Contractor's technical approach for developing GIS data to include utility locating, collecting, and attributing all GIS data.
- b. Provide a GIS deliverable at the end of each phase and at each Beneficial Occupancy Date (BOD) when contracted efforts, studies or construction are delivered in phases.
- c. To ensure specifications compliance and quality a preliminary GIS deliverable shall be provided for review when 25 percent of the data has been collected and updated according to this specification.
- d. Deliver digital geographic maps, GPS collection files and related data. All working text and documents and personal geodatabase will be included for review in the draft and final delivery of data in PDF format.
- e. Do not deliver blank unused schema or feature class data with no attributes. Deliver only data pertinent to the contract that adds value to the Geodatabase per this section.
- f. Do not include existing data in the GIS deliverable.
- g. Spatial and non-spatial GIS data must be provided in a format that does not require translation or pre/post processing.
- h. It is the Contractor's responsibility to perform quality assurance for all data and related materials required in this section prior to submitting product to the Government.
- i. The data will be analyzed for discrepancies in subject content, correct format in accordance with this statement of work, and compatibility with the existing SDSFIE Schema as well as all other specifications included in this section.

1.3.9 GIS Deliverable Package Requirements

All reports must be provided in pdf format. Each GIS deliverable must contain the following information and be in the most up to date SDSFIE

format utilized by the USMC at the time of delivery.

a. Digital and Paper Maps.

1. All maps of **GIS DATA DELIVERABLES** will be ANSI C size.
2. Each map will include a project title, contract number, scale, legend, standard symbology, attributes, i.e., building numbers, road names, etc.
3. All utilities will be labeled with direction of flow and segment line size.
4. Provide paper copy and pdf copies of Maps for project.
5. Provide a copy of all red-line construction drawings in pdf format.
6. Communication data will be provided on a separate map.

b. Provide all spatial and non-spatial data for review and acceptance.

c. Provide a report of specific procedures, list GPS equipment, software and versions that were utilized for the GPS data collection and creation of geospatial data.

d. Submit all GPS data files collected in the field.

e. Provide details on any offsets to include justification as to why offsets were utilized and which features and or points offsets were used.

f. Provide the source that was utilized for required attributes, such as redlines drawings and or field notes.

g. Summit DD form 1354, Transfer and Acceptance of DOD Real Property.

h. Provide a coversheet that specifies the CM / PM, contract number, contract title, point of contract for GIS related questions.

i. All geospatial data, pdf reports, spreadsheet, database files, reports, and maps will be submitted on a Digital Versatile Disc (DVD) platform.

j. Failure to comply will result in non - compliance and rejection of data.

1.3.10 Ownership

All digital files, hardcopy products, GPS raw data, source data acquired for this project, and related materials, including that furnished by the Government, will become the property of the Government and will not be issued, posted, distributed, or published by the Contractor. All documentation will be delivered in the final delivery.

Note: No endorsement of software or hardware is implied.

1.4 ATTRIBUTE DATA COLLECTION AND GPS REQUIREMENTS FOR REAL PROPERTY AND OTHER MISCELLANEOUS FEATURES THAT ARE NOT CONSIDERED A UTILITY

Locate, GPS and collect attribute data as specified for each feature listed with (GPS) accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required. Items in this section that require Survey Grade GPS are property identified in the feature class description.

1.4.1 Feature Dataset CLJN.CL.AccessControl

Locate, GPS and collect attribute data as specified for each feature listed with GPS accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

CLJN.CL.AccessControlPoint (point) -The location of a feature, manned or unmanned, intended to selectively restrict entrance to or use of a place or other resource.

- a) accessControlType - The type of access control. Domain values, i.e., gate, tireShedder, barricade, etc.
- b) buildDate - The calendar date on which the original construction was completed for a facility.
- c) contractNumber - The contract number associated with the feature.
- d) facilityNumber - Asset number used for visual identification of the facility.
- e) featureDescription - The narrative describing the feature. (Review current data for description)
- f) featureName - The common name of the feature. (Review current data for common name)
- g) gatePurposeType - Purpose that the gate exists and functions under. Domain values i.e., decorative, insternalSecurity, perimeterSecurity, recreation, residential, safely, vehicleBarrier, other, etc.
- h) gateTypeMaterial - The type of material of the gate. Domain values i.e., metal, steel, wood, wroughtiron, etc.
- i) isBaseEntryPoint -The Yes / No indicator of whether or not the location is an entry point for the military installation.
- j) isCheckpoint - Indicator if location is where officials check vehicle contents or personnel. Yes / No
- k) mediaId - gpsDataCollected
- l) MetadataId - metaID000072
- m) isManned - Yes / No
- n) isRangeAccess - Yes / No
- o) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.AccessControlLine (polyline) - The location of a feature, manned or unmanned, intended to selectively restrict entrance to or use of a place or other resource.

- a) accessControlTypeThe type of access control. Domain AccessControlType

- b) `builtDate` - The calendar date on which the original construction was completed for a facility.
- c) `contractNumber` - The contract number associated with the feature.
- d) `facilityNumber` - Asset number used for visual identification of the facility.
- e) `featureDescription` - The narrative describing the feature. (Review current data for description)
- f) `featureName` - The common name of the feature. (Review current data for common name)
- g) `gatePurposeType` - Purpose that the gate exists and functions under. Domain values i.e., decorative, internalSecurity, perimeterSecurity, recreation, residential, safety, vehicleBarrier, other, etc.
- h) `gateTypeMaterial` - The type of material of the gate. Domain values i.e., metal, steel, wood, wroughtiron, etc.
- i) `gateUse` - The type of a gate (or similar route barrier) based on its intended use.
- j) `mediaId` - `gpsDataCollected`
- k) `MetadataId` - `metaID000072`
- l) `isBaseEntryPoint` - Yes / No
- m) `isCheckpoint` - Yes / No
- n) `isManned` - Yes / No
- o) `isRangeAccess` - Yes / No
- p) `operationalStatus` - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

`CLJN.CL.BarricadePoint (point)` - The coordinated series of obstacles designed or employed to channel, direct, restrict, delay, or stop the movement of personnel, equipment, or an opposing force and to impose additional losses in personnel, time, and equipment on the opposing force. Barricades can exist naturally, be man-made, or a combination of both.

- a) `accessControlType` - The type of access control. Domain values, i.e., gate, tireShedder, barricade, etc.
- b) `builtDate` - The calendar date on which the original construction was completed for a facility.
- c) `contractNumber` - The contract number associated with the feature.
- d) `facilityNumber` - Asset number used for visual identification of the facility.
- e) `featureDescription` - The narrative describing the feature. (Review current data for description)
- f) `featureName` - The common name of the feature. (Review current data for common name)
- g) `barricadeType` - The type of barricade. Domain values i.e., bollard, bollardPipe, pedestrianBarrier, other, etc.
- h) `barricadeUse` - The intended use of the barricade Domain values i.e., pedestrianTraffic, security, vehicularTraffic, etc.
- i) `gatePurposeType` - Purpose that the gate exists and functions under. Domain values i.e., internalSecurity, perimeterSecurity, recreation, residential, safety, vehicleBarrier, etc.
- j) `gateTypeMaterial` - The type of material of the gate. Domain values i.e., metal, steel, wood, wroughtiron, etc.

- k) gateUse - The type of a gate (or similar route barrier) based on its intended use.
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.BarricadeLine (polyline) - The coordinated series of obstacles designed or employed to channel, direct, restrict, delay, or stop the movement of personnel, equipment, or an opposing force and to impose additional losses in personnel, time, and equipment on the opposing force. Barricades can exist naturally, be man-made, or a combination of both.

- a) accessControlType - The type of access control. Domain values, i.e., gate, tireShedder, barricade, etc.
- b) barricadeUse - The intended use of the barricade Domain values i.e., pedestrianTraffic, security, vehicularTraffic, etc.
- c) builtDate - The calendar date on which the original construction was completed for a facility.
- d) contractNumber - The contract number associated with the feature.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) gatePurposeType - Purpose that the gate exists and functions under. Domain values i.e., internalSecurity,
- i) perimeterSecurity, recreation, residential, safety, vehicleBarrier, etc.
- j) mediaId - gpsDataCollected
- k) l) MetadataId - metaID000072
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) gateTypeMaterial - The type of material of the gate. Domain values i.e., metal, steel, wood, wroughtiron, etc.

1.4.2 Feature Dataset CLJN.CL.CivilWorks

Locate, GPS and collect attribute data as specified for each feature listed with GPS accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

CLJN.CL.PitOrQuarry (Polygon) - The location where material has been or is being excavated or extracted for use at another location.

- a) featureDescription - The narrative describing the feature. (Review current data for description)
- b) featureName - The common name of the feature. (Review current data for common name)
- c) contractNumber - The contract number associated with the feature.

- d) mediaId - gpsDataCollected
- e) MetadataId - metaID000072
- f) isWaterFilled - Yes / No
- g) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

1.4.3 Feature Dataset CLJN.CL.HarbourArea

Locate, GPS and collect attribute data as specified for each feature listed with GPS accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

CLJN.CL.BoatRampPoint - (Point) - The partially submerged hard surfaced or non-hardsurface structure on a shoreline for launching or retrieving vessels or vehicles.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) isLighted - Yes / No
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.DockOrWharf (Polygon) - The location of a manmade water-land interface structure often used for access to boats, ships, or barges.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) dockType - The kind or type of the dock. Domain values i.e., access ramp, pier, slipway, general, etc.
- d) dockUseType - The predominant use. Domain values i.e., fishing, fueling, loading, staging, etc.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) materialType - The material composition of the feature. Domain values i.e., concrete, steel, wood, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072

- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- l) owner - The entity that owns the feature. Domain values, i.e., ppv, usmc, usn, leased, federalOther, etc.

CLJN.CL.MarineNavigationAid (Point) - The physical object that serves as an aid to navigation. *Requires Survey Grade GPS.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) heightAboveSurfaceLevel - The vertical distance measured from the lowest point of the base of the feature at ground or water level to the tallest point of the feature.
- g) heightAboveSurfaceLevelUom - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.
- h) isLighted - Yes / No
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) navaidType - Type of the navaid. Domain value i.e., buoyMarkerDangerPoint, buoyMarkerDangerPoint etc.
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, closed, abandoned, etc.

1.4.4 Feature Dataset CLJN.CL.RealProperty

Locate, GPS and collect attribute data as specified for each feature listed with GPS accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

Specific instruction for all Disposal polygons, polylines and points. All demolished or removed property shall be accounted for in the following 3 disposal features. A simple copy and paste with the following exceptions as explains in the disposal area, polyline and point may be permitted with the exception of the directions for attribution for each feature as noted. However, under no circumstance should potable water wells be removed from their original feature class. Potable wells are never deleted from their main feature, all that is required is the water wells are attributed in such a way that indicated if they are abandoned in Place (AIP) or Removed.

CLJN.CL.Disposal_FacilityArea (polygon)- The location of a facility asset in the DoD real property inventory for which a disposal action is being or has been taken to physically demolish, remove, or release the DoD of accountability for and control of the asset.

- a) abandonedDate - The date the feature was abandoned. Leave

- blank if removed.
- b) `builtDate` - The calendar date on which the original construction was completed for a facility.
- c) `contractNumber` - The contract number associated with the feature demolition or abandonment.
- d) `ClassType` - Population is contingent only if data is currently available for feature.
- e) `disposalCompletionDate` - The actual calendar date of the disposal or abandonment of the asset.
- f) `facilityNumber` - Asset Identification such as building or structure number.
- g) `featureDescription` - Population is contingent only if data is currently available for feature.
- h) `featureName` (Mandatory) - Feature Name and subtype
- i) `facilityIdfk` - Population is contingent only if data is currently available for feature.
- j) `operationalStatus` - The state of usability of the feature. Domain values i.e., removed, abandoned, etc.
- k) `owner` - Population is contingent only if data is currently available for feature.
- l) `removedDate` - The date the feature was removed. Leave blank if abandoned.
- m) `realPropertyJurisdictionType` - Population is contingent only if data is currently available for feature.
- n) `registryIdentifier` - Population is contingent only if data is currently available for feature.
- o) `sourceFeatureClass` (Mandatory) - The feature class containing the polygon feature.

`CLJN.CL.Disposal_FacilityLine` (polyline) - The location of a personal property asset in the DoD real property inventory for which a disposal action is being or has been taken to physically demolish, remove, or release the DoD of accountability for and control of the asset.

- a) `abandonedDate` - The date the feature was abandoned. Leave blank if removed.
- b) `builtDate` - The calendar date on which the original construction was completed for a facility.
- c) `contractNumber` - The contract number associated with the feature demolition or abandoned.
- d) `classType` - Population is contingent only if data is currently available for feature.
- e) `disposalCompletionDate` - The actual calendar date of the disposal or abandonment of the asset.
- f) `facilityNumber` - Asset Identification RoadName, fence, utility line, fence gate information, etc.
- g) `featureDescription` - Population is contingent only if data is currently available for feature.
- h) `featureName` (Mandatory) - Feature Name and subtype
- i) `operationalStatus` - The state of usability of the feature. Domain values i.e., removed, abandoned, etc.
- j) `owner` - The entity that owns the feature. Domain values, i.e., ppv, usmc, usn, leased, federalOther, etc.
- k) `removedDate` - The date the feature was removed. Leave blank if abandoned.
- l) `realPropertyJurisdictionType` - The type of real property jurisdiction. Domain values i.e., tbd, etc.

- m) registryIdentifier - Population is contingent only if data is currently available for feature.
- n) sdsId - Population is contingent only if data is currently available for feature.
- o) sourceFeatureClass (Mandatory) - The feature class containing the line feature.

CLJN.CL.Disposal_FacilityPoint (point) - The location of a personal property asset in the DoD real property inventory for which a disposal action is being or has been taken to physically demolish, remove, or release the DoD of accountability for and control of the asset.

- a) abandonedDate - The date the feature was abandoned. Leave blank if removed.
- b) builtDate - The calendar date on which the original construction was completed for a facility.
- c) contractNumber - The contract number associated with the feature demolition or abandoned.
- d) ClassType - Population is contingent only if data is currently available for feature.
- e) disposalCompletionDate - The actual calendar date of the disposal or abandonment of the asset.
- f) facilityNumber - Asset Identification such as generator, ows, towers, etc.
- g) featureDescription - Population is contingent only if data is currently available for feature.
- h) featureName (Mandatory) - Feature Name and subtype
- i) facilityIdfk - Population is contingent only if data is currently available for feature.
- j) operationalStatus - The state of usability of the feature. Domain values i.e., removed, abandoned, etc.
- k) owner - The entity that owns the feature. Domain values, i.e., ppv, usmc, usn, leased, federalOther, etc.
- l) removedDate - The date the feature was removed. Leave blank if abandoned.
- m) realPropertyJurisdictionType - The type of real property jurisdiction. Domain values i.e., tbd, etc.
- n) registryIdentifier - Population is contingent only if data is currently available for feature.
- o) sdsId - Population is contingent only if data is currently available for feature.
- p) sourceFeatureClass (Mandatory) - The feature class containing the point feature.

CLJN.CL.Bridge - Bridge (polygon) - The structure erected over a depression or an obstacle such as a body of water, railroad, etc., to provide a pathway for vehicles, rail services, pedestrians or to carry utility services.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) contractNumber - The contract number associated with the feature.

- e) featureDescription - The narrative describing the feature.
Value Base Area or Road Name Crossing
- f) featureName - The common name of the feature. Pedestrian, Railroad, Road, other, etc.
- g) heightAboveSurfaceLevel - The vertical distance measured from the lowest point of the base of the feature at ground or water level to the tallest point of the feature.
- h) heightUom - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) isFixed - Indicator of whether the bridge cannot be opened for navigation or other purposes. Yes / No
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.Building - Building (polygon) - The roofed and floored facility enclosed by exterior walls and consisting of one or more levels.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature if feature function does not accurately address the description of building.
- e) featureName - The common name of the feature. (Review current data for common name)
- f) featureFunction - The purpose(s) of, or intended role(s) served by, the feature. Domain values i.e., Fishing (3), Aircraft Repair (341), Motor Vehicle Repair (343), Utilities (350), Water Treatment (362), Water Distribution (363), Residence (563), Guard (781), Government (811), Recreation (921) etc.
- g) floorCount - The number of floors
- h) mediaId - gpsDataCollected
- i) MetadataId - metaID000072
- j) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.Fence (polyline) - The freestanding structure designed to restrict or prevent movement across a boundary.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - FENCE or GATE.
- f) FenceDesignType - The configuration of fabricated fence materials in a particular manner to build a fence. This may

or may not include specifications of the post type(s).
Domain values i.e., cross, postAndFrame, metalRail,
postAndFrame, etc.

- g) fenceFabricatedMaterialType - The fabricated material of the fence. Domain values i.e., barbedWire, chainLink, wroughtIron, metalOther, steel, wood, etc.
- h) fencePrimaryMaterialType - The fundamental or raw substance of the fence. Domain values i.e., jute, metalOther, steel, wood, wroughtIron, etc.
- i) fenceTopType - The fabricated material used as an upper barrier on the fence. Domain values i.e., spiked, electricfiedWire, etc.
- j) fenceUseType - The purpose that the fence serves. Domain values, i.e., internalSecurity, perimeterSecurity, recreation, residential, safety, vechicleBarrier, etc.
- k) heightAboveSurfaceLevel - The vertical distance measurement in feet.
- l) heightUom - The unit of measure for the height measurement. Domain values 0.3048 metres or feet, etc.
- m) mediaId - gpsDataCollected
- n) MetadataId - metaID000072
- o) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.Gate (polyline) - A movable barrier that closes an opening in a fence, wall, or other enclosure or enclosure.

- a) accessControlType - The type of access control. Domain values, i.e., gate etc.
- b) builtDate - The calendar date on which the original construction was completed for a facility.
- c) contractNumber - The contract number associated with the feature.
- d) facilityNumber - Asset number used for visual identification of the facility.
- e) featureDescription - The narrative describing the feature. (Review current data for description)
- f) featureName - The common name of the feature. (Review current data for common name)
- g) gateTypeMaterial - The type of material of the gate. Domain values i.e., metal, steel, wood, wroughtiron, etc.
- h) gatePurposeType - Purpose that the gate exists and functions under. Domain values i.e., decorative, insternalSecurity, perimaterSecurity, recreation, residential, safely, vehicleBarrier, other, etc.
- i) gateTopType - The fabricated material used as an upper barrier on the fence. Domain values i.e., spiked,
- j) isBaseEntryPoint - Yes or No
- k) isCheckpoint - Yes or No
- l) isManned - Yes or No
- m) isPortable - Yes or No
- n) isRangeAccess - Yes or No
- o) mediaId - gpsDataCollected
- p) metadataId - metaID000072
- q) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.RecreationBoundary (polygon) - The area designated for recreational purposes.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) isFormallyDelineated Yes / No
- g) isHandicappedAccessible Yes / No
- h) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.OpenStorage - Open Storage (polygon) - The non-covered and/or covered storage areas, paved or otherwise established, for the storage of general supply materials or the receipt, processing, staging and issue of materials.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) mediaId - gpsDataCollected
- g) MetadataId - metaID000072
- h) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.PavementSectionAirfieldArea - Pavement Section Airfield (polygon) - The location of a surface feature that comprises a section of a military airfield area. *Requires Survey Grade GPS.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) airfieldPavementUse - The use of the airfield. Domain values i.e., apron, fueling area, helipad, runway, taxiway, etc.
- e) featureDescription - The narrative describing the feature. Values should include Area i.e., MCAS NEW RIVER, HADNOT POINT, RIFLE RANGE, MCOLF CAMP DAVIS, GSRA, HOSPITAL, etc.
- f) featureName - The common name of the feature. (Review current data for common name)
- g) highestElevation - The elevation from a specified vertical

- datum to the highest point on a feature.
- h) highestElevationUom - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.
- i) isLighted - Yes / No
- j) isPaved - Yes / No
- k) mediaId - gpsDataCollected
- l) MetadataId - metaID000072
- m) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- n) owner - The entity that owns the feature. Domain values, i.e., ppv, usmc, usn, leased, federalOther, etc.
- o) runwayClassification - Classification of the runway. Domain values i.e., classA, classB, rotary, olf, etc.

CLJN.CL.PavementSectionParkingArea (polygon) - The area used for parking vehicles not including residential streets and driveways.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) isLighted - Yes / No
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- j) owner - The entity that owns the feature. Domain values, i.e., ppv, usmc, usn, leased, federalOther, etc.
- k) pavementSurfaceType - The type of material used to construct the surface of the pavement feature. Domain values i.e., asphalt, gravel, asphaltOverAsphaltConcrete, portlandCementConcrete, etc.
- l) vehicleType - The type of vehicle permitted on the pavement section. Domain value i.e., all, gov, mil, pov, etc.

CLJN.CL.PavementSectionRoadway (polygon) - The surface area that comprise a road area, upon which vehicles drive and park.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - FULL Road Name All Capital Letters, i.e., D STREET, SIXTH STREET, FOSTER BOULEVARD, PORTLAND COURT
- f) isPaved - Yes / No
- g) mediaId - gpsDataCollected

- h) MetadataId - metaID000072
- i) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- j) owner - The entity that owns the feature. Domain values, i.e., ppv, usmc, usn, leased, federalOther, etc.
- k) pavementSurfaceType - The type of material used to construct the surface of the pavement feature. Domain values i.e., gravel, asphalt, asphaltOverAsphaltConcrete, portlandCementConcrete, etc.
- l) roadSectionType - The type of road asset represented by this section. Domain values i.e., roadway, stagingArea, etc.
- m) vehicleType - The type of vehicle permitted on the pavement section. Domain value i.e., all, gov, mil, pov, etc.

CLJN.CL.PavementSection - Pavement Section (polygon) - The portion of a pavement branch that differs in some aspect from other sections such that further segmentation is required to uniquely identify that section.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. Value i.e., GENERATOR PAD, TRANSFORMER PAD, DUMPSTER PAD, BLEACHER PAD, UTILITY PANEL PAD, etc.
- e) FeatureName - Slab.
- f) featureName - The common name of the feature. (Review current data for common name)
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- j) owner - The entity that owns the feature. Domain values, i.e., ppv, usmc, usn, leased, federalOther, etc.

CLJN.CL.PavementSectionSidewalk (polygon) - The paved pedestrian walkway prepared to facilitate travel on foot. It may or may not be adjacent to a street/road.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) isLighted - Yes / No
- g) isPaved - Yes / No
- h) materialType - The material composition of the feature. Domain values i.e., asphalt, concrete, etc.
- i) mediaId - gpsDataCollected

- j) MetadataId - metaID000072
- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- l) owner - The entity that owns the feature. Domain values, i.e., ppv, usmc, usn, leased, federalOther, etc.

CLJN.CL.StructureArea - Structure (polygon) - The facility, other than a building or linear structure, which is constructed on or in the land.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. Values i.e., Picnic Pavilion, Gazebo, Postal Shelter, Buss Stop, Golf Shelter, Vehicle Wash Platform, Outdoor Classroom,
- e) featureName - The common name of the feature. Values i.e., CANOPY, PLATFORM, PAVILLION, RAMP, WEIGH STATION, etc.
- f) mediaId - gpsDataCollected
- g) MetadataId - metaID000072
- h) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.TowerPoint (point) - The vertical projection, higher than its diameter, generally used for observation, etc.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. I.e., Range, Observation, Cell, etc.
- e) featureName - Common name utilized for Range Area name.
- f) heightMax - Maximum height of structure in feet.
- g) heightUom - The unit of measure for the height measurement. Domain values .3048 metres or feet, etc.
- h) mediaId - gpsDataCollected
- i) MetadataId - metaID000072
- j) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- k) towerUseType - The primary operational use of the tower. Domain values, i.e., fire, observation, communication, training, etc.

CLJN.CL.TrafficControlLight (point) - A feature used to represent traffic lights.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.

- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) heightAboveSurfaceLevel - Maximum height of structure in feet.
- g) heightAboveSurfaceLevelUom - The unit of measure for the height measurement. Domain values .3048 metres or feet, etc.
- h) mediald - gpsDataCollected
- i) MetadataId - metaID000072
- j) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.WallLine - Wall - The linear feature used for separation of facilities, ornamental decoration, or structural reinforcement.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. Values i.e., BENCH, DUMSPETER ENCLOSURE, UTILITY ENCLOSURE, RETAINING WALL, BLAST PROTECTION, BAFFLE WALL, MECHANICAL YARD, etc.
- e) featureName - The common name of the feature. (Review current data for common name)
- f) height - The height of the feature in feet.
- g) heightUom - The unit of measure for the height measurement. Domain values .3048 metres or feet, etc.
- h) mediald - gpsDataCollected
- i) MetadataId - metaID000072
- j) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- k) wallMaterialType - The material from which the majority of the wall is constructed. Domain values i.e., brick, cinderblock, grass, glassBlock, masonry, wood, etc.

1.4.5 Feature Dataset CLJN.CL.Recreation

Locate, GPS and collect attribute data as specified for each feature listed with (GPS) accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

CLJN.CL.RecreationTrail - Recreation Trail (Polyline) - The path or walkway providing opportunity for physical activities.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.

- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature area. Values i.e., HADNOT POINT, FRECH CREEK, WALLAS CREEK, MCAS, etc.
- e) featureName - The common name of the feature such as common trail name. Values, i.e., GREENWAY, MCAS, KNOX, etc.
- f) MediaId - gpsDataCollected
- g) MetadataId - metaID000072
- h) materialType - The material composition of the feature. Domain values i.e., asphalt, concrete, etc.
- i) officialLength - The officially reported length of the feature in feet.
- j) officialLengthUom - The official length. Domain values i.e. 0.3048 metres, feet, etc.
- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.Playground - Playground (Polygon) The area designed for children to play outdoors.

- a) builtDate - The calendar date on which the original construction was completed for a facility.
- b) contractNumber - The contract number associated with the feature.
- c) featureDescription - The narrative describing the feature. (Review current data for description).
- d) featureName - The common name of the feature. (Review current data for common name)
- e) featureName - The common name of the feature such as common trail name.
- f) isHandicappedAccessible - Yes / No
- g) MediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- j) owner - The entity that owns the feature. Domain values, i.e., ppv, usmc, usn, leased, federalOther, etc.
- k) isHandicappedAccessible - Yes / No
- l) playgroundCategory - Playground categorization by physical location on the installation. Domain values i.e., childDevCenter, generalPurpose, housingArea, school, etc.
- m) playgroundMaterial - The primary material that the play pieces are constructed from. Domain values i.e., paintedMetal, plastic, vinylCoatedMetal, wood, etc.
- n) recreationFeatureType - The type of recreation feature. Domain values i.e., paintball, playground, obstacleCourse, picnicSite, tennisCourt, volleyballCourt, swimmingPool, etc.
- o) heightAboveSurfaceLevel - The vertical distance measured from the lowest point of the base of the feature at ground or water level to the tallest point of the feature.
- p) heightAboveSurfaceLevelUom - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.

CLJN.CL.RecreationFeatureArea - Recreation Feature Area (Polygon) - The location of an object or other physical asset associated with a

recreation site. - Recreation area, i.e., swimming pool, basketball, tennis, baseball, football, and other recreation features.

- a) `builtDate` - The calendar date on which the original construction was completed for a facility.
- b) `facilityNumber` - Asset number used for visual identification of the facility.
- c) `contractNumber` - The contract number associated with the feature.
- d) `featureDescription` - The narrative describing the feature.
- e) `featureName` - The common name of the feature if not addressed in `RecreationFeatureType` field.
- f) `mediaId` - `gpsDataCollected`
- g) `MetadataId` - `metaID000072`
- h) `heightAboveSurfaceLevel` - The vertical distance measured from the lowest point of the base of the feature at ground or water level to the tallest point of the feature.
- i) `heightAboveSurfaceLevelUom` - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.
- j) `isHandicappedAccessible` - Recreation Area has a formal designation. Yes / No
- k) `isIndoor` - Yes or No
- l) `operationalStatus` - The state of usability of the feature i.e., `inService`, `notInService`, `abandoned`, etc.
- m) `owner` - The entity that owns the feature. Domain values, i.e., `ppv`, `usmc`, `usn`, `leased`, `federalOther`, etc.
- n) `RecreationFeatureType` - The type of recreation feature. Domain values. i.e., `athleticCourt`, `athleticField`, `basketballCourt`, `climbingStructure`, `dugout`, `exerciseStation`, `footballField`, `picnicSite`, `recreationalFirearmsRange`, `volleyballCourt`, etc.

1.4.6 Feature Dataset CLJN.CL.Transportation

Locate, GPS and collect attribute data as specified for each feature listed with (GPS) accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

CLJN.CL.Sign - Sign (point) - The structure that conveys directional, warning, or other information.

- a) `builtDate` - The calendar date on which the original construction was completed for a facility.
- b) `contractNumber` - The contract number associated with the feature.
- c) `mediaId` - `gpsDataCollected`
- d) `MetadataId` - `metaID000072`
- e) `heightAboveSurfaceLevel` - The vertical distance measured from the lowest point of the base of the feature at ground or water level to the tallest point of the feature.
- f) `heightAboveSurfaceLevelUom` - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.
- g) `operationalStatus` - The state of usability of the feature i.e., `inService`, `notInService`, `abandoned`, etc.

- h) signAssemblyType - The type of sign assembly material. Domain values i.e., IBeamSteelBreakaway, PedestrianPole, SignalMastArm, signalPole, fire, safety, etc.
- i) signText - The text displayed on the sign.
- j) signType - The type of sign. Domain values i.e., regulatory, school, warning, etc.
- k) owner - The entity that owns the feature. Domain values, i.e., ppv, usmc, usn, leased, federalOther, etc.

CLJN.CL.RoadCenterline - The center of a roadway, as measured from the edge of the navigable road with the paved or unpaved surface. Polyline is to be drawn in direction of flow with no breaks except where naturally occurring such as intersections and crossings.

- a) dataSource - The agency that last updated the record.
- b) dateUpdated - The date the record was created or last modified.
- c) elevationFrom - Elevation value at start of segment.
- d) elevationTo - Elevation value at end of segment.
- e) featureDescription - The narrative describing the feature.
- f) featureName - the common name of the feature.
- g) fullStreetName - The combined full street name.
- h) isPaved - The yes or no indicator of whether the feature has a paved surface. Domain values i.e., yes, no.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) numLanes - The number of traffic lanes throughout the length of the centerline.
- l) oneWayDirection - The one-way road directionality. Domain values i.e. ft, tf, b, etc.
- m) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- n) owner - The entity that owns the feature. Domain values, i.e., usmc, ncdot, etc.
- o) roadClass - The general description of the type of road, based on the US Census MAF/TIGER Feature Classification Codes (MTFCC). Domain values i.e., primary, secondary, local, etc.
- p) roadWidth - The width of the feature.
- q) roadWidthUom - The width unit of measure in feet
- r) Domain: GsipLengthUom (i.e. usSurveyFoot, metre, etc.)
- s) speedLimit - The posted speed limit in MPH.
- t) verticalDatum - The vertical reference datum for the z location value. Domain values i.e. navd88, etc.
- u) verticalEpoch - The time period epoch to which the elevation measurement is referenced. Domain values i.e., opus, etc.

1.4.7 Attribute Data Collection and GPS Requirements for Utilities

Locate, GPS and collect attribute data as specified for each feature listed with (Survey Grade GPS) accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

1.4.8 Feature Dataset CLJN.CL.Telecommunication

Locate, GPS and collect attribute data as specified for each feature listed with (GPS) accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

CLJN.CL.CommUtilSegment (polyline) - The location of a feature used for destruction in a communication network, particularly a cable for the transmission of a signal.

- a) availableStrands - A list of fiber strands that are available.
- b) cableCount - The number of copper pairs or fiber strands dedicated at a given location.
- c) cableId - The cable identifier. (Review current data for description)
- d) cableInstaller - The name of the group responsible for installation of the cable feature.
- e) cableInstallType - The type of installation of the cables. Domain values i.e., aerea, directBuried, tunnel, underground, etc.
- f) cableInsulation - The material composition of the insulation of the cable. Domain values i.e., pvc, xlpe, etc.
- g) cableMaterial - The material composition of the cable. Domain values i.e., fiberOpt, cu, etc.
- h) cableRoute - The start and end points of a cable section. (Review current data for description)
- i) cableSheathing - The type of sheathing or insulation of the cable. Domain values i.e., bp, cpnm, cj, etc.
- j) communicationsSegmentType - The type of communications network segment that this feature represents. Domain values i.e., cCoaxial, cFiberOptic, etc.
- k) contractNumber - The contract number associated with the feature.
- l) dateInService - The date the utility equipment was put in service.
- m) featureDescription - The narrative describing the feature. (Review current data for description)
- n) featureName - The common name of the feature. (Review current data for naming convention)
- o) numberOfPairs - The number of wire pairs in the cable.
- p) numberOfSingleModeStrands - The number of single-mode fiber strands.
- q) numberOfStrands - The total number of fiber strands in the cable.
- r) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- s) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- t) wireGauge - The gauge of the wire.

CLJN.CL.Feat_CUGEnclosureAccess (point) - The location of a communication access point to the related communication underground enclosure.

- a) commUtilityFeatureType - Type of communication feature, i.e., cUGEnclosureAccess
- b) contractNumber - The contract number associated with the

- feature.
- c) dateInService - The date the utility equipment was put in service.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for naming convention)
- f) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., elevated, semiBuried, underground, etc.
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., communications.
- j) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- k) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- l) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., communications, etc.

CLJN.CL.Feat_CPedestal (point) - The location of an above-ground enclosed structure that provides access to buried plant and a place to house utility features.

- a) commUtilityFeatureType - Type of communication feature, i.e., cPedestal
- b) contractNumber- The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in service.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for naming convention)
- f) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., elevated, semiBuried, underground, etc.
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., communications.
- j) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- k) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.

CLJN.CL.CommUtilNode_CAntenna (point) - A device that can transmit or receive radio frequency signals.

- a) communicationsNodeType - Type of communication node, i.e., cAntenna
- b) contractNumber- The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in

- service.
- d) facilityNumber - Asset number used for visual identification of the facility.
- e) featureDescription - The narrative describing the feature. (Review current data for description)
- f) featureName - The common name of the feature. (Review current data for naming convention)
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- j) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.

CLJN.CL.Feat_CDuctBank (polyline) - The location of one or more ducts routed in parallel between two nodes.

- a) commUtilityFeatureType - Type of communication feature, i.e., cDuctBank, etc.
- b) contractNumber- The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in service.
- d) ductDiameterUom - - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) ductMaterial - The material composition of the feature. Domain values i.e., cooper, carbonSteel, etc.
- f) featureDescription - The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for naming convention)
- h) mediaId - gpsDataCollected
- i) MetadataId - metaID000072
- j) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., communications.
- k) NumberOfDucts
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- n) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., communications, etc.

1.4.9 Feature Dataset CLJN.CL.Utilities_Electrical Class

Locate, GPS and collect attribute data as specified for each feature listed with (GPS) accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

CLJN.CL.AlternativeEnergyArea (polygon) - The apparatus or device used for the production of energy from a renewable resource.

- a) alternativeEnergyType - The type of alternative energy that the feature represents. Domain values i.e., photovoltaic, windTurbine, tbd, etc.
- b) contractNumber - The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in service.
- d) expansionDistributionNetwork - An indication of the distribution network interconnection an alternative energy feature uses to supply renewable energy. Domain values i.e., partOElectricalNetwork, etc.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, recreational, tbd, etc.
- i) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- j) hasInverter - Yes / No
- k) isMetered - Yes / No
- l) mediaId - gpsDataCollected
- m) MetadataId - metaID000072
- n) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- o) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- p) panelType - The type of panel present.
- q) systemCapacityDc - The system capacity for the DC current produced by the solar photovoltaic array, preferably measured in kilowatts.

CLJN.CL.ElecUtilNode_EFuse (point) - The location of a device used to protect electric distribution devices from dangerously high currents, and reduce risk of severe injury for personnel.

- a) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- b) alternativeEnergyType - The type of alternative energy that the feature represents. Domain values i.e., photovoltaic, windTurbine, tbd, etc.
- c) contractNumber - The contract number associated with the feature.
- d) dateInService - The date the utility equipment was put in service.
- e) electricalNodeType - The type of electrical network node that this feature represents. Domain values consist of electrical nodes, i.e., efuse.
- f) facilityNumber - Asset number used for visual identification of the facility.
- g) featureDescription - The narrative describing the feature. (Review current data for description)

- h) featureName - The common name of the feature. (Review current data for common name)
- i) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, recreational, etc.
- j) mediaId - gpsDataCollected
- k) MetadataId - metaID000071
- l) numberOfPhases - Number of phases. Domain values i.e., one, two, three, etc.
- m) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- n) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.

CLJN.CL.ElecUtilNode_EGenerator (point) - The location of an available kinetic power source providing electricity.

- a) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- b) contractNumber - The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in service.
- d) electricalNodeType - The type of electrical network node that this feature represents. Domain values consist of electrical nodes, i.e., eGenerator.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) generatorPowerSource - The power source of the generator. Domain values, i.e., gas, natural gas, propane, solarPower, etc.
- j) generatorType - The type of electrical generator. Domain values i.e., emergency, primary, standby, etc.
- k) isPortable - Yes / No
- l) kvaRate - The rating of the complex power that the generator creates.
- m) kwRate - The rating of the real power that the generator creates.
- n) Manufacturer - The name of the manufacturer of the feature.
- o) mediaId - gpsDataCollected
- p) MetadataId - metaID000072
- q) modelNumber - The model, product, catalog, or item number for the feature item.
- r) numberOfPhases - Number of phases. Domain values i.e., one, two, three, etc.
- s) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- t) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.

- u) serialNumber - The manufacturer serial or unique identification number for the feature item.
- v) voltage - The system voltage applied to the subject item. Domain value i.e., 120V, 480V, 480YTo277V etc.

CLJN.CL.ElecUtilNode_EMeter (point) - The location of a device that measures the amount of electric energy consumed by the power user.

- a) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- b) contractNumber - The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in service.
- d) electricalNodeType - The type of electrical network node that this feature represents. Domain values consist of electrical nodes, i.e., eMeter.
- e) energySource - Indicates if the meter is measuring a standard power source or an alternative energy source. Domain values i.e., standardPowerSource, alternativeEnergySource, tbd, etc.
- f) facilityNumber - Asset number used for visual identification of the facility.
- g) featureDescription - The narrative describing the feature. (Review current data for description)
- h) featureName - The common name of the feature. (Review current data for common name)
- i) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- j) isAmi - An indicator of whether or not the meter is an AMI or smart meter. Yes / No
- k) mediaId - gpsDataCollected
- l) MetadataId - metaID000072
- m) meterType - The type of meter. Domain valves i.e., diaphragm, orifice, rotary, other, tbd, etc.
- n) meterUse - An indication of the type of service the meter is monitoring. Domain valves eleMeter, generator, loadPoint, commercial, etc.
- o) mountingType - The type of mounting for the subject item. Domain valves electrical, pole, pad, transformer, wall, etc.
- p) numberOfPhases - Number of phases. Domain values i.e., one, two, three, etc.
- q) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- r) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- s) transformerKva - The kva rate for the transformer.
- t) voltage - The system voltage applied to the subject item. Domain value i.e., 120V, 480V, 480YTo277V etc.

CLJN.CL.ElecUtilNode_ECircuitBreaker (point) - The location of a circuit breaker, an automatically operated electrical switch designed to protect an electrical circuit from damage caused by excess current from an overload or short circuit.

- a) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- b) contractNumber - The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in service.
- d) electricalNodeType - The type of electrical network node that this feature represents. Domain values consist of electrical nodes, i.e., eCircuitBreaker.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- l) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.

CLJN.CL.ElecUtilNode_EExteriorLight (point) - The location of a lighting device that is supplied by local distribution systems and is generally the only service for which the electric utility installs, operates and maintains utilization equipment.

- a) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- b) contractNumber - The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in service.
- d) electricalNodeType - The type of electrical network node that this feature represents. Domain values consist of electrical nodes, i.e., eExteriorLight.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) exteriorLightType - The type of exterior light. Domain i.e., landscapelight, parkingLotLight, pedestrianLight, recreationFieldLight, securityLight, streetlight, sidewalkLight, etc.
- g) featureDescription - The narrative describing the feature. (Review current data for description)
- h) featureName - The common name of the feature. (Review current data for common name)
- i) feederId - The Feeder Manager identifier assigned to electric feeders and devices that participate in a specific distribution circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)

- j) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- k) hasSensor - Yes / No
- l) heightAboveSurfaceLevel - The vertical distance measured from the lowest point of the base of the feature at ground or water level to the tallest point of the feature.
- m) heightAboveSurfaceLevelUom - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.
- n) isSolar - Yes / No
- o) lampType - The type of lamp per fixture. Domain i.e., led, hps, mh, etc.
- p) mediaId - gpsDataCollected
- q) MetadataId - metaID000072
- r) mountingType - The type of mounting for the subject item. Domain values i.e., pole, pad, transformer, wall, ground, etc.
- s) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- t) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- u) voltage - The system voltage applied to the subject item. Domain value i.e., 120V, 480V, 480YTo277V etc.

CLJN.CL.ElecUtilNode_EAirfieldLight (point) - The location of an electrical device used to illuminate runways, taxiways, helipads, aprons, and any other aircraft movement area, as well as to guide ground traffic.

- a) airfieldLightType - The type of lighting present on the airfield. Domain value i.e., runwayLight, taxiwayLight, apron, helipadLight, approachLight, etc.
- b) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- c) contractNumber - The contract number associated with the feature.
- d) dateInService - The date the utility equipment was put in service
- e) electricalNodeType - The type of electrical network node that this feature represents. Domain values consist of electrical nodes, i.e., eAirfieldLight.
- f) facilityNumber - Asset number used for visual identification of the facility.
- g) featureDescription - The narrative describing the feature. (Review current data for description)
- h) featureName - The common name of the feature. (Review current data for common name)
- i) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- j) mediaId - gpsDataCollected
- k) MetadataId - metaID000072
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.

- n) voltage - The system voltage applied to the subject item.
Domain value i.e., 120V, 480V, 480YTo277V etc.

CLJN.CL.ElecUtilNode_EEnergyStorage - The location of energy storage device or natural system capable of capture of energy produced at one time for use at a later time, within the relative span of a human lifetime.

- a) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- b) contractNumber - The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in service.
- d) electricalNodeType - The type of electrical network node that this feature represents. Domain values consist of electrical nodes, i.e., eEnergyStorage.
- e) featureDescription - The narrative describing the feature.
(Review current data for description)
- f) featureName - The narrative describing the feature.
(Review current data for description)
- g) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- h) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- i) ownerName - The name of the item owner, i.e., MCB CL, Company Name, etc.

CLJN.CL.ElecUtilNode_ESubstation (point) - A substation is a part of an electrical generation, transmission, and distribution system. Substations transform voltage from high to low, or the reverse, or perform any of several other important functions. Between the generating station and consumer, electric power may flow through several substations at different voltage levels.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) electricalNodeType - The type of electrical network node that this feature represents. Domain values consist of electrical nodes, i.e., eSubstation
- d) facilityNumber - Asset number used for visual identification of the facility.-
- e) featureDescription - The narrative describing the feature.
(Review current data for description)
- f) featureName - The common name of the feature. (Review current data for common name)
- g) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- h) mediaId - gpsDataCollected
- i) MetadataId - metaID000072

- j) numberOfAvailableBays - The number of available bays at the substation.
- k) numberOfCircuits - The number of circuits present at the substation.
- l) numberOfSpareBreakers - The number of Spare Breakers in the substation.
- m) numberOfTransformers - The number of transformers present.
- n) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- o) ownerName - The name of the item owner, i.e., MCB CL, Company Name, etc.
- p) voltageIn - The line-to-line voltage of the transmission line that is the source for the substation. Domain value i.e., 120V, 480V, 480YTo277V etc.
- q) voltageOut - The line-to-line output voltage of the substation. Domain value i.e., 120V, 480V, 480YTo277V etc.

CLJN.CL.Feat_ESubstation (Polygon) - The location of a facility in an electrical system where the voltage is reduced from transmission levels to distribution levels.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) electricalUtilityFeatureType - The type of electrical utility feature. Domain value, i.e., eSubstation.
- d) FacilityNumber - Asset number used for visual identification of the facility.
- e) featureDescription - The narrative describing the feature. (Review current data for description)
- f) featureName - The common name of the feature. (Review current data for common name)
- g) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- h) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) networkType - The primary type of utility network to which this feature relates. Domain values i.e., electrical, etc.
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- n) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., electrical, etc.

CLJN.CL.ElecUtilNode_EVoltageRegulator (point) - Current Regulators are different than Voltage Regulators and are used on the airfield lighting systems.

- a) circuitId - An operator generated identifier locally used to

- reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- b) contractNumber - The contract number associated with the feature.
 - c) dateInService - The date the utility equipment was put in service.
 - d) electricalNodeType - The type of electrical network node that this feature represents. Domain values consist of electrical nodes, i.e., ecurrentRegulator.
 - e) facilityNumber - Asset number used for visual identification of the facility.
 - f) featureDescription - The narrative describing the feature. (Review current data for description)
 - g) featureName - The common name of the feature. (Review current data for common name)
 - h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
 - i) mediaId - gpsDataCollected
 - j) MetadataId - metaID000072
 - k) numberOfPhases - Number of phases. Domain values i.e., one, two, three, etc.
 - l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
 - m) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.

CLJN.CL.ElecUtilNode_ESwitchingStation (point) - A Switching Station is an electrical substation with only one voltage level, whose only function are switching actions.

- a) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- b) contractNumber - The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in service.
- d) electricalNodeType - The type of electrical network node that this feature represents. Domain values consist of electrical nodes, i.e., eSwitchingStation.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - Number of Switches.
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) numberOfSwitches - The number of switches present.
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) ownerName - The name of the item owner, i.e., MCB CL, MCCA,

PPV, Company Name, etc.

CLJN.CL.ElecUtilNode_ESwitch (point) - The location of a device throughout distribution feeder circuits to redirect power flows to balance loads or for sectionalizing to allow repair of damaged lines or equipment.

- a) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- b) contractNumber - The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in service.
- d) electricalNodeType - The type of electrical network node that this feature represents. Domain values consist of electrical nodes, i.e., eSwitch.
- e) electricalSwitchInstallation - The mounting/installation style of the electrical switch. Domain values buildingMounted, padMounted, poleMounted, electricalPanel, etc.
- f) electricalSwitchType - The type or style of electrical switch. Domain values circuitBrkr, disconnect, fuseCutout, gangDisc, hdSaftly, iso, reclosure, etc.
- g) facilityNumber - Asset number used for visual identification of the facility.
- h) featureDescription - The narrative describing the feature. (Review current data for description)
- i) featureName - The common name of the feature. (Review current data for common name)
- j) feederId - The Feeder Manager identifier assigned to electric feeders and devices that participate in a specific distribution circuit, utilize (tbd) if unknown.
- k) feederId2 - The feeder Manager Identifier assigned if the electric device is supplied by second feeder, utilize. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- l) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- m) mediaId - gpsDataCollected
- n) MetadataId - metaID000072
- o) numberOfPhases - Number of phases. Domain values i.e., one, two, three, etc.
- p) numberOfSwitches - The number of switches present, i.e.,
- q) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- r) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- s) switchPosition - Code indicating normal position of switch, per phase. Domain value closed, closedOpen, open, openClosed, unknown, tbd, etc.
- t) voltage - The system voltage applied to the subject item. Domain value i.e., 120V, 480V, 480YTo277V etc.

CLJN.CL.Feat_EPedestal (point) An aboveground service entrance, allowing maintenance access to the specific utility, usually electric or communications.

- a) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- b) bcontractNumber - The contract number associated with the feature.
- c) cdateInService - The date the utility equipment was put in service.
- d) electricalUtilityFeatureType - The type of electrical utility feature, i.e., ePedestal
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) featureName - The common name of the feature. (Review current data for common name)
- i) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- j) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- k) mediaId - gpsDataCollected
- l) MetadataId - metaID000072
- m) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- n) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- o) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., electrical, etc.

ElecUtilNode_ETransformer - Electrical Utility Node - Transformer (point) - The location of an electric distribution or power transformer.

- a) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- b) contractNumber - The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in service.
- d) electricalNodeType - The type of electrical network node that this feature represents. Domain values consist of electrical nodes i.e., eTransformer.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review

- current data for common name)
- h) feederId - The Feeder Manager identifier assigned to electric feeders and devices that participate in a specific distribution circuit, utilize (tbd) if unknown.
- i) feederId2 - The feeder Manager Identifier assigned if the electric device is supplied by second feeder, utilize (tbd) if unknown.
- j) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- k) mediaId - gpsDataCollected
- l) MetadataId - metaID000072
- m) Manufacture - The name of the manufacturer of the feature.
- n) modelNumber - The model, product, catalog, or item number for the feature item.
- o) mountingType - The type of mounting for the subject item. Domain value ground, pad, pole, transformer, wall, tbd, etc.
- p) numberOfPhases - Number of phases. Domain values i.e., one, two, three, etc.
- q) numberOfTransformers - The number of transformers present.
- r) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- s) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- t) primaryVoltage - The voltage on the source side of the regulator with the associated units given. Domain value i.e., 120V, 480V, 480YTo277V etc.
- u) secondaryVoltage - The voltage on the load side of the regulator with the associated units given. Domain value i.e., 120V, 480V, 480YTo277V etc.
- v) totalKva - The total kva rate.
- w) transformerType - The type of transformer. Domain values i.e., inverter, isolation, stepDown, stepUp, vault, etc.

CLJN.CL.ElecUtilSegment (polyline) - The location of a linear feature, particularly a cable that transmits, distributes or connects customers to electricity. All polylines shall be drawn in the direction of flow with no breaks except for what is naturally occurring such at nodes, etc.

- a) ElectricalSegmentType - The identifier for Primary or Secondary line segments within an electrical distribution system.
- b) cableInsultaion - The material composition of the insulation of the cable. Domain value, i.e., ip, epr, pe, pvc, rubber, xipe, tdb, unknow, etc.
- c) cableMaterial - The material composition of the cable. Domain value, i.e., ac, al, copper, fiberOpt, steel, steelGalv, etc.
- d) cableSheathing - The type of sheathing or insulation of the cable. Domain value, i.e., shielded, weatherProof, asbestos, cellulose, tapeArmor, tbd, etc.
- e) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- f) conductorSize - The size of the conductor.

- g) contractNumber - The contract number associated with the feature.
- h) dateInService - The date the utility equipment was put in service.
- i) facilityNumber - Asset number used for visual identification of the facility.
- j) featureDescription - The narrative describing the feature. (Review current data for description)
- k) featureName - The common name of the feature. (Review current data for common name)
- l) feederId - The Feeder Manager identifier assigned to electric feeders and devices that participate in a specific distribution circuit, utilize (tbd) if unknown.
- m) feederId2 - The feeder Manager identifier assigned if the electric device is supplied by second feeder, utilize. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD GIS Office)
- n) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- o) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- p) mediaId - gpsDataCollected
- q) MetadataId - metaID000072
- r) neutralSize - The size of a single neutral conductor. Domain value i.e., .5, .75, 1, 1.25, 2, 4, etc.
- s) numberOfPhases - Number of phases. Value, i.e., 1, 2, 3, 4, etc.
- t) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- u) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- v) voltage - The system voltage applied to the subject item. Domain value i.e., 120V, 480V, 480YTo277V etc.

CLJN.CL.Feat_EScadaSensor (point) - The location of a device that is used to remotely measure the status of electrical network components as part of a Supervisory Control and Data Acquisition (SCADA) system.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) electricalUtilityFeatureType - The type of electrical utility feature, i.e., eScadaSensor
- d) FacilityNumber - Asset number used for visual identification of the facility.
- e) featureDescription - The narrative describing the feature. (Review current data for description)
- f) featureName - The common name of the feature. (Review current data for common name)
- g) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- h) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground,

- elevated, semiBuried, underground, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., electrical.
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- n) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., electrical, etc.

CLJN.CL.Feat_EDemarcationPoint (point) - The location where the electrical service provider ownership ends, and the customer ownership begins.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) electricalUtilityFeatureType - The type of electrical utility feature, i.e., eDemarcationPoint.
- d) facilityNumber - Asset number used for visual identification of the facility.
- e) featureDescription - The narrative describing the feature. (Review current data for description)
- f) featureName - The common name of the feature. (Review current data for common name)
- g) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- h) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., electrical.
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) outsideProvider - The name of the outside provider for the Utility Feature. Value, i.e., owner of point may be 3rd party company.
- n) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- o) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., electrical, etc.

CLJN.CL.Feat_ESupportStructure (point) - The location of a structural framework that holds electric devices in an elevated position.

- a) circuitId - An operator generated identifier locally used to reference a specific electrical circuit. (Data can be found in Geodatabase, i.e., RG2, FC1, CHB, IND, etc. or contact PWD

- GIS Office)
- b) configurationType - The cable mounting configuration on the pole or tower. Domain value, i.e, armless, crossarmEqual, crossarmUnequal, shortArm, vertical, other, tbd, unknown, etc.
 - c) contractNumber - The contract number associated with the feature.
 - d) dateInService - The date the utility equipment was put in service.
 - e) electricalUtilityFeatureType - The type of electrical utility feature i.e., eSupportStructure.
 - f) facilityNumber - Asset number used for visual identification of the facility.
 - g) featureDescription - The narrative describing the feature. (Review current data for description)
 - h) featureName - The common name of the feature. (Review current data for common name)
 - i) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
 - j) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
 - k) heightAboveSurfaceLevel - The vertical distance measured from the lowest point of the base of the feature at ground or water level to the tallest point of the feature in feet.
 - l) heightAboveSurfaceLevelUom - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.
 - m) materialType - The material composition of the feature. Domain value, i.e., cement, fiberglass, log, metal, steel, wood, etc.
 - n) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., electrical.
 - o) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
 - p) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
 - q) serialNumber - Physical ID on pole that is a unique identifier added to pole on label by contractor/shop.
 - r) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., electrical, etc.

CLJN.CL.Feat_ESurfaceStructure - The location of a structural framework that holds electric devices in a position at or near the ground surface.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) electricalStructureType - The type of electrical feature. Domain values i.e., electricalCabinet, handHole, junctionBox, manhole, etc.
- d) electricalUtilityFeatureType - The type of electrical utility feature i.e., eSurfaceStructure.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature.

- (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The common name of the feature. (Review current data for common name)
- i) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- j) mediaId - gpsDataCollected
- k) MetadataId - metaID000072
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc. utilityNetworkSubtype

CLJN.CL.Feat_EAnchorGuy (point) - The location of a wire or set of wires running from the top of the pole to an anchor installed in the ground and consist of wires, appropriate fastenings and the anchor.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) electricalUtilityFeatureType - The type of electrical utility feature, i.e., eAnchorGuy.
- d) facilityNumber - Asset number used for visual identification of the facility.
- e) featureDescription - The narrative describing the feature. (Review current data for description)
- f) featureName - The common name of the feature. (Review current data for common name)
- g) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- h) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., electrical.
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- n) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., electrical, etc.

CLJN.CL.Feat_EUgEnclosureAccess (point) - The location of an electrical access point to the related electrical underground enclosure.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) electricalUtilityFeatureType - The type of electrical utility

- feature i.e., eUgEnclosureAccess.
- d) facilityNumber - Asset number used for visual identification of the facility.
- e) featureDescription - The narrative describing the feature. (Review current data for description)
- f) featureName - The common name of the feature. (Review current data for common name)
- g) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- h) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., electrical.
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- n) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., electrical, etc.

1.4.10 Feature Dataset CLJN.CL.Utilities_Pol

Locate, GPS and collect attribute data as specified for each feature listed with (GPS) accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

CLJN.CL.PolUtilNode_OOwsSystem (point) - A filtering device placed in the fuel stream specifically to remove oil and water from the fuel.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- j) polNetworkSubType - The subtype of POL network in which this feature participates. Domain values i.e., contaminatedMedia, b5, automotiveDiesel, etc.

- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.

CLJN.CL.PolUtilNode_OValve (point) -The location of a network component used to control flow, pressure, and level within fueling systems.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) depth - The distance, measured vertically downward to the base in inches.
- d) depthUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- f) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- g) facilityNumber - Asset number used for visual identification of the facility.
- h) featureDescription - The narrative describing the feature. (Review current data for description)
- i) featureName - The common name of the feature. (Review current data for common name)
- j) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- k) mediaId - gpsDataCollected
- l) MetadataId - metaID000072
- m) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- n) polNetworkSubType - The subtype of POL network in which this feature participates. Domain values i.e., jetA, kerosene, marineDiesel, jp5, automotiveDiesel, etc.
- o) polNodeType - The type of POL network node that this feature represents i.e., oValve, etc.
- p) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- q) valveMaterial - The material composition of the valve. Domain values, i.e., ductileIron, carbonSteel, etc.
- r) valveType - The normal status or operating position of the valve. Domain values i.e., check, gate, etc.

CLJN.CL.PolUtilNode_OMeter (point) - The location of a device that measures the volumetric flow rate of fuel passing through the meter.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)

- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) isAmi - Description of meter - meter is an AMI or smart meter. Yes / No
- h) mediaId - gpsDataCollected
- i) MetadataId - metaID000072
- j) meterType - The type of meter. Domain values i.e., diaphragm, orifice, rotary, other, tbd, etc.
- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- l) ownerName - The name of the item owner, i.e., MCB CL, AmeriGas, etc., etc.
- m) polNetworkSubType - The subtype of POL network in which this feature participates. Domain values i.e., jetA, kerosene, marineDiesel, jp5, automotiveDiesel, contaminatedMedia, etc.
- n) polNodeType - The type of POL network node that this feature represents i.e., oMeter

CLJN.CL.PolUtilNode_OTank (point) -The location of a container for storage of POL products at atmospheric pressure.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- h) locatedUnderground - Yes / No
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) nominalCapacity - The numeric volume of the feature when filled to its design capacity.
- l) nominalCapacityUom - The unit of measure of the like named value. Domain values i.e., usgallon
- m) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- n) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- o) polNetworkSubType - The subtype of POL network in which this feature participates. Domain values i.e., jetA, kerosene, marineDiesel, jp5, automotiveDiesel, contaminatedMedia, etc.
- p) secondaryContainment - Indicates the storage tank has a secondary containment area that contains spills. Domain values i.e., concreteVault, doubleBottom, plasticPanSystem, other, etc.

- q) polNodeType - The type of POL network node that this feature represents. Domain values, i.e., (oTank)
- r) secondaryContainment - Indicates the storage tank has a secondary containment area that contains spills, i.e., spillPan, etc.
- s) storageTankProduct - The product contained in the storage tank. Domain values i.e., automotiveDiesel, bf5, dielectricOil, diesel, ethanol, gasoline, heatingOilUnspecified, jp, marineDiesel, propane, reclaimedFuel, usedCookingOil, usedFuel, usedOil, etc.
- t) tankTopHeight - The top of the tank reservoir measured from the lowest point of the base of the feature at ground or water level to the tallest point of the feature.
- u) tankTopHeightUom - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.

CLJN.CL.PolUtilNode_ODispenser (point) - The location of a machine at a fueling station that is used to pump fuel into vehicles or Aerospace Ground Equipment (AGE).w

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. Type of dispenser i.e., Marine, Aircraft, Automobile, HeavyEquipment, POV, GOV, etc.
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- h) mediaId - gpsDataCollected
- i) MetadataId - metaID000072
- j) networkType - The primary type of utility network to which this feature relates. Domain values i.e., (pol)
- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- l) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- m) polNetworkSubType - The subtype of POL network in which this feature participates. Domain values i.e., jetA, kerosene, marineDiesel, jp5, automotiveDiesel, contaminatedMedia, etc.
- n) polNodeType - The type of POL network node that this feature represents i.e., oDispenser

CLJN.CL.PolUtilSegment (polyline) - The location of a linear feature, particularly a pipeline, used for the conveyance of petroleum, oil, and lubricants (POL) product. All polylines shall be drawn in the direction of flow with no breaks except for what is naturally occurring such at nodes, etc.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) depth - The distance, measured vertically downward to the base in inches.
- d) depthUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- f) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- g) facilityNumber - Asset number used for visual identification of the facility.
- h) featureDescription - The narrative describing the feature. (Review current data for description)
- i) featureName - The common name of the feature. (Review current data for common name)
- j) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- k) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- l) materialType - The material composition of the feature. Domain values i.e., cooper, carbonSteel, etc.
- m) mediaId - gpsDataCollected
- n) MetadataId - metaID000072
- o) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- p) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- q) polNetworkSubType - The subtype of POL network in which this feature participates. Domain values i.e., jetA, kerosene, marineDiesel, jp5, automotiveDiesel, contaminatedMedia, etc.

1.4.11 Feature Dataset CLJN.CL.Utilities_Sewer

Locate, GPS and collect attribute data as specified for each feature listed with (GPS) accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

CLJN.CL.Feat_SDemarcationPoint (point) - The location where the wastewater service provider ownership ends, and the customer ownership begins.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)

- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- h) mediaId - gpsDataCollected
- i) MetadataId - metaID000072
- j) networkType - The primary type of utility network to which this feature relates. Domain values i.e., wastewater, etc.
- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- l) outsideProvider - The name of the outside provider for the Utility Feature. Value, i.e., owner of point may be 3rd party company.
- m) owner - The entity that owns the feature. Domain values, i.e., ppv, usmc, usn, leased, federalOther, etc.
- n) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates. Domain values i.e., domesticSewage, oilyWaste, industrialWaste, etc.
- o) wastewaterNodeType - The type of water utility feature i.e., sDemarcationPoint.

CLJN.CL.WastUtilNode_SMeter (point) - The location of a device or set of devices used to measure the flow of wastewater.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) isAmi - An indicator of whether or not the meter is an AMI or smart meter. Yes / No
- h) Manufacturer - The name of the manufacturer of the feature.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) meterType - The type of meter. Domain valves i.e., diaphragm, orifice, rotary, other, tbd, etc.
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- n) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates. Domain values i.e., domesticSewage, oilyWaste, industrialWaste, etc.
- o) wastewaterNodeType - The type of wastewater network node that this feature represents i.e., smeter.

CLJN.CL.Feat_SScadaSensor (point) - The location of a device that is used to remotely measure the status of wastewater network components as part of a Supervisory Control and Data Acquisition (SCADA) system.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., wastewater, etc.
- j) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- k) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- l) utilityNetworkSubType - The subtype of wastewater network in which this feature participates. Domain values i.e., domesticSewage, etc.
- m) wastewaterUtilityFeatureType - The type of water utility feature i.e., sScadaSensor

CLJN.CL.Feat_SUGEnclosureAccess (point) -The location of a wastewater access point to the related wastewater underground enclosure.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- h) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- i) invertElevation - The elevation of the bottom of the feature in inches.
- j) invertElevationUom - The invert elevation. Domain values, i.e., length equal to .0254, inch, etc.
- k) numberOfPipes - The number of pipes connecting to the manhole.
- l) mediaId - gpsDataCollected

- m) MetadataId - metaID000072
- n) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., wastewater.
- o) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- p) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- q) rimElevation - The elevation at the top of the feature in feet.
- r) rimElevationUom - The unit of measure for rim elevation. Domain values i.e. measurement equal to 0.3048 metres, etc.
- s) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., wastewater, etc.
- t) wastewaterUtilityFeatureType - The type of water utility feature i.e., sUgEnclosureAccess.

CLJN.CL.WastUtilNode_SCleanOut (point) - The location of a wastewater device access point in a lateral used for maintenance purposes.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- g) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) materialType - The material composition of the feature. Domain values i.e., copper, ductileIron, fiber, fiberglassReinforcedPolyester, galvanizedIron, galvanizedSteel, PVC, terracotta, etc.
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- n) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates, i.e., domesticSewage, etc.
- o) wastewaterNodeType - The type of wastewater network node that this feature represents. i.e., scleanOut.

CLJN.CL.WastUtilNode_SFitting (point) - The location of a mechanical device on the wastewater system that caps or plugs a single pipe, or connects two or more pipes.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- d) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) fittingMaterial - The material of the pipe fitting. Domain values i.e., copper, ductileIron, fiber, fiberglassReinforcedPolyester, galvanizedIron, galvanizedSteel, PVC, steel, etc.
- i) fittingType - The type of pipe fitting. Domain values, i.e., bend, reducer, tee, plug, etc.
- j) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- k) mediaId - digitized
- l) MetadataId - metaID000071
- m) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- n) ownerName - The name of the item owner, i.e., MCB CL, MCB, PPV, Company Name, etc.
- o) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates, i.e., domesticSewage, etc.
- p) wastewaterNodeType - The type of wastewater network node that this feature represents. i.e., sFitting.

CLJN.CL.WastUtilNode_SSsystemValve (point) - The location of a device that regulates, directs, or controls the flow of wastewater.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- d) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) operationalStatus - The state of usability of the feature

- i.e., inService, notInService, abandoned, etc.
- l) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- m) valveMaterial - The material composition of the valve. Domain values, i.e., ductileIron, carbonSteel, etc.
- n) valvePosition - The normal status or operating position of the valve. Domain values i.e., normallyClosed, normallyOpen, other, tbd, unknown.
- o) valveType - The normal status or operating position of the valve. Domain values i.e., flowControl, butterfly, check, gate, postIndicator, etc.
- p) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates, i.e., domesticSewage, etc.
- q) wastewaterNodeType - The type of wastewater network node that this feature represents. i.e., sSystemValve.

CLJN.CL.WastUtilNode_SReleaseValve (point) - The location of a wastewater device used to purge air from a force main.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- d) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- l) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- m) valveMaterial - The material composition of the valve. Domain values, i.e., ductileIron, carbonSteel, etc.
- n) valveType - The normal status or operating position of the valve. Domain values i.e., airRelease.
- o) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates, i.e., domesticSewage, etc.
- p) wastewaterNodeType - The type of wastewater network node that this feature represents. i.e., sReleaseValve.

CLJN.CL.WastUtilNode_SGreaseTrap (point) - The location of a tank which separates grease from water, collects the grease for removal, and allows the water to exit.

- a) contractNumber - The contract number associated with the

- feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- j) ownerName - The name of the item owner, i.e., MCB CL, MCB, PPV, Company Name, etc.
- k) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates, i.e., domesticSewage, etc.
- l) wastewaterNodeType - The type of wastewater network node that this feature represents. i.e., sGreaseTrap.

CLJN.CL.WastUtilNode_STank (point) - The location of a container for storage of products associated with the wastewater network.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) diameter - Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.5, 1.75, 2, etc.
- d) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription- The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- j) hasSecondaryContainment - Yes / No
- k) materialType - The material composition of the feature. Domain values i.e., concrete, etc.
- l) nominalCapacity - The unit total numeric capacity in gallons.
- m) nominalCapacityUom - The unit of measure of the like named value i.e., usGallon
- n) mediaId - gpsDataCollected
- o) MetadataId - metaID000072
- p) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- q) ownerName - The name of the item owner, i.e., MCB CL, MCB, PPV, Company Name, etc.

- PPV, Company Name, etc
- r) storageTankProduct - The product contained in the storage tank. Domain values i.e., oilyWastewater, rawWater, wasteFuel.
- s) volume - The volumetric capacity of the feature
- t) volumeUom - The unit of measure of the like named value i.e., usGallon
- u) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates, i.e., domesticSewage, oilyWaste, etc.
- v) wastewaterNodeType - The type of wastewater network node that this feature represents. i.e.,stank.
- w) width - The dimension of a feature in feet.
- x) widthUom - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.

CLJN.CL.WastUtilNode_SOilWateSeparator (point) - The location of a device or structure placed in the wastewater stream to separate water from oil products.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) nominalCapacity - The unit total numeric capacity in gallons.
- j) nominalCapacityUom - The unit of measure of the like named value i.e., usGallon
- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- l) ownerName - The name of the item owner, i.e., MCB CL, MCB, PPV, Company Name, etc.
- m) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates, i.e., domesticSewage, oilyWaste, etc.
- n) wastewaterNodeType - The type of wastewater network node that this feature represents. i.e., sOilWaterSeparator.

CLJN.CL.WastUtilNode_SPump (point) - The location of a piece of wastewater equipment that adds energy to a fluid being conveyed through a pipe or other closed conduit.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.

- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) isMainPump - Yes / No
- j) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- k) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- l) pumpType - Type of pump. Domain values i.e., liftstation, booster, submersible, grinder, etc.
- m) ratedFlow - The common rate of flow of each pump.
- n) ratedFlowUom - The rate of flow for each pump. Domain value i.e., galMin
- o) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates, i.e., domesticSewage, etc.
- p) wastewaterNodeType - The type of wastewater network node that this feature represents. i.e., sPump.

CLJN.CL.Feat_SPumpStation (polygon) - The location of a facility that collects and discharges wastewater via pumps.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature.
- e) featureDescription - The narrative describing the feature. (Review current data for description)
- f) featureName - The common name of the feature. (Review current data for common name)
- g) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- h) hasGeneratorBackup - Yes / No
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) isMainPump - Yes / No
- l) nominalCapacity - The station total capacity in gallons.
- m) nominalCapacityUom - The unit of measure of the like named value i.e., usGallon
- n) numberOfPumps - The number of pumps in the feature.
- o) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- p) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- q) pumpStationType - Type of pumping station. Domain value i.e., pumpingStation, ejectorStation, liftStation, etc.

- r) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates, i.e., domesticSewage, etc.
- s) wastewaterNodeType - The type of wastewater network node that this feature represents. i.e., sPumpStation.

CLJN.CL.Feat_SSepcticTankPoint (point) - The location of a small-scale anaerobic digester and leach field designed to treat wastewater from an individual facility, and is not connected to the wastewater collection system.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) materialType - The material composition of the feature. Domain values i.e., plastic, concrete, fiberglass, etc.
- h) mediaId - gpsDataCollected
- i) MetadataId - metaID000072
- j) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., wastewater.
- k) nominalCapacity - The unit total numeric capacity in gallons.
- l) nominalCapacityUom - The unit of measure of the like named value i.e., usGallon
- m) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- n) secondaryContainment - Indicates the storage tank has a secondary containment area that contains spills. Domain values i.e., concreteVault, doubleBottom, plasticPanSystem, other, etc.
- o) septicTankType - The type of septic tank. Domain values, i.e., mound, septicTank, etc.
- p) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., domesticSewage, etc.
- q) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- r) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates, i.e., domesticSewage, oilyWaste, etc.
- s) wastewaterNodeType - The type of wastewater network node that this feature represents. i.e., tbd

CLJN.CL.WastUtilSegment (polyline) - The location of a feature used for the conveyance of wastewater. All polylines shall be drawn in the direction of flow with no breaks except for what is naturally occurring such at nodes, etc.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- d) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature. (Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) materialType - The material composition of the feature. Domain values i.e., asbestosCement, pvc, etc.
- j) invertElevationDownstream - Numeric number of the elevation downstream invert in inches.
- k) invertElevationDownstreamUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, etc.
- l) invertElevationUpstream - Numeric number of the elevation upstream invert in inches.
- m) invertElevationUpstreamUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, etc.
- n) isLined - Yes / No
- o) mediaId - gpsDataCollected
- p) MetadataId - metaID000072
- q) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- r) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- s) pipeType - The type of pipe used. Domain values i.e., box, circular, pipArch, tbd, etc.
- t) slope - The slope of the bottom of the subject item expressed as a percentage.
- u) wastewaterNetworkSubType - The subtype of wastewater network in which this feature participates, i.e., domesticSewage, etc.
- v) wastewaterSegmentType - The type of wastewater network segment that this feature represents. Domain values i.e., sForceMain, sGravityMain, sLaterallLine, sPressurizedServiceLine, etc.

1.4.12 Feature Dataset CLJN.CL.Utilities_Stormwater

Locate, GPS and collect attribute data as specified for each feature listed with (GPS) accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

CLJN.CL.StormUtilNode_SwInlet (point) - The location where stormwater is collected and received into the utility system.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. Values i.e., CATCHBASIN, ENDWALL, HEADWALL, INLET, ETC.
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) inletCoverType - The type of inlet cover. Domain values i.e., Domain values i.e., concrete, metalGate, etc.
- h) inletDiameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.5, 1, 4, etc.
- i) inletDiameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- j) inletOpeningSize - The size of the inlet opening in inches.
- k) inletOpeningSizeUom - The unit of measure for the inlet opening size. Domain values, i.e., 0.0254 metres, inches etc.
- l) invertElevation - The elevation of the bottom of the feature in inches.
- m) invertElevationUom - The invert elevation. Domain values, i.e., length equal to .0254, inch, etc.
- n) materialType - The material composition of the feature. Domain values i.e., concrete, steel, pvc, etc.
- o) mediaId - gpsDataCollected
- p) MetadataId - metaID000072
- q) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- r) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- s) rimElevation - The elevation at the top of the feature in feet.
- t) rimElevationUom - The unit of measure for rim elevation. Domain values i.e. measurement equal to 0.3048 metres, etc.
- u) stormwaterInletType - The type of stormwater inlet feature. Domain values i.e., catch basin, curbinlet, grateInlet, weirInlet, etc.
- v) stormwaterNodeType - The type of stormwater network node that this feature represents. Domain values i.e., swCatchBasin, swCleanout, swDownspout, swInlet, swInfall, etc.

CLJN.CL.Feat_SwUgEnclosureAccess (point) - The location of a Stormwater access point to the related Stormwater underground enclosure.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- d) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) facilityNumber - Asset number used for visual identification

- of the facility.
- f) featureDescription - The narrative describing the feature.
(Review current data for description)
- g) featureName - The common name of the feature. Values i.e., swManhole, etc.
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) invertElevation - The elevation of the bottom of the feature in inches.
- j) invertElevationUom - The invert elevation. Domain values, i.e., length equal to .0254, inch, etc.
- k) mediaId - gpsDataCollected
- l) MetadataId - metaID000072
- m) networkType - The type of stormwater network node that this feature represents. Domain values i.e., stormwater.
- n) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- o) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- p) rimElevation - The elevation at the top of the feature in feet.
- q) rimElevationUom - The unit of measure for rim elevation. Domain values i.e. measurement equal to 0.3048 metres, etc.
- r) stormwaterUtilityFeatureType - The type of stormwater utility feature, i.e., swUgEnclosureAccess
- s) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., stormwater, etc.

CLJN.CL.StormUtilSeg (polyline) - The location of a feature used for the conveyance of stormwater. For example, a pipeline, culvert, or ditch. All polylines shall be drawn in the direction of flow with no breaks except for what is naturally occurring such at nodes, etc.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- d) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The narrative describing the feature.
(Review current data for description)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) invertElevation - The elevation of the bottom of the feature in inches.
- j) invertElevationUom - The invert elevation. Domain values, i.e., length equal to .0254, inch, etc.
- k) invertElevationDownstream - Numeric number of the elevation

- downstream invert in inches.
- l) invertElevationDownstreamUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, etc.
- m) invertElevationUpstream - Numeric number of the elevation upstream invert in inches.
- n) invertElevationUpstreamUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, etc.
- o) mediaId - gpsDataCollected
- p) MetadataId - metaID000072
- q) openDrainSurface - The surface material of the drain, typically at the bottom of the structure.
- r) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- s) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- t) percentSlope - The slope of the bottom of the subject item expressed as a percentage.
- u) pipeType - The type of pipe used. Domain values i.e., box, circular, pipArch, tbd, etc.
- v) stormwaterSegmentType - The type of stormwater network segment that this feature represents. Domain values i.e., swCulvert, swForceMain, swGravityMain, swLateralLine, swOpenDrain, swSwale, swTrenchDrain, tbd.

CLJN.CL.StormUtilNode_SwOilWateSepa (point) - The location of a device or structure placed in the stormwater stream to separate water from oil products.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service degradationIndex
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- h) isCovered - Yes / No
- i) nominalCapacity - The numeric volume of the feature when filled to its design capacity.
- j) nominalCapacityUom - The unit of measure of the like named value. Domain values i.e., usgallon
- k) operationalStatus - The state of usability of the feature i.e., inService, abandoned, etc.
- l) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- m) stormwaterNodeType - The type of stormwater network node that this feature represents. Domain values i.e., swCatchBasin, swCleanout, swDownspout, swInlet, swInfall, etc.

CLJN.CL.Feat_SwRetentionBasinArea (polygon) - The location of a human-created area installed to improve water quality by permanently storing runoff.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) networkType - The type of stormwater network node that this feature represents. Domain values i.e., stormwater.
- j) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- k) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- l) stormwaterUtilityFeatureType - The type of stormwater utility feature, i.e. swRetentionBasinArea
- m) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., stormwater, etc.

1.4.13 Feature Dataset CLJN.CL.Utilities_Thermal

Locate, GPS and collect attribute data as specified for each feature listed with (GPS) accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

CLJN.CL.TherUtilNode_TPump (point) - The location of a facility that operates to maintain flow at adequate pressure for the thermal system.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) operationalStatus - The state of usability of the feature

- i.e., inService, notInService, abandoned, etc.
- h) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- i) pumpElevation - The elevation of the pump feature in feet.
- j) pumpElevationUom - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.
- k) pumpType - The type of pump.
- l) ratedFlow - The numeric flow rating of the pump.
- m) ratedFlowUom - The rate of flow for each pump. Domain value i.e., galMin
- n) thermalNodeType - The type of thermal network node that this feature represents, tPump.

CLJN.CL.TherUtilNode_TProdStruc (point) - The location of a facility which produce steam, high-temperature water, low-temperature water, dual-temperature water or chilled water.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) heightAboveSurfaceLevel - The vertical distance measured from the lowest point of the base of the feature at ground or water level to the tallest point of the feature in feet.
- h) heightAboveSurfaceLevelUom - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) nominalCapacity - The numeric volume of the feature when filled to its design capacity
- l) nominalCapacityUom - The unit of measure for nominal capacity. Domain value i.e., tons, btu, etc.
- m) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- n) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- o) thermalNetworkSubType - The subtype of thermal network in which this feature participates. Domain values i.e., steamSupply, otherSupply, geothermalSupply (well), highTemperatureHotWaterSupply, etc.
- p) thermalNodeType - The type of thermal network node that this feature represents, tProductionStructure.
- q) thermalProdStrucType - The type of production structure based upon various classifications including methods of transferring heat, piping arrangement, pumping arrangement, or the relative temperature of transferred media. Examples include Boilers, Chillers, Cooling Towers, Heat Pumps, Single/Double pipe systems, Low/Medium/High Temperatures

- systems, etc.
- r) volume - The volumetric capacity of the feature
- s) volumeUom - Rate of flow in tons, btu, etc.

CLJN.CL.TherUtilNode_TCondCollector (point) - The location of a thermal related well or a tank that collects condensation.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- h) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- i) thermalNetworkSubType - The subtype of thermal network in which this feature participates. Domain values i.e., chilledWaterReturn, dualTemperatureWaterSupply, geothermalReturn, highTemperatureHotWaterSupply, lowTemperatureHotWaterSupply, steamSupply, etc.
- j) thermalNodeType - The type of thermal network node that this feature represents, tCondCollector.

CLJN.CL.TherUtilNode_TSystemValve (point) - The location of a device that regulates, directs, or controls the flow of steam or water.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- h) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- i) thermalNetworkSubType - The subtype of thermal network in which this feature participates. Domain values i.e., chilledWaterReturn, dualTemperatureWaterSupply, geothermalReturn, highTemperatureHotWaterSupply,

- lowTemperatureHotWaterSupply, steamSupply, etc.
- j) thermalNodeType - The type of thermal network node that this feature represents, tSystemValve
- k) valveMaterial - The material composition of the valve. Domain values i.e., steel, etc.
- l) valvePosition - The normal status or operating position of the valve. Domain value i.e., normallyClose, normallyOpen, other, tbd, unknown.
- m) valveType - The normal status or operating position of the valve. Domain values i.e., reliefValve, flowControl, gate, pressureRegulator, pressureReducing, etc.

CLJN.CL.Feat_TUGEnclosureAccess (point) - The location of a thermal access point to the related thermal underground enclosure.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- h) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- i) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- j) networkType - The primary type of utility network to which this feature relates. Domain values i.e., thermal.
- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- l) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- m) thermalUtilityFeatureType - The type of thermal utility feature tUgEnclosureAccess.
- n) thermalNetworkSubType - The subtype of thermal network in which this feature participates. Domain values i.e., steamSupply, otherSupply, geothermalSupply, highTemperatureHotWaterSupply, etc.

ThermalUtilitySegment (polyline) - The location of a feature used for the conveyance of steam, high-temperature water, low-temperature water, or chilled water. All polylines shall be drawn in the direction of flow with no breaks except for what is naturally occurring such at nodes, etc.

- a) contractNumber - The contract number associated with the feature.

- b) dateInService - The date the utility equipment was put in service.
- c) depth - The distance, measured vertically downward to the base in inches.
- d) depthUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- f) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- g) facilityNumber - Asset number used for visual identification of the facility.
- h) featureDescription - The narrative describing the feature. (Review current data for description)
- i) featureName - The common name of the feature. (Review current data for common name)
- j) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- l) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- m) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- n) materialType - Type of segment material. Domain values i.e., steel, castiron, etc.
- o) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- p) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- q) pipeType - The type of pipe used. Domain values i.e., box, circular, pipArch, tbd, etc.
- r) thermalNetworkSubType - The subtype of thermal network in which this feature participates. Domain values i.e., steamSupply, otherSupply, geothermalSupply, highTemperatureHotWaterSupply, etc.
- s) thermalSegmentType - The type of thermal network segment that this feature represents. Domain values i.e., tMainLine, tService Line.

1.4.14 Feature Dataset CLJN.CL.Utilities_Water

Locate, GPS and collect attribute data as specified for each feature listed with (GPS) accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating the feature where required.

CLJN.CL.WateUtilNode_WSystemValve (point) - The location of a device that regulates, directs, or controls the flow of water.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in

- service.
- c) depth - The distance, measured vertically downward to the base in inches.
- d) depthUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- f) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- g) facilityNumber - Asset number used for visual identification of the facility.
- h) featureDescription - Utilize CLJN.CL.Feat_WUtilityArea to use Service Area Values i.e., Stone Bay, Onslow Beach, Handnot Point, etc.
- i) featureName - The common name of the feature. (Review current data for common name)
- j) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- k) mediaId - gpsDataCollected
- l) MetadataId - metaID000072
- m) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- n) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- o) turnDirectionToClose - The turn direction to close the valve. Domain values i.e., leftToClose, rightToClose, other, na, tbd, unknown, etc.
- p) valveMaterial - The material composition of the valve. Domain values i.e., ductileIron, steel, pvc, etc.
- q) valvePosition - The normal status or operating position of the valve. Domain value i.e., normallyClose, normallyOpen, other, tbd, unknown.
- r) valveType - The subtype of water network in which this feature participates. Domain values i.e., ball, gate, postIndicator, waterServiceValve, postIndicator, fireHydrantValve, etc.
- s) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater, etc.
- t) waterNodeType - The type of water network node that this feature represents. Domain values i.e., wAirGap, wControlValve, wFireHydrant, wFitting, wFlushingStation, wHydrant, wMeter, etc.

CLJN.CL.WateUtilNode_WReliefValve (point) - The location of a water related device designed to release when the set pressure is exceeded.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) depth - The distance, measured vertically downward to the base in inches.
- d) depthUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.

- e) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 1.75, 2, etc.
- f) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- g) facilityNumber - Asset number used for visual identification of the facility.
- h) featureDescription - The common name of the feature. (Review current data for common name)
- i) featureName - The common name of the feature. (Review current data for common name)
- j) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- k) mediaId - gpsDataCollected
- l) MetadataId - metaID000072
- m) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- n) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- o) valveMaterial - The material composition of the valve. Domain values i.e., steel, pvc, etc.
- p) valveType - The subtype of water network in which this feature participates. Domain values i.e., wReliefValve.
- q) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater.
- r) waterNodeType - The type of water network node that this feature represents. Domain values i.e., wReliefValve

CLJN.CL.WateUtilNode_WPressReduStation (point) - The location of a feature which reduces the pressure from line pressure to the desired operating pressure and can switch from low to high pressure for flushing.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) featureDescription - The common name of the feature. (Review current data for common name)
- d) featureName - The common name of the feature. (Review current data for common name)
- e) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- f) mediaId - gpsDataCollected
- g) MetadataId - metaID000072
- h) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- i) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- j) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater.
- k) waterNodeType - The type of water network node that this

feature represents. Domain values i.e.,
wPressureReducingStation.

CLJN.CL.WateUtilNode_WBackPrevDevice (point) - The location of a feature that is used to protect water supplies from contamination or pollution.

- a) bfpType - Backflow prevention device type. Domain values i.e., ag, avb, dcva, pvb, rpz, spvb, etc.
- b) contractNumber - The contract number associated with the feature.
- c) dateInService - The date the utility equipment was put in service.
- d) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.75, 2, etc.
- e) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- f) featureDescription - The common name of the feature. (Review current data for common name)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- l) ownerName - The name of the item owner, i.e., MCB CL, MCB, PPV, Company Name, etc.
- m) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater.
- n) waterNodeType - The type of water network node that this feature represents. Domain values i.e., wBackflowPreventionDevice.

CLJN.CL.WateUtilNode_WMeter (point) - The location of a device used to measure the quantity and/or rate of water flowing through a pipe, which may be the amount of water used by the customer.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.75, 2, etc.
- d) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The common name of the feature. (Review current data for common name)
- g) featureName - The common name of the feature. (Review current data for common name)

- h) fittingType - The type of pipe fitting. Domain values i.e., bend, tap, cap, other, tbd, etc.
- i) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- j) isAmi - The yes or no indicator of whether or not the meter is an AMI or smart meter.
- k) mediaId - gpsDataCollected
- l) MetadataId - metaID000072
- m) meterType - The type of meter. Domain values i.e., turbine, rotary, etc.
- n) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- o) ownerName - The name of the item owner, i.e., MCB CL, MCB, PPV, Company Name, etc.
- p) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater.
- q) waterNodeType - The type of water network node that this feature represents, wMeter.

CLJN.CL.WateUtilNode_WHydrant (point) - Hydrants not exclusively used for firefighting. Secondary uses are flushing main lines and laterals, filling tank trucks, and providing a temporary water source for construction jobs.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The common name of the feature. (Review current data for common name)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) HydrantPurpose - The purpose of the Hydrant. Values i.e., fireHydrant, flushedFDC, YardHydrant, etc.
- h) mediaId - gpsDataCollected
- i) MetadataId - metaID000072
- j) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- k) ownerName - The name of the item owner, i.e., MCB CL, MCB, PPV, Company Name, etc.
- l) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater.
- m) waterNodeType - The type of water network node that this feature represents. Domain values i.e., whHydrant.

CLJN.CL.WateUtilNode_WFireHydrant (point) a valve connection on a water

supply system having one or more outlets and that is used in firefighting to supply hose and fire department pumpers with water.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.5, 1.75, 2, etc.
- d) diameter1 - The diameter of the outlet.
- e) diameter2 - The diameter of the outlet.
- f) diameter3 - The diameter of the outlet.
- g) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- h) facilityNumber - Asset number used for visual identification of the facility.
- i) featureDescription - The common name of the feature. (Review current data for common name)
- j) featureName - The common name of the feature. (Review current data for common name)
- k) fireConnectionType - The yes or no indicator of whether or not the fire hydrant is a fire protection connection. Yes or No
- l) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- m) hydrantNumber - The equipment number as designated by the fire department that is primarily responsible for the fire hydrants operation and maintenance.
- n) inletDiameter - The diameter of the inlet.
- o) inletDiameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- p) mediaId - gpsDataCollected
- q) MetadataId - metaID000072
- r) isFireConnection - The yes or no indicator of whether or not the fire hydrant is a fire protection connection. Yes or No
- s) outletDiameter - The diameter of the outlet.
- t) outletDiameter1 - The diameter of the outlet.
- u) outletDiameter2 - The diameter of the outlet.
- v) outletDiameter3 - The diameter of the outlet.
- w) outletDiameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- x) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- y) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- z) waterNodeType - The type of water network node that this feature represents, wFireHydrant.

CLJN.CL.WateUtilNode_WFitting (point) - The location of a mechanical device that connects two or more pipes, or caps or plugs a single pipe, on the water system.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.

- c) Diameter - The diameter of the feature in inches. Domain value i.e., .5, 1, 1.25, 1.5, 1.75, 2, etc.
- d) diameter1 - The diameter of the outlet.
- e) diameter2 - The diameter of the outlet.
- f) diameter3 - The diameter of the outlet.
- g) diameter4 - The diameter of the outlet.
- h) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- i) facilityNumber - Asset number used for visual identification of the facility.
- j) featureDescription - The common name of the feature. (Review current data for common name)
- k) featureName - The common name of the feature. (Review current data for common name)
- l) fittingType - The type of pipe fitting. Domain values i.e., bend, cap, tee, etc.
- m) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- n) mediaId - digitized
- o) MetadataId - metaID000071
- p) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- q) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- r) waterNodeType - The type of water network node that this feature represents. Domain values i.e., wfitting.
- s) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater.

CLJN.CL.WateUtilNode_WPump (point) - The location of a water related piece of equipment that adds energy to a fluid, such as water, being conveyed through a pipe or other closed conduit.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The common name of the feature. (Review current data for common name)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) mediaId - gpsDataCollected
- h) MetadataId - metaID000072
- i) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- j) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- k) pumpType - Type of pump. Domain values i.e., booster, submersible, etc.

- l) ratedFlow - The common rate of flow of each pump.
- m) ratedFlowUom - The rate of flow for each pump. Domain value i.e., galMin
- n) waterNodeType - The type of water network node that this feature represents. Domain values i.e., wpump.
- o) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater.

CLJN.CL.WateUtilNode_WStorageStructure (point) - The location of a facility that store large volumes of water.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) Elevation - The elevation from a specified vertical datum to the highest point on a feature.
- d) elevationUom - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The common name of the feature. (Review current data for common name)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- j) groundElevation - The elevation of the ground at the location of the item in feet.
- k) invertElevation - The elevation of the bottom of the feature in feet.
- l) mediaId - gpsDataCollected
- m) MetadataId - metaID000072
- n) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- o) overflowElevation - The elevation of the overflow device (i.e., pipe invert).
- p) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- q) secondaryContainment - Indicates the storage tank has a secondary containment area that contains spills. Domain values i.e., concreteVault, doubleBottom, plasticPanSystem, other, etc.
- r) storageTankProduct - The product contained in the storage tank.
- s) storageTankType - The primary type of storage tank.
- t) topElevation - The elevation at the top of the feature.
- u) topElevationUom The unit of measure Domain values i.e. 0.3048 metres, feet, etc.
- v) volume - The volumetric capacity of the feature in usgallons.
- w) volumeUom - Unit of measure in usgallons

- x) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater.
- y) waterNodeType - The type of water network node that this feature represents. Domain values i.e., wstorageStructure.
- z) width - The dimension of a feature in feet.
- aa) widthUom - The unit of measure Domain values i.e. 0.3048 metres, feet, etc.

CLJN.CL.Feat_WUgEnclosureAccess (point) - The location of a water access point to the related water underground enclosure.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.5, 1.75, 2, etc.
- d) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) facilityNumber - Asset number used for visual identification of the facility.
- f) featureDescription - The common name of the feature. (Review current data for common name)
- g) featureName - The common name of the feature. (Review current data for common name)
- h) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- i) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- j) lidDiameter - Diameter of the lid or cover that allows access to the manhole.
- k) lidDiameterUom - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 2, etc.
- l) lidMaterial - Material type of the manhole access lid or cover.
- m) mediaId - gpsDataCollected
- n) MetadataId - metaID000072
- o) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- p) ownerName - The name of the item owner, i.e., MCB CL, MCB, PPV, Company Name, etc.
- q) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater.
- r) waterUtilityFeatureType - The type of water utility feature i.e., wUgEnclosureAccess.

WateUtilNode_WSource(point) - A source of water intake to the water system including reservoirs, natural water bodies, wells, and/or feeds from external water networks. Do not delete potable from any feature class, please attribute as removed or AIP.

- a) abandonedDate - The date the feature was abandoned - see feature name to add contract number for abandoned.
- b) contractNumber - The contract number associated with the original construction of this feature.
- c) dateInService - The date the utility equipment was put in service.
- d) facilityNumber - Asset number used for visual identification of the facility.
- e) featureDescription - The common name of the feature. (Review current data for common name)
- f) featureName - The common name of the feature. Until such a time that the well is abandoned or removed. (Add contract number associated with removal or abandonment of water well)
- g) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- h) mediaId - gpsDataCollected
- i) MetadataId - metaID000072
- j) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- k) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- l) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater.
- m) removedDate - Enter Remove date; however, do not delete water well from well feature class. (Attribute contract number to remove well in featureName)
- n) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater.
- o) waterNodeType - The type of water network node that this feature represents. Domain values i.e., wSource.
- p) waterSourceType - Source of water, well.

CLJN.CL.Feat_WScadaSensor (point) - The location of a device that is used to remotely measure the status of water network components as part of a Supervisory Control and Data Acquisition (SCADA) system.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The common name of the feature. (Review current data for common name)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities,
- g) familyHousing, recreational, training, water, etc.
- h) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.

- i) mediaId - gpsDataCollected
- j) MetadataId - metaID000072
- k) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., water.
- l) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- m) ownerName - The name of the item owner, i.e., MCB CL, M CCS, PPV, Company Name, etc.
- n) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., water, etc.
- o) waterUtilityFeatureType - The type of water utility feature is wScadaSensor.

CLJN.CL.Feat_WDemarcationPoint (point) - The location where the water service provider ownership ends, and the customer ownership begins.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The common name of the feature. (Review current data for common name)
- e) featureName - The common name of the feature. (Review current data for common name)
- f) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- g) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- h) mediaId - gpsDataCollected
- i) MetadataId - metaID000072
- j) networkType - The primary type of utility network to which this feature relates. Domain values, i.e., water.
- k) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- l) outsideProvider - The name of the outside provider for the Utility Feature.
- m) ownerName - The name of the item owner, i.e., MCB CL, M CCS, PPV, Company Name, etc.
- n) utilityNetworkSubtype - The primary subtype of utility to which this feature relates. Domain values i.e., water, etc.
- o) waterUtilityFeatureType - The type of water utility feature is wDemarcationPoint.

CLJN.CL.WaterUtilitySegment (polyline) - The location of a feature used for the conveyance of water.

- a) contractNumber - The contract number associated with the feature.
- b) dateInService - The date the utility equipment was put in service.
- c) depth - The distance, measured vertically downward to the base in inches.

- d) depthUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- e) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.5, 1.75, 2, etc.
- f) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- g) elevation - The elevation at the top of the feature.
- h) elevationUom - The elevation unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- i) facilityNumber - Asset number used for visual identification of the facility.
- j) featureDescription - The narrative describing the feature. (Review current data for description)
- k) featureName - The common name of the feature. (Review current data for common name)
- l) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- m) groundConfiguration - The configuration of the asset in relationship to the ground. Domain values i.e., aboveground, elevated, semiBuried, underground, etc.
- n) invertElevationDownstream - Numeric number of the elevation downstream invert in inches.
- o) invertElevationDownstreamUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, etc.
- p) invertElevationUpstream - Numeric number of the elevation upstream invert in inches.
- q) invertElevationUpstreamUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, etc.
- r) lateralSegmentType - The type of lateral water network segment that this feature represents. Domain values i.e., wDomesticLateral, wFireProtectionLateral, wHydrantLateral, wInlineStorageLateral, wIrrigationLateral, wTransportPipeLateral, etc.
- s) materialType - The material composition of the feature. Domain values i.e., pvc, tbd, etc.
- t) mediald - gpsDataCollected
- u) MetadataId - metaID000072
- v) operationalStatus - The state of usability of the feature i.e., inService, notInService, abandoned, etc.
- w) ownerName - The name of the item owner, i.e., MCB CL, MCCS, PPV, Company Name, etc.
- x) waterNetworkSubType - The subtype of water network in which this feature participates. Domain values i.e., fireProtectionWater, nonPotableWater, potableWater, rawWater, saltWater.
- y) waterSegmentType - The type of wastewater network segment that this feature represents. Domain values i.e., wDistributionMain, wGravityMain, wLateral, wTransmissionMain

1.4.15 Feature Dataset CLJN.CL.Wells

Locate, GPS and collect attribute data as specified for each feature listed with (GPS) accuracy as described in paragraph "Global Positioning System (GPS) Data Collection". Attribute fields may be associated with Domains, which are utilized to constrain the values allowed in a particular field, attribute table or feature class. Domains must be utilized when populating

the feature where required.

CLJN.CL.WellPoint - (point) - The man-made vertical excavation penetrating the surface of the Earth used collect environmental samples or monitor fluid or gas characteristics, inject fluids, gases or thermal energy into the subsurface, or extract contamination or other impurities from the subsurface. *(Potable Water Wells used for water distribution are not to be deleted from the this feature class, if they are demolished or AIP, the contract number utilize to make any changes should be attributed in featureName and the operation status should be changed to removed)*

- a) abandonedDate - The date the feature was abandoned - see feature name to add contract number for abandoned.
- b) builtDate - The calendar date on which the original construction was completed for a facility.
- c) contractNumber - The contract number associated with the original construction of this feature.
- d) depth - The distance, measured vertically downward to the base in inches.
- e) depthUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- f) Diameter - The diameter of the feature in inches. Domain value i.e., .5, .75, 1, 1.25, 1.5, 2, 3, etc.
- g) diameterUom - The diameter unit of measure. Domain values, i.e., 0.0254 metres, inches etc.
- h) facilityNumber - Asset number used for visual identification of the facility.
- i) featureDescription - Utilize CLJN.CL.Feat_WUtilityArea to use Service Area Values i.e., Stone Bay, Onslow Beach, Handnot Point, etc.
- j) featureName - The common name of the feature. Until such a time that the well is abandoned or removed. (Add contract number associated with removal or abandonment of water well)
- k) functionalArea - The principle activity within a landuse area. Domain values i.e., utilities, familyHousing, recreational, training, water, etc.
- l) locationAccuracy - The location accuracy for the data that was collected and verified i.e., Survey Grade GPS
- m) mediaId - gpsDataCollected
- n) MetadataId - metaID000072
- o) operationalStatus - The state of usability of the feature i.e., inService, notInService, removed, etc.
- p) ownerName - The name of the item owner, i.e., MCB CL, MCCA, PPV, Company Name, etc.
- q) removedDate - Enter Remove date; however, do not delete water well from well feature class. *(Attribute contract number to remove well in featureName)*
- r) wellCapacity- The total capacity in gallons.
- s) wellCapacityUom - The unit of measure of the like named value i.e., usGallon
- t) wellPurposeType - The purpose of the well. Domain values extraction.
- u) wellResourceType - The resource type which is being extracted, i.e. waterNonPotable.

1.4.16 Feature Dataset CLJN.CL.CadFloorPlan

All new and renovated buildings or structures shall be required to have a linear representation, "clean floor plan", for each floor. A polyline for each level will include exterior and interior walls, doors and windows, exits and stairwells, etc. No nonpermanent fixtures, such as furniture, shall be included. Please note the dataset/feature name may change, however, the attribution requirements will remain the same.

CLJN.CL.CadFloorPlan (polyline) A linear representation of the floor plan representing the outer and inner walls, doors and windows of a building or structure that has been exported into a GIS Feature. (Note - Naming convention may change in the future)

This feature will present all levels, entry, exits, windows, stairwells. No none permanent fixtures, such as furniture should be included.

- a) contractNumber - The contract number associated with the feature.
- b) builtDate - The date the utility equipment was put in service.
- c) facilityNumber - Asset number used for visual identification of the facility.
- d) featureDescription - The narrative describing the feature. (Review current data for description)
- e) featureName - The narrative describing the feature. (Review current data for description)
- f) florid - Floor Level
- g) mediald - digitized
- h) MetadataId - metaID000071
- i) operationalStatus - The state of usability of the feature i.e., inService, notInService, removed, etc.
- j) ownerName - The name of the item owner, i.e., MCB CL, M CCS, PPV, Company

1.4.17 Non-Compliance

Failure to follow the specification outlined in this document will result in non-acceptance of data deliverable.

Note: Geospatial data delivery does not replace record drawing requirements.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

-- End of Section --

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

12/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE Guideline 0 (2005) The Commissioning Process

ASSOCIATED AIR BALANCE COUNCIL (AABC)

ACG Commissioning Guideline (2005) Commissioning Guideline

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB Commissioning Standard (2009) Procedural Standards for Whole Building Systems Commissioning of New Construction; 3rd Edition

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1429 (1994) HVAC Systems Commissioning Manual, 1st Edition

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED (2002; R 2005) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

1.2 SUMMARY

Commissioning consists of systematically documenting that specified components and systems have been installed and started up properly and then functionally tested to verify and document proper operation through all sequences of operation and conditions. In addition, if enhanced commissioning is implemented, training of the Government's Operations Personnel will be verified and final project O&M Documents will be reviewed for completeness.

1.2.1 Systems for Commissioning

The following systems are scheduled to be commissioned as applicable to project design:

a. Mechanical Systems:

(1) Air distribution systems (All equipment of the heating, ventilating and air conditioning system)

- (a) Air Handling Units
- (b) Exhaust Fans
- (c) Energy recovery systems
- (d) Air cooled chillers
- (e) Pumps
- (f) Boilers

(2) Building Automation Systems (BAS), including linkages to remote monitoring and control sites (excluding any security-related control interlocks)

b. Plumbing Systems

- (1) Domestic Hot Water Heater
- (2) Domestic Hot Water Recirculation Pump and associated control

1.2.2 Related Documents

Basis-of-Design Document and the Commissioning Plan.

1.3 DEFINITIONS

Basis of Design Document: A document that records the concepts, calculations, decisions, and product selections used to meet the Government's Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

Commissioning Authority: An entity identified by the Government who plans, schedules, and coordinates the Commissioning Team to implement the Commissioning Process.

Commissioning Plan: Prepared and updated by the Commissioning Authority, the Commissioning Plan outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.

Commissioning Process: A quality-focused process for enhancing the delivery of a project. The Process focuses on verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Government's Project Requirements. Commissioning is typically abbreviated by "Cx". Commissioning and Cx have the exact same meaning and will be used interchangeably throughout the Contract documents.

Commissioning Team: The individuals who through coordinated actions are responsible for implementing the Commissioning Process.

Construction Checklist: Documents prepared by the Cx Authority and issued to the Contractor early in the Construction Phase. The purpose of the Checklist is to verify that appropriate components are on site, correctly installed and functional and ready for Functional Performance Testing.

Corrective Issue Report: A report generated by the Cx Authority during Functional Performance Testing documenting deficiencies found during the testing procedures.

Functional Performance Testing: The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Government's Project Requirements.

Government's Project Requirements: A written document that details the functional requirements of a project and the expectations of how it will be used and operated. This includes project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

1.4 COMMISSIONING TEAM

The Commissioning Team shall consist of a minimum of one (1) Representative for each of the following:

- a. Government.
- b. Architect.
- c. Engineer.
- d. Contractor.
- e. Sub-contractors.
- f. Commissioning Authority.

Each Commissioning Team Representative shall have appropriate experience in construction administration along with a thorough understanding of construction project administrative procedures.

Each Cx Team Representative shall be familiar with ASHRAE Guideline 0 - The Commissioning Process.

1.5 SUBMITTALS

Submittals related to equipment and systems to be commissioned shall be provided to the Commissioning Authority for reference. The Commissioning Authority will coordinate required submittals with the contractor. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Checklist

SD-06 Test Reports

Completed Pre-Functional Performance Test Checklists
Test Reports
Independent Testing Reports
Construction Checklist Forms

SD-10 Operation and Maintenance Data

Operations & Maintenance Manuals

SD-11 Closeout Submittals

As-Built Drawings Training Attendance Roster

Training Plan

Training Questionnaire

The following submittals shall be provided electronically to the commissioning authority if not included in specific Division 01 or 23 specifications:

Equipment Start up Plan

DALT Plan

TAB Deficiency Report

TAB Plan

Pre-PVT Checklists

1.6 QUALITY ASSURANCE

1.6.1 Qualifications

1.6.1.1 Commissioning Firm

Government will provide a Commissioning Firm that is either a member of ACG or certified by the NEBB or the TABB and certified in all categories and functions where measurements or performance are specified on the plans and specifications. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, immediately notify the Contracting Officer and submit another Commissioning Firm for approval. Any firm that has been the subject of disciplinary action by the ACG, the NEBB, or the TABB within the five years preceding Contract Award is not eligible to perform any duties related to the HVAC systems, including Commissioning. All work specified in this Section and in other related Sections to be performed by the Commissioning Firm shall be considered invalid if the Commissioning Firm loses its certification prior to Contract completion and must be performed by an approved successor. These Commissioning services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The Commissioning Firm shall be independent of the work of design and construction. The Commissioning Firm shall not be employed by, or contracted through, a Contractor or construction manager holding construction contracts. The Commissioning Firm shall be a consultant of the Government. The Commissioning Firm shall report results and recommendations directly to the Government.

1.6.1.2 Commissioning Authority

The Commissioning Authority shall be an ACG Certified Commissioning Agent, a NEBB Qualified Commissioning Administrator, or a TABB Certified Commissioning Supervisor and shall be an employee of the approved Commissioning Firm. The Commissioning Authority shall have documented commissioning authority experience in at least 2 building projects. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Commissioning Authority loses

subject certification during this period, immediately notify the Contracting Officer and submit another Commissioning Authority for approval. Any individual that has been the subject of disciplinary action by the ACG, the NEBB, or the TABB within the five years preceding Contract Award is not eligible to perform any duties related to the HVAC systems, including Commissioning. All work specified in this Section and in other related Sections performed by the Commissioning Authority shall be considered invalid if the Commissioning Authority loses his certification prior to Contract completion and must be performed by the approved successor.

Duties of the Commissioning Authority include the following:

a. Assist In Responding To Bidder RFI's

(1) During the Pre-Bid phase, the Commissioning Authority shall review all commissioning related Requests for Information (RFI) in effort to clearly define the unique requirements of the Commissioning Process to the prospective bidders. The Commissioning Authority shall provide responses to any RFI's that specifically address commissioning process issues.

b. Development of Commissioning Plan

c. Commissioning Specific Requirements

(1) The Commissioning Authority will perform the enhanced commissioning requirements as listed in LEED.

(2) A minimum of one commissioning review of the Government's project requirements, basis of design, and design documents will be performed prior to the mid construction documents phase. The subsequent submitted documents will be back-checked against the comments.

(3) A review of the Contractor submittals for the applicable systems being commissioned will be performed. The review will verify compliance with the Government's project requirements and basis of design.

(4) Coordinate commissioning related meetings with the contractor and owner. Verify required commissioning related activities are included in the master construction schedule.

(5) Perform Construction Phase Commissioning site observations, maintain a commissioning issues log, and verify completion of Pre-Functional Construction Checklists.

(6) Witness select equipment start-ups, QC testing (DALI) and verify TAB results.

(7) Witness and Document Functional Performance Testing on systems to be commissioned.

(8) A System Manual shall be development in conjunction with the Contractor. The Commissioning Plan will set the format to be followed and shall comply with ASHRAE Guideline 0.

(9) Verification of the required training for the building's

operating staff and occupants will be provided. The Commissioning Plan shall provide a listing of equipment and systems that will require training, along with the training requirements.

(10) The Commissioning Authority will be involved in the review of building operations 10 months after substantial completion. The review will be performed in conjunction with the Operations and Maintenance staff and occupants. Any outstanding commissioning-related issues shall be resolved during this period, which may include additional seasonal testing to be performed with the assistance of the contractor.

1.6.1.3 Contractor Commissioning Responsibilities

Perform and assist as required for all Commissioning work specified herein and in related sections under the direct guidance of the Commissioning Authority. In addition, the Contractor's commissioning representative shall fulfill the roles and responsibilities as specified in The Commissioning Plan. The Commissioning Authority shall prepare the Commissioning Plan. After approval of the Commissioning Plan, revise the Contract schedule to reflect the schedule requirements in the Commissioning Plan.

1.6.2 Regulatory Requirements

Commissioning shall be accomplished according to one or a combination of the following:

- a. ASHRAE Guideline 0
- b. NEBB Commissioning Standard
- c. SMACNA 1429
- d. ACG Commissioning Guideline
- e. LEED

1.7 SEQUENCING AND SCHEDULING

Work described in this Section shall be coordinated, sequenced and scheduled with all work required in related Sections and the construction schedule.

PART 2 PRODUCTS

2.1 VERIFICATION TESTING EQUIPMENT AND INSTRUMENTS

Contractor shall provide all tools, instruments, laptop computers, PDA's, software programs and services required to perform system Verification Testing procedures. This includes providing the connection to systems to be tested, operation of the test equipment and instrumentation and generating test results as required.

PART 3 EXECUTION

3.1 PROJECT SCHEDULE

The Commissioning Authority will provide to the Contractor, within four

(4) weeks after notification of award, a Schedule in CPM format identifying the Cx Activities and durations for the Project. The Contractor shall then incorporate these Cx Activities into the Master Construction Schedule. Some activities include but are not limited to:

- a. Establishment of Permanent Power
- b. Equipment Start Up.
- c. TAB air and water.
- d. TAB review meeting.
- e. Pre-PVTs are performed.
- f. Functional Performance Testing.
- g. Two-day Trending is performed.
- h. Trend Review meeting is held.
- i. Phase I control training is held with PW.
- j. PVTs are performed.
- k. Phase 2 control training and other building system training is performed.

The Cx Authority will review and update Cx Activities to coordinate with the Contractor's Master Schedule Update.

3.2 PREPARATION

Upon Contracting Officer's acceptance of the Submittal Schedule as required, the Cx Authority will indicate which submittals are "Commissioning Related".

Contractor shall submit one (1) copy of each Commissioning Related submittal to the Cx Authority at the time of submission to the Contracting Officer.

Commissioning Authority will review Product Submittals and Shop Drawings within the same review period as the Contracting Officer. The Cx Authority will review the Submittals and Shop Drawings for Cx Process related information and issue review comments directly to the Contracting Officer.

Contracting Officer will incorporate the Commissioning comments along with their comments on the "stamped" copy returned to the Contractor.

3.3 REQUEST FOR INFORMATION (INTERPRETATION)

Contractor shall submit one (1) copy of each RFI related to the equipment and systems to be commissioned to the Commissioning Authority at the time of submission to the Contracting Officer.

Commissioning Authority will review each RFI for Commissioning related information and issue comments directly to the Contracting Officer.

3.4 COMMISSIONING PROGRESS MEETINGS

The Commissioning Authority will conduct periodic Cx Progress Meetings throughout the construction phase of the project. Commissioning Team Members are required to attend these meetings. When feasible the commissioning meeting will coincide with other review and construction meetings. A scoping meeting will be held to identify responsibilities of the commissioning team members. Commissioning Progress Meetings will be held as needed. Additional meetings may become necessary if Commissioning requirements are not being completed on schedule.

In addition to Commissioning Progress meetings, the contractor shall arrange for the following commissioning related meetings as coordinated with the commissioning authority and PWD:

1. Commissioning Kick-off meeting with subcontractors
2. Pre-DALT/TAB Scheduling and Coordination Meeting
3. Controls Integration Meeting

3.5 QUALITY ASSURANCE TESTING

3.5.1 Contractor Field Testing

Contractor shall issue one (1) copy of ALL Test Reports to the Commissioning Authority for recording into the Commissioning Systems Manual.

3.5.2 Independent Testing

Contractor shall issue one (1) copy of ALL Independent Testing Reports to the Commissioning Authority for recording into the Commissioning Systems Manual.

3.5.3 Witnessing of Testing by Cx Authority

Contractor shall notify the Commissioning Authority in advance of ALL Field or Independent Testing being performed. The Cx Authority will witness a random sampling of Field and Independent Testing.

3.6 SUBSTANTIATING SYSTEM STATUS

The Commissioning Authority will prepare and issue to the Contractor a Pre-Functional Construction Checklist Form for each system or major piece of equipment to be Commissioned. Reference sample Pre-Functional Construction Checklist at the end of this Section. The contractor shall be responsible for completion and submission of the forms.

The Commissioning Authority will monitor and track the completion of the Construction Checklist Forms during period construction site observation visits.

The Contractor shall complete the Pre-Functional Construction Checklist Forms, provided by the Cx Authority, as follows:

- a. Complete Section 01 "Equipment Delivery" of the Construction Checklist and forward to the Cx Authority within seven (7) calendar days after equipment delivery to the site.
- b. Complete Section 02 "Equipment Installation" of the Construction

Checklist and forward to the Cx Authority within seven (7) calendar days after the equipment installation is completed.

c. Complete Section 03 "Equipment Start-up" of the Construction Checklist and forward to the Cx Authority within seven (7) calendar days after the equipment has been successfully started.

d. Complete Section 04 "DDC/EMCS Control & Integration" of the Construction Checklist and forward to the Cx Authority within seven (7) calendar days after the equipment is fully operational and ready for Functional Performance Testing.

e. Complete Section 05 "Completion and Notification for Testing" of the Construction Checklist and forward to the Cx Authority within seven (7) calendar days after the equipment is fully operational and ready for Functional Performance Testing.

3.7 OPERATION AND MAINTENANCE DATA

The Enhanced Commissioning Process has special requirements on compiling and submitting Operation and Maintenance Data.

Upon receipt of the "stamped" submittal from the Contracting Officer, the Contractor shall submit one (1) electronic copy of the respective Operations and Maintenance Data to the Commissioning Authority.

The Cx Authority will compile this information into the Project "Systems Manual" which will be used during Training Sessions, and finally turned over to the Physical Plant Personnel.

3.8 FUNCTIONAL PERFORMANCE TESTING

The Commissioning Authority will develop the Functional Performance Test Procedures to be used on the systems being Commissioned. The Test Procedures will be submitted to the Contractor in advance of scheduled Functional Performance Testing to give the Contractor and Subcontractor's time to review the Procedures and make comments or suggest revisions. Reference sample Functional Performance Test Procedure Form at the end of this Section.

The Commissioning Authority will oversee and document results of all Functional Performance Testing Procedures required for equipment and systems to be Commissioned.

The Contractor is required to provide all testing instruments and all skilled labor required to conduct the Functional Test Procedures. The Commissioning Authority will attend all Functional Test Procedures and record all results of the Testing on the Functional Test Procedure Form.

3.9 CORRECTIVE ISSUE REPORT

The Commissioning Authority will document deficiencies discovered during the construction phase and Functional Performance Testing of systems on a Corrective Issue Report. The Cx Authority will then forward this form to the Contractor for action in correcting the deficiency.

When the deficiency has been corrected, the Contractor shall note action taken and return the Corrective Issue Report to the Commissioning Authority. Reference sample Corrective Issue Report at the end of this

Section.

Corrective Issue Reports must be completed as a pre-requisite for Substantial Completion.

3.10 TRAINING GOVERNMENT EMPLOYEES

All training sessions shall be coordinated with the Commissioning Authority. The Cx Authority will prepare a template Training Form to be used for each Training Session required by the Contract Documents and issue to the Contractor. The Training Plan and completed Training Forms shall be used to schedule, perform and document the required training sessions. The contractor shall submit the Training Plan and Forms for review prior to scheduling training. Reference sample form at the end of this Section.

Training Instructors shall be a Manufacturer's Representative or Applications Engineer fully qualified in the operation, troubleshooting and maintenance procedures for the equipment or systems being covered. Sales Representatives or others possessing only general knowledge of the equipment or systems will not be acceptable.

The following format shall be used to schedule, perform, document and evaluate the required training sessions:

- a. Contractor shall submit a separate Training Form for each training session required by the Contract Documents to the Commissioning Authority. This form shall be submitted a minimum of fourteen (14) calendar days in advance of the proposed training session.
- b. Contractor shall complete the first section of the form including the proposed training session date, name of instructor(s), and proposed length (time) of the session(s). Also, attach an Agenda indicating the format of the training session and listing any handouts that will be provided.
- c. Commissioning Authority will then review the proposed training information with the Government. If the submitted information is complete and the proposed dates meet the Government's Operations Personnel schedule, the Government will respond to the Contractor to proceed with scheduling the subject training session.
- d. During the training session, the Contractor shall have all in attendance sign in the third section of the Training Form. Attach additional pages if necessary. The Contractor shall then forward the Training Form to the Commissioning Authority.

Upon receipt of the Training Form, the Commissioning Authority will have each of the attendees complete the Evaluation Form to gain feedback on the value of the session. Reference sample form at the end of this Section.

- a. If the session meets the objectives and intent of the Contract Documents, the Commissioning Authority will approve the training form and return to the Contractor for Project Records.
- b. If negative feedback is received, the Evaluation Forms will be reviewed with the Commissioning Team and if necessary, re-scheduling of the training may be required.

Operations & Maintenance Manuals and accurate As-built Drawings shall be submitted and approved by the Contracting Officer BEFORE training sessions will be held. The As-built Drawings and O&M information will be reviewed and used as reference during training instructions.

3.11 SECOND SEASON TAB VERIFICATION

Second Season TAB Verification as required by Division 23 of this specification shall be performed during the occupancy phase. The contractor shall notify the commissioning Authority 14 days prior to performing second season (opposite season) TAB verification.

3.12 DEFERRED FUNCTIONAL TESTING

Deferred Testing shall be performed prior to the end of warranty no later than 10 months after building acceptance (BOD). Deferred testing will be required on equipment and systems that could not be completed or that failed due to defective parts or unacceptable installation. Deferred testing will only be applicable to equipment and systems not required for occupancy at the time of BOD, subject to Governmental approval.

The Commissioning Authority will oversee and document results of all Deferred Functional Performance Testing Procedures required for equipment and systems to be Commissioned.

The Contractor is required to provide all testing instruments and all skilled labor required to conduct the Functional Test Procedures. The Commissioning Authority will attend all Functional Test Procedures and record all results of the Testing on the Functional Test Procedure Form.

3.13 SEASONAL TESTING

Seasonal Testing shall be performed prior to the end of warranty no later than 10 months after building acceptance (BOD). Seasonal testing will be required on equipment and systems that could not be tested due to seasonal ambient conditions.

The Commissioning Authority will oversee and document results of all Seasonal Functional Performance Testing Procedures required for equipment and systems to be Commissioned.

The Contractor is required to provide all testing instruments and all skilled labor required to conduct the Functional Test Procedures. The Commissioning Authority will attend all Functional Test Procedures and record all results of the Testing on the Functional Test Procedure Form.

3.14 OCCUPANCY PHASE REVIEW

The commissioning authority will assist in scheduling warranty review meeting with the facilities O/M staff, Users and PWD. Warranty review will consist of reviewing outstanding warranty items, outstanding commissioning issues and walk down of the commissioned systems to identify any additional warranty related items. Any outstanding or new items will be submitted to the contractor for resolution prior to the contractors warranty expiring.

The controls contractor shall provide trend data within 10 days of notification to the Commissioning Authority. Trend data shall consist of the identified points determined by the Commissioning Authority

illustrating system operation for 5 consecutive days in each operational season.

3.15 COMMISSIONING FORMS

The following forms are provided for the commissioning process:

- a. Commissioning Progress Meeting Agenda.
- b. Construction Checklist.
- c. Functional Performance Test Procedure.
- d. Corrective Issue Report.
- e. Operation Training Form.
- f. Training Evaluation Form.
- g. Commissioning Schedule.

-- End of Section --

SECTION 02 41 00

DEMOLITION
05/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.6 (2006) Safety & Health Program
Requirements for Demolition Operations -
American National Standard for
Construction and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014) Safety and Health Requirements
Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61 National Emission Standards for Hazardous
Air Pollutants

1.2 PROJECT DESCRIPTION

1.2.1 Definitions 1.2.1.1 Demolition

Demolition is the process of wrecking or taking out any load-supporting structural member of a facility together with any related handling and disposal operations.

1.2.1.2 Demolition Plan

Demolition Plan is the planned steps and processes for managing demolition activities and identifying the required sequencing activities and disposal mechanisms.

1.2.1.3 Furniture Demolition

The contractor is responsible for removing the furniture from FC530. Base Property will survey the furnishings to determine what is serviceable vs. unserviceable and mark the furniture for the contractor. Adhere to the following:

1. THE CONTRACTOR SHALL MOVE ALL SERVICEABLE WHEELED DESK CHAIRS, COMFORTERS, REFRIGERATORS AND MICROWAVES TO BUILDING 1212 AND/OR BUILDING 1301 AT (910) 451-7636.
2. THE CONTRACTOR SHALL TRANSPORT ALL METAL WARDROBES, METAL SECRETARIES, AND METAL RACKS TO THE MARINE CORPS BASE CAMP LEJEUNE QUALIFIED

RECYCLING PROGRAM'S TREATMENT AND PROCESSING (T&P) FACILITY LOCATED
OFF OF PINEY GREEN ROAD LOT.

- a. POC: Gary Denson, Qualified Recycling Program (QRP) Manager
FSC/Recycling, GF Public Works Division. Bldg. 982, Piney
Green Road, Camp Lejeune, NC 28547 AT (910) 451-2037 or JP
Nakamura at 451-4214.
 - b. QRP hours of operation: 0700-1500 Monday through Thursday and
Friday 0700-1400.
 - c. The contractor shall follow this protocol:
 - i. The Contractor must present a copy of the approved
contract to the QRP manager.
 - ii. Once the contract has been received by the QRP, the
Contractor can deliver the scrap furniture items to the
QRP facility also known as the Treatment and Processing
Facility (T&P).
 - iii. The Contractor shall weigh load on the Base landfill
scales.
 - iv. The Contractor shall dump all items at the T&P located
on Piney Green Road as indicated by the QRP personnel.
 - v. The Contractor shall follow the QRP personnel
instructions regarding pile height, location of various
items, etc.
 - vi. The Contractor shall re-weigh, after the load has been
emptied, on the Base landfill scales and provide weight
tickets to the QRP.
3. THE CONTRACTOR SHALL DISPOSE OF ALL OF THE OTHER ITEMS INCLUDING BUT
NOT LIMITED TO UNSERVICEABLE WHEELED CHAIRS, REFRIGERATORS AND
MICROWAVES, DESKS, NIGHT TABLES, MATTRESSES, WARDROBES, LAMPS,
MIRRORS, AREA RUGS, AND DRAPERIES AT A PERMITTED OFF-SITE SOLID WASTE
LANDFILL.

1.2.2 Demolition/Deconstruction Plan

Prepare a Demolition Plan and submit proposed demolition and removal
procedures for approval before work is started. Include in the plan
procedures for careful removal and disposition of materials specified to be
removed, coordination with other work in progress,, a detailed
description of methods and equipment to be used for each operation and of
the sequence of operations.

1.2.3 General Requirements

Do not begin demolition until authorization is received from the
Contracting Officer. Remove rubbish and debris from the project site; do
not allow accumulations inside or outside the buildings. The work includes
demolition, salvage of identified items and materials, and removal of
resulting rubbish and debris. Remove rubbish and debris from Government
property daily, unless otherwise directed. Store materials that cannot be
removed daily in areas specified by the Contracting Officer. In the
interest of occupational safety and health, perform the work in accordance
with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in
place, to be reused, or to remain the property of the Government. Repair
or replace damaged items as approved by the Contracting Officer.
Coordinate the work of this section with all other work indicated.

Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Do not overload pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.

1.3.2 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off by the Government and disconnected and sealed by the Contractor.

1.3.3 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.5 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Demolition Plan

Existing Conditions

SD-07 Certificates

Notification

SD-11 Closeout Submittals

Receipts

Receipts and Bills of Laden, as specified.

1.6 QUALITY ASSURANCE

Submit timely notification of demolition projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSP A10.6. Comply with the Environmental Protection Agency requirements specified. Use of explosives will not be permitted.

1.6.1 Dust and Debris Control

Prevent the spread of dust and debris to occupied portions of the building and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

1.7 PROTECTION

1.7.1 Traffic Control Signs

a. Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Notify the Contracting Officer prior to beginning such work.

1.7.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.9 EXISTING CONDITIONS

Before beginning any demolition work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of

alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

3.1.1 Utilities and Related Equipment

3.1.1.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.1.2 Disconnecting Existing Utilities

Remove existing utilities, as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area. Remove meters and related equipment and deliver to a location in accordance with instructions of the Contracting Officer.

3.1.2 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs including aggregate base to a depth of 16 inches below new finish grade. Provide neat sawcuts at limits of pavement removal as indicated.

3.1.3 Roofing

Remove existing roof system and associated components in their entirety down to existing roof deck (asphalt shingles). Remove roofing to effect the connections with new flashing, roof deck, and roofing. Remove roofing system without damaging the roof deck. Sequence work to minimize building exposure between demolition or deconstruction and new roof materials installation.

3.1.3.1 Temporary Roofing

Install temporary roofing and flashing as necessary to maintain a watertight condition throughout the course of the work. Remove temporary

work prior to installation of permanent roof system materials unless approved otherwise by the Contracting Officer.

3.1.3.2 Reroofing

When removing the existing roofing system from the roof deck, remove only as much roofing as can be recovered by the end of the work day, unless approved otherwise by the Contracting Officer. Do not attempt to open the roof covering system in threatening weather. Reseal all openings prior to suspension of work the same day.

3.1.4 Masonry

Sawcut and remove masonry so as to prevent damage to surfaces to remain and to facilitate the installation of new work. Where new masonry adjoins existing, the new work shall abut or tie into the existing construction as indicated. Provide square, straight edges and corners where existing masonry adjoins new work and other locations.

3.1.5 Concrete

Saw concrete along straight lines to a depth of a minimum 2 inch. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete.

3.1.6 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

- a. Concrete and Masonry: Completely fill holes and depressions, caused by previous physical damage or left as a result of removals in existing masonry walls and concrete to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.

3.1.7 Mechanical Equipment and Fixtures

Disconnect mechanical hardware at the nearest connection to existing services to remain, unless otherwise noted. Disconnect mechanical equipment and fixtures at fittings. Remove service valves attached to the unit. Salvage each item of equipment and fixtures as a whole unit; listed, indexed, tagged, and stored. Salvage each unit with its normal operating auxiliary equipment. Transport salvaged equipment and fixtures, including motors and machines, to a designated on station storage area as directed by the Contracting Officer. Do not remove equipment until approved. Do not offer low-efficiency equipment for reuse.

3.1.7.1 Preparation for Storage

Remove water, dirt, dust, and foreign matter from units; tanks, piping and fixtures shall be drained; interiors, if previously used to store flammable, explosive, or other dangerous liquids, shall be steam cleaned. Seal openings with caps, plates, or plugs. Secure motors attached by flexible connections to the unit. Change lubricating systems with the proper oil or grease.

3.1.7.2 Ducts

Classify removed duct work as scrap metal.

3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition or deconstruction work in areas occupied by structures to be demolished or deconstructed until all demolition and deconstruction in the area has been completed and debris removed. Fill holes, open basements and other hazardous openings.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.4 CLEANUP

Remove debris and rubbish from basement and similar excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.5 DISPOSAL OF REMOVED MATERIALS

3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations.

3.5.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

3.5.3 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

3.6 REUSE OF SALVAGED ITEMS

Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

-- End of Section --

SECTION 02 82 30

RE-ESTABLISHING VEGETATION

03/12

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

The work covered by this section consists of preparing seedbeds; furnishing and placing limestone, fertilizer, and seed; compacting seedbeds; furnishing, placing, and securing mulch; mowing; and other operations necessary for the permanent establishment of grasses.

Seeding and mulching shall be performed on all earth areas disturbed by construction. The Contractor shall adapt his operations to variations in weather or soil conditions as necessary for the successful establishment and growth.

The quantity of mowing to be performed will be affected by the actual conditions which occur during the construction of the project. The quantity of mowing may be increased, decreased, or eliminated entirely at the direction of the Contracting Officer. Such variations in quantity will not be considered as alterations in the details of construction or a change in the character of the work.

PART 2 PRODUCTS

2.1 FERTILIZER

The quality of all fertilizer and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Fertilizer Law and with the rules and regulations, adopted by the North Carolina Board of Agriculture in accordance with the provisions of said law, in effect at the time of sampling. Fertilizer shall be 10-10-10. Dry fertilizer shall have been manufactured from cured stock. Liquid fertilizer shall be stored and cared for after manufacture in a manner that will prevent loss of plant food values.

2.2 LIMESTONE

The quality of all limestone and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Lime Law and with the rules and regulations adopted by the North Carolina Board of. Limestone shall be agricultural grade ground Dolomitic limestone. All limestone shall contain not less than 90 percent calcium carbonate equivalents. Dolomitic limestone shall contain not less than 10 percent of magnesium. Dolomitic limestone shall be so graded that at least 90 percent will pass through a U.S. Standard 20 mesh screen, and at least 35 percent will pass through a U.S. Standard 100 mesh screen.

2.3 SOD

Sod shall consist of a live, dense, well rooted growth of centipede grass free from an excessive amount of restricted noxious weeds as defined by

the North Carolina Board of Agriculture. The area from which sod is to be obtained shall have been mowed to a height of not less than 2 inches. Sod shall be cut into rectangular sections of sizes convenient for handling without breaking or loss of soil. It shall be cut with a sod cutter or other acceptable means to a depth that will retain in the sod practically all of the dense root system of the grass. During wet weather the sod shall be allowed to dry sufficiently before lifting to prevent tearing during handling and placing, and during extremely dry weather it shall be watered before lifting if such watering is necessary to insure its vitality and to prevent loss of soil during handling.

2.4 MULCH FOR EROSION CONTROL

Mulch for erosion control shall consist of grain straw or other acceptable material, and shall have been approved by the Contracting Officer before being used. All mulch shall be reasonably free from mature seed bearing stalks, roots, or bulblets. Material for holding mulch in place shall be asphalt or other approved binding material.

2.5 SEED

The quality of all seed and all operations in connection with the furnishing of this material shall comply with the requirements of the North Carolina Seed Law and with the rules and regulations adopted by the North Carolina Board of Agriculture. Seed shall have been approved by the North Carolina Department of Agriculture before being sown. No seed will be accepted with a date of test more than 8 months prior to the date of sowing, excluding the month in which the test was completed. Seed mix by weight shall be as specified on the plans.

2.6 MATTING FOR EROSION CONTROL

2.6.1 General

Matting for erosion control shall be or excelsior matting. Other acceptable material manufactured especially for erosion control may be used when approved by the Contracting Officer in writing before being used. Matting for erosion control shall not be dyed, bleached, or otherwise treated in a manner that will result in toxicity to vegetation.

2.6.2 Erosion Control Matting

Matting shall consist of a machine produced mat of curled wood excelsior a minimum of 47 inches in width. The mat shall weigh 1.6 pounds per square yard with a tolerance of plus or minus 10 percent. At least 80 percent of the individual fibers shall be 6 inches or more in length. The fibers shall be evenly distributed over the entire area of the blanket. One side of the excelsior matting shall be covered with an extruded plastic mesh. The mesh size for the plastic mesh shall be a maximum of 1 inch x 1 inch.

2.6.3 Wire Staples

Staples shall be machine made of No. 11 gage new steel wire formed into a "U" shape. The size when formed shall be not less than 6 inches in length with a throat of not less than 1 inch in width.

2.7 WATER

Water used in the planting or care of vegetation shall meet the requirements

of Class C fresh waters as defined in 15 NAC 2B.0200.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

The work shall be performed immediately upon completion of earthwork areas. No exception will be made to this requirement unless otherwise permitted in writing by the Contracting Officer. Upon failure or neglect on the part of the Contractor to coordinate his grading with seeding and mulching operations and diligently pursue the control of erosion and siltation, the Contracting Officer may suspend the Contractor's operations until such time as the work is coordinated in a manner acceptable to the Contracting Officer.

3.2 SEEDBED PREPARATION

The Contractor shall cut and satisfactorily dispose of weeds or other unacceptable growth on the areas to be seeded. The soil shall then be scarified or otherwise loosened to a depth of not less than 3 inches except as otherwise provided below or otherwise directed by the Contracting Officer. Clods shall be broken and the top 2 to 3 inches of soil shall be worked into an acceptable seedbed by the use of soil pulverizers, drags, or harrows; or by other methods approved by the Contracting Officer. All rock and debris 3 inches or larger shall be removed prior to the application of seed and fertilizer. On cut slopes that are 2:1 and steeper, both the depth of preparation and the degree of smoothness of the seedbed may be reduced as permitted by the Contracting Officer, but in all cases the slope surface shall be scarified, grooved, trenched, or punctured so as to provide pockets, ridges, or trenches in which the seeding materials can lodge. On cut slopes that are either 2:1 or steeper, the Contracting Officer may permit the preparation of a partial or complete seedbed during the initial grading of the slope. If at the time of final sodding and mulching operations such initial preparation is still in a condition acceptable to the Contracting Officer, additional seedbed preparation may be reduced or eliminated. Seedbed preparation within 2 feet of the edge of any pavement shall be limited to a depth of 2 to 3 inches. The preparation of seedbeds shall not be done when the soil is frozen, extremely wet, or when the Contracting Officer determines that it is an otherwise unfavorable working condition.

3.3 LIMESTONE AND FERTILIZER

Limestone may be applied as a part of the seedbed preparation, provided it is immediately worked into the soil. If not so applied, limestone and fertilizer shall be distributed uniformly over the prepared seedbed and then harrowed, raked, or otherwise thoroughly worked into the seedbed. Apply fertilizer at the rate as specified on the plans. Apply lime at the rate as specified on the plans. Application equipment for liquid fertilizer, other than a hydraulic seeder, shall be calibrated to ensure that the required rate of fertilizer is applied uniformly.

3.4 SODDING

Extreme care shall be exercised to prevent breaking the sod sections and to prevent the sod from drying out. Any sod that is torn, broken, or too dry will be rejected. Torn or broken sod, if kept moist, may be used for filling unavoidable small gaps in sod cover as permitted by the Contracting Officer. Sod shall be placed on the designated areas within 24

hours after being cut. The area to be sodded shall be brought to a firm uniform surface. The limestone and fertilizer shall be distributed uniformly over the area. The area shall be roughened by means of picks, rakes, or other approved means to a depth of not less than 2 inches without distorting the uniformity of the surface. The finished surface shall be moistened with water prior to placing the sod. Within 24 hours after soil preparation has been completed, place the sod. Each piece of sod shall be packed tightly against the edge of adjacent pieces so that the fewest possible gaps will be left between the pieces. Unavoidable gaps shall be closed with small pieces of sod. Sod shall be placed beginning at either the top or the toe of the slope. Sod shall be placed with the long edge horizontal and with staggered vertical joints. The edge of the sod shall be turned slightly into the ground at the top of a slope and a layer of earth placed over it and tamped as to conduct the surface water over and onto the top of the sod. On all slopes 2:1 or steeper, in drainage channels, and on any areas that are in such condition that there is danger of sod slipping, sod shall be stapled in place by driving staples flush with the sod. Stapling shall be done concurrently with sod placement and prior to tamping. Use wire staples, per Section 2.6.3. The number of staples shall be sufficient to prevent slipping or displacement of the sod. Staples shall be driven perpendicular to the slope. Where backfill is necessary on cut slopes to obtain a uniform sodding area, staples shall be of sufficient length to reach a minimum of 3 inches into the solid earth underneath the backfill. Sod shall not be placed when the atmospheric temperature is below 32 degrees F. Frozen sod shall not be used. After sod has been placed and tamped, it shall be carefully and thoroughly watered as required to maintain the sod in a healthy condition. Watering shall be conducted until final acceptance. Application of water may be made by the use of hydraulic seeding equipment, farm type irrigation equipment, or by other acceptable means.

3.5 MULCHING

All seeded areas shall be mulched. Grain straw or excelsior mat may be used as mulch at any time of the year. Mulch shall be applied within 24 hours after completion of seeding unless otherwise permitted by the Contracting Officer. Care shall be exercised to prevent displacement of soil or seed or other damage to the seeded area during the mulching operations. Mulch shall be uniformly spread by hand or by approved mechanical spreaders or blowers which will provide an acceptable application. An acceptable application will be that which will allow some sunlight to penetrate and air to circulate but also partially shade the ground, reduce erosion, and conserve soil moisture. Mulch shall be held in place by applying a sufficient amount of asphalt or other approved binding material to assure that the mulch is properly held in place. The rate and method of application of binding material shall meet the approval of the Contracting Officer. Where the binding material is not applied directly with the mulch it shall be applied immediately following the mulch application. During the application of binding material, adequate precautions shall be taken to prevent damage to vehicles, structures, guardrails, and devices. Areas where seeding and mulching have been performed shall be maintained in a satisfactory condition until final acceptance of the project. Maintenance shall include mowing at the location and times directed by the Contracting Officer. Areas of damage or failure due to any cause shall be corrected by being repaired or by being completely redone as may be directed by the Contracting Officer. Excelsior matting shall be installed on all seeded slopes greater than 3:1 (h:v). Install the matting per the manufacturer's printed instructions.

3.6 SEEDING

Seed shall be distributed uniformly over the seedbed at the rate as specified on the plans. Seed shall be harrowed, dragged, raked, or otherwise worked so as to cover the seed with a layer of soil. The depth of covering shall be 1/4 inch. When a hydraulic seeder is used for application of seed and fertilizer, the seed shall not remain in water containing fertilizer for more than 30 minutes prior to application unless otherwise permitted by the Contracting Officer. Immediately after seed has been properly covered the seedbed shall be compacted in the manner and degree approved by the Contracting Officer.

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SECTION 03 01 00

REHABILITATION OF CONCRETE
02/18

PART 1 GENERAL

1.1 SCOPE

This specification governs the rehabilitation of structural concrete.

1.2 DEFINITIONS

1.2.1 Bracing

Temporary supplemental members used to avoid local or global instability during construction, evaluation, or repair that are intended to be removed after completion of construction.

1.2.2 Delamination

A planar separation in a material that is roughly parallel to the surface of the material.

1.2.3 Rehabilitation

Repairing or modifying an existing structure to a desired useful condition.

1.2.4 Repair

The reconstruction or renewal of concrete parts of an existing structure for its maintenance or to correct deterioration, damage, or faulty construction of members or systems of a structure.

1.2.5 Shoring

Props or posts of timber or other material in compression used for the temporary support of excavations, formwork, or unsafe structures; the process of erecting shores.

1.2.6 Termination Joint

The interface where a placement of repair material meets existing concrete, the edge of an expansion joint, or other existing surfaces.

1.2.7 Unsound Concrete

Concrete that is fractured, delaminated, spalled, deteriorated, defective, contaminated or otherwise damaged.

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 503.7	(2007) Specification for Crack Repair by Epoxy Injection
ACI 548.4	(2011) Standard Specification for Latex-Modified Concrete (LMC) Overlays
ACI 548.10	(2010) Specification for Type MMS (Methyl Methacrylate Slurry) Polymer Overlays for Bridge and Parking Garage Decks

ASTM INTERNATIONAL (ASTM)

ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C387/C387M	(2017) Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar
ASTM C881/C881M	(2020a) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C882/C882M	(2020) Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
ASTM C928/C928M	(2020a) Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1600/C1600M	(2017) Standard Specification for Rapid Hardening Hydraulic Cement
ASTM C1602/C1602M	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM D93	(2019) Standard Test Methods for Flash-Point by Pensky-Martens Closed Cup Tester
ASTM D323	(2015a) Vapor Pressure of Petroleum Products (Reid Method)
ASTM D542	(2014) Index of Refraction of Transparent Organic Plastics
ASTM D1078	(2011) Standard Test Method for

	Distillation Range of Volatile Organic Liquids
ASTM D3418	(2015) Transition Temperatures of Polymers by Differential Scanning Calorimetry
ASTM D4016	(2014) Viscosity of Chemical Grouts by Brook field Viscometer (Laboratory Method)
ASTM E329	(2020) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualifications

Work Plan

Quality Control Plan

SD-03 Product Data

Conventional Concrete

Polymers

Miscellaneous Materials And Equipment

SD-05 Design Data

Repair Procedures

Mixture Proportioning

SD-06 Test Reports

Mixture Proportioning

Quality Control

Conventional Concrete

Polymers

Miscellaneous Materials And Equipment

SD-07 Certificates

Qualifications

Conventional Concrete

Polymers

SD-08 Manufacturer's Instructions

Equipment For Concrete Preparation

Conventional Concrete

Polymers

Miscellaneous Materials And Equipment

1.5 QUALITY ASSURANCE

1.5.1 General Requirements

- a. Follow the requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE for Work involving portland cement concrete.
- b. To protect personnel from overexposure to toxic materials, conform to the applicable manufacturer's Safety data sheets or local regulations. Submit manufacturer's Safety Data Sheets for all polymers as well as other potentially hazardous materials.
- c. Submit the repair procedures for executing the work as well as the test data and documentation on materials used for repair. Submittal must include component materials, mixture proportions, and supplier's quality control program.
- d. Inspection and testing of surface preparation as well as placement of reinforcing steel must be in accordance with provisions included herein and the Contract Document.
- e. Sampling and testing of materials, as well as inspection and testing of work, must be in accordance with established procedures, manufacturer's instructions, specific instructions from the Contracting Officer if given, or recommended practices as referenced herein and the Contract Documents.
- f. Trial batches and testing requirements for various repair materials specified are the responsibility of the Contractor.
- g. The testing agency must inspect, sample, and test repair materials and concrete production as required. When it appears that material furnished or work performed by Contractor fails to conform to Contract Documents the testing agency will immediately report such deficiency.

1.5.2 Quality Control Plan

Submit a quality control plan as specified in Sections 01 45 10 QUALITY CONTROL and 03 30 00 CAST-IN-PLACE CONCRETE.

1.5.3 Qualifications

The submittals must where applicable, identify agencies and individuals who will be working on this contract and their relevant experience. Do not make changes in approved agencies or personnel without prior approval of the Contracting Officer.

1.5.3.1 Testing Agencies

In addition to the requirements of Section 01 45 10 QUALITY CONTROL, agencies that test concrete materials must meet the requirements of ASTM C1077. Testing agencies that test or inspect placement of reinforcing steel must meet the requirement of ASTM E329. Submit data on qualifications of Contractor's proposed testing agency for acceptance.

1.5.3.2 Quality Control Personnel

Field tests of repair materials required must be made by an ICRI Concrete Surface Repair Technician Tier 2. Submit resumes, pertinent information, past experience, training and education of all operators of specialized demolition equipment if needed for this and the three paragraphs above.

1.5.3.3 Contractor Qualifications

The contractor performing the repair work must have been involved in a minimum of three concrete repair projects similar in size and scope to this project for at least five years. Submit information, including name, dollar value, date, and point-of-contact for similar projects which demonstrates the required experience and/or training.

1.5.3.4 Worker Qualifications

- a. Each worker engaged in the use of specialized removal or application equipment, including saw operators, and epoxy injection, must have satisfactorily completed an instruction program and three years of experience in the operation of the equipment.
- b. Workers installing adhesive anchors must be ACI Adhesive Anchor Installer certified or equivalent.

1.5.3.5 Regulatory Requirements

Perform all work in accordance with applicable Federal, State, and local safety, health, and environmental requirements. The Contractor is responsible for obtaining all permits required by Federal, State, and local agencies for the performance of the work.

1.5.4 Pre-Construction Conference

Conduct a pre-construction conference to discuss repair materials performance requirements, control provisions, and roles and responsibilities for the Work to ensure that the Contractor's personnel understand all aspects of the repair material, its properties and application procedures. The conference must include the Contracting Officer or authorized representative, the Contractor's field superintendent and foreman, and a competent Technical Representative of the material manufacturer, and other involved trades or supplier representatives. The Technical Representative must be fully qualified to perform the work.

1.5.5 Work Plan

Prepare a work plan describing the methods of concrete removal and repair, including methods, equipment and materials to be used for each feature. Submit the work plan for approval at least 30 days prior to the start of the work. The plan must include, but not be limited to, repair materials

to be used with specific information on products and/or constituents, and requirements for handling, storage, etc., equipment to be used, surface preparation, and requirements for placement, finishing, curing and protection specific to the materials used. Include a description of field demonstrations in the work plan. Do not commence work until the work plan and field demonstration representative of the type of work are approved.

1.6 ACCEPTANCE OF REHABILITATION WORK

1.6.1 General Requirements

- a. Completed concrete rehabilitation work must conform to applicable requirements of Contract Document and this specification. The Contractor is responsible to bring Work into compliance with requirements of Contract Documents if the Concrete repair work fails to meet one or more requirements of Contract Documents.
- b. Correct rejected repair work by removing and replacing or by strengthening with additional construction acceptable to the Contracting Officer. Use repair methods that meet applicable requirements for function, durability, dimensional tolerances, and appearance.
- c. Submit proposed work plan, repair methods, materials, and modifications to the Work needed to correct rejected repair work to meet the requirements of Contract Documents.

1.6.2 Tolerances

- a. Construction tolerances for repairs must conform to ACI 117. Where existing conditions do not allow tolerances to conform to ACI 117, use the details and materials for such conditions as indicated in the Contract Documents. For conditions not shown or that are different than indicated in the Contract Documents, notify the Contracting Officer before proceeding with the work at those locations.
- b. Inaccurately formed concrete surfaces resulting in concrete members with dimensions that exceed ACI 117 tolerances are subject to rejection.

1.6.3 Appearance

Concrete surfaces not meeting the requirements of the Contract Documents must be brought into compliance.

1.7 PROTECTION OF COMPLETED REHABILITATION WORK

- a. Do not allow construction loads to exceed the loads that a structural member or structure is safely capable of supporting without damage. Provide supplemental support if construction loads are expected to exceed safe load capacity.
- b. Protect repaired and adjacent areas from damage by construction traffic, equipment, and materials. During the curing period, protect repair materials from damage by mechanical disturbances, including load-induced stresses, shock, and vibration.
- c. Protect repair materials from environmental damage by weather events during the length of the curing period.

PART 2 PRODUCTS

Products or materials used must conform to the requirements included herein as well as the Contract Documents. The usage of other products or materials not covered by this requirement or specified in the Contract Documents are permitted upon approval by the Contracting Officer. Additional information and submittals for products and materials not included in this document including product data, samples, design data, test reports, certificates, manufacturer's instructions, and field reports must be submitted as requested by the Contracting Officer.

2.1 MATERIALS FOR SHORING AND BRACING

2.1.1 Shoring and Bracing Systems

Use commercially manufactured and engineered shoring and bracing systems and components, except where custom built assemblies of lumber or other suitable materials are permitted by the Contracting Officer.

2.2 EQUIPMENT FOR CONCRETE PREPARATION

Means and methods used for concrete removal and surface preparation must be selected and used such as to minimize damage to the structure and to the concrete substrate that remains.

2.2.1 Equipment for Concrete Removal

Removal equipment and techniques must be suitable to produce concrete surface profiles and level of cleanliness in designated areas as required by this specification and the contract Documents.

2.2.1.1 Cutting Equipment

- a. The following cutting equipment are permitted: High-pressure water jet without abrasives, Saw cutting, Diamond wire cutting, and Mechanical shearing.
- b. Cutting, lifting, and transporting equipment must be adequate to cut, support, and transport concrete sections without incurring any damage to the existing structure.

2.2.1.2 Concrete Breakers

- a. Provide sharp tips on breaker equipment to minimize microcracking damage in partial depth removal.
- b. The use of the following impact equipment and methods is permitted: Hand-held breakers,, Needle scalers, Scarifiers, and Milling methods.

2.2.2 Surface preparation and cleaning equipment

2.2.2.1 Abrasive Blasting

- a. Use dry or wet oil-free abrasive blasting capable of removing loose micro-fractured (bruised) or otherwise damaged or pulverized concrete surfaces, and rust from exposed steel reinforcement, and providing a surface profile in compliance with the Contract Documents.

2.2.2.2 Low Pressure Water Cleaning

Use equipment capable of delivering 1000 psi to to 5000 psi at 2 gal/min to 10 gal/min for cleaning loose material from repair areas.

2.2.2.3 Other Cleaning Equipment

Use equipment that delivers oil free air capable of cleaning loose material and debris from repair areas. If necessary to dry the concrete surface, clean, dry, compressed air may be used. Also, use vacuums capable of removing loose material and debris.

2.3 MATERIALS FOR FORMWORK AND EMBEDDED ITEMS

- a. Formwork and embedded items must meet the requirements specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.
- b. Install and remove formwork without damaging or staining the existing structure or repair material.
- c. Forms used for polymer concrete/mortars must be tight enough to hold the material that is used without leaking. All surfaces where bond is not desired, but which are exposed to the monomer or resin, must be treated with a form release agent.

2.4 CONVENTIONAL CONCRETE

- a. Portland cement concrete materials must meet the requirements specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.
- b. Use cementitious materials indicated in the Contract Documents.
- c. Aggregates used in concrete must be obtained from the same sources as aggregates used in the concrete represented by submitted historical data or used in trial mixtures.
- d. Refer to Section 03 30 00 CAST-IN-PLACE CONCRETE for details on submittals involving conventional concrete.

2.5 POLYMERS

- a. The requirements for the properties of polymers and aggregates used in polymers must meet the requirements specified in this paragraph as well as the properties specified in the referenced specifications and the Contract Documents.
- b. Polymers used must be compatible with other polymers and materials used on the project. Unless repair materials are specified in the contract documents, the Contractor is responsible for verifying material compatibilities.
- c. Submit product data, manufacturer's Safety Data Sheets, samples, design data, test reports, certificates, manufacturer's instructions, and field reports for materials as required by this document as well as the referenced specifications and the Contract Documents.

2.5.1 Epoxies

- a. Epoxy mortars and epoxy compounds must conform to ASTM C881/C881M.

- b. Epoxy used for crack repair must meet the requirements of ACI 503.7.

2.5.2 Methacrylates

- a. Methyl methacrylate slurry (MMS) used for overlays must meet the requirements of ACI 548.10.
- b. High molecular weight methacrylate (HMWM) must be a 2-component, rapid curing, and solvent-free system.
- c. HMWM monomers must be a high molecular weight or substituted methacrylate that conforms the following properties:

Physical Properties of HMWM Monomer		
Property	Test Method	Criteria
Vapor Pressure Flash Point Density	ASTM D323 ASTM D93	Less than 0.02 psi at 77 degrees F Greater than 200 degrees F Greater than 8.4 lbs. per gal. at 77 degrees F
Viscosity Index of Refraction Boiling point @ 0.02 psi Shrinkage on cure	ASTM D4016 ASTM D542 ASTM D1078	12 + 4 cps at 73 degrees F 1.470 + 0.002 158 degrees F Less than 11 percent
Glass Transition Temperature (DSC)	ASTM D3418	158 degrees F
Curing Time (100 g mass)	ASTM D3418	Greater than 40 minutes at 73 degrees F, with 4 percent cumene hydroperoxide
Bond Strength	ASTM C882/C882M	Greater than 1,500 psi

- d. The initiator/promoter system for HMWM must be capable of providing a surface cure time of not less than 40 minutes nor more than 3 hours at the surface temperature of the concrete during application. The initiator/promoter system must be such that the gel time may be adjusted to compensate for changes in temperature that may occur throughout the treatment application.
- d. The initiator/promoter system for HMWM must meet the following criteria:

Initiator Cuemene Hydroperoxide	78 percent
Promoter Cobalt Napthenate	6 percent

2.5.3 Aggregate

- a. Unless otherwise specified or recommended by the polymer material manufacturer, aggregate used with polymers must meet ASTM C33/C33M requirements.
- b. Aggregate properties and proportions used with polymers must meet the requirements of the polymer material manufacturer, the requirements of the referenced polymer standard, and the Contract Documents.
- c. For patch repairs, the maximum-sized aggregate must not be greater than one third the depth of the patch area.

2.6 MISCELLANEOUS MATERIALS AND EQUIPMENT

2.6.1 Packaged and proprietary materials

The required properties for the materials listed in this paragraph must meet the properties specified in the Contract Documents. Submit Product data, certificates, and manufacturer's instructions as required by the Contracting Officer and the Contract Documents.

- a. Packaged, rapid hardening concrete repair materials must conform to ASTM C928/C928M.
- b. Packaged, mortar and concrete must conform ASTM C387/C387M.
- c. Rapid hardening cement must conform to ASTM C1600/C1600M.

Water used with packaged and proprietary materials must meet ASTM C1602/C1602M requirements. Aggregates must meet the repair material manufacturer's requirements if available and ASTM C33/C33M if such requirements are not specified.

2.6.2 Concrete Accessories

All concrete accessories not included in this document must meet the requirements specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.6.3 Miscellaneous Equipment

- a. Equipment designed specifically for the application of repair materials must be used as required by the repair material manufacturer and the referenced specification.
- b. Equipment not listed in this specification but referenced or used for repairs must be clean and in good operating condition.
- c. All supplies and equipment must be available in sufficient quantities to allow continuity in the installation project and quality assurance.

2.7 MIXTURE PROPORTIONING

- a. Portland cement-based concrete mixtures must be in accordance with the

requirements of Section 03 30 00 CAST-IN-PLACE CONCRETE.

- b. Polymer-modified portland cement concrete proportioning, handling, and mixing procedures as well as equipment used for mixing these materials must conform to the requirements provided by the repair material manufacturer as well as ACI 548.4 when such materials are used for overlays.
- d. Proportioning and mixing materials not specified above must follow the requirements provided by the repair material manufacturer.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

3.1.1 Examination

Locate area of unsound concrete or delamination as shown on the contract drawings.

3.1.2 Protection

Protect pedestrians, motorized traffic, mechanical, electrical, and plumbing equipment, surrounding construction, project site, landscaping, and surrounding buildings from damage or injury resulting from concrete rehabilitation work.

- a. Construct dust and debris barriers surrounding repair work perimeter to control dust and to protect and control construction traffic.
- b. Dispose of runoff from wet demolition or surface preparation operations in accordance with all local ordinances. Disposal methods must avoid soil erosion, avoid undermining pavements and foundations, damage to landscaping and vegetation, and minimize water penetration through other parts of buildings.
- c. Collect and neutralize alkaline wastes and acid wastes and dispose in accordance with local, state, and federal regulations.
- d. Comply with local noise ordinances during demolition operations.
- e. Perform demolition work and surface preparation work in a manner that minimizes disturbances of operations. Coordinate work with the Contracting Officer.

3.1.3 Formwork

Execution of formwork and shoring must meet the requirements specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.1.3.1 Formwork

- a. Construct forms to sizes, shapes, lines, and dimensions to match existing adjacent surfaces and textures. Provide forms that match openings, offsets, chamfers, anchorages, inserts and other features as described on Contract Documents. Construct forms to accommodate installation of products by other trades. Provide forms for easy removal to minimize damage to concrete surfaces and adjacent surfaces. Apply form release coating over formwork surfaces prior to each

concrete placement. Form release agents must not be applied to or come in contact with the repair area concrete substrate or reinforcement.

- b. Do not damage repair material during removal of formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete or repair material. Perform needed repair and treatment required on vertical surfaces at once and follow immediately with specified curing. Remove all formwork anchors embedded in existing concrete. Fill anchor holes and repair all damage to existing concrete at anchor holes.

3.1.4 Concrete preparation

- a. Remove concrete as needed per the removal requirements of this section. Limits on removal equipment are specified in the paragraph titled EQUIPMENT FOR CONCRETE PREPARATION.
- b. Remove foreign material, such as dirt, oil, grease, or other chemicals, from the cracks before injection using compressed air, low-pressure water, or vacuuming. Allow wet surfaces to dry at least 24 hours.
- c. Immediately before placing the repair material or installing formwork, make the repair area available for inspection by the Contracting Officer. Obtain acceptance by the Contracting Officer of surface preparation before proceeding with Work. If the Work is rejected, perform additional operations to the satisfaction of Contracting Officer.

3.1.5 Quality Control

3.1.5.1 Quality control of surface preparation

Evaluation of prepared substrate must be continuously monitored to assure that the prepared substrate surface meets project requirements.

3.1.5.2 Quality control of repair overlays

All components of overlay PPCC materials must be certified by the material manufacturer or aggregate supplier to meet all project testing requirements. During the PPCC overlay, take mixed samples and check that the materials are mixed properly. Confirm that the right PC overlay thickness was applied by recording the volume of PC overlay materials and the substrate surface area covered by the overlay.

3.1.6 Curing

- a. For portland cement concrete Work, follow the requirements indicated in 03 30 00 CAST-IN-PLACE CONCRETE.
- b. For polymer concrete/mortar Work, follow manufacturer's requirements for curing.
- c. For polymer modified portland cement concrete Work follow manufacturer's requirements for curing.

3.1.7 Clean up

- a. Clean and remove all spills and leaks of injection adhesive and stains

caused by the injection adhesives.

- b. Dispose wastewater used for cutting and cleaning without staining or damaging the existing surfaces of the structure or the environment of the project area. The method of disposal must meet all the requirements of Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

3.1.8 Safety

- a. Provide Material Safety Data Sheets (MSDS) for products on site reviewing them before work begins.
- b. Provide safety guards, maintenance, and warnings for all machinery and equipment.
- c. Have personal protection equipment practice in place - eye protection and face guards.
- d. Have all workers in contact with wet cementitious material wear protective gloves and clothing.
- e. Provide eyewash facilities on-site with location signage.
- f. Provide dust masks for workers operating mixers.
- g. Provide secured storage available for all hazardous or flammable materials.
- h. Conduct safety meetings prior to beginning repair operations.

3.2 CRACK REPAIR

3.2.1 Preparation

3.2.1.1 General Requirements

- a. Clean all cracks in accordance with the paragraph titled Concrete Preparation.
- b. Do not repair cracks when the temperature of the concrete is below freezing and moisture conditions indicate the possibility of ice on the internal surfaces of the crack.
- c. Do not apply adhesive if the temperature of the concrete is not within the range of application temperatures recommended by the manufacturer of the adhesive.

3.2.1.2 Crack routing

Inspect surfaces adjacent to crack to receive repair material. If deteriorated, route a V-groove section at the crack face until sound concrete is reached.

3.2.1.3 Sealing

- a. For epoxy injection, apply a surface seal over all exterior faces of the crack that can be reached to contain the injection adhesive in the crack.

- b. For gravity fill repairs, apply a surface seal along the bottom surface of the element that can be reached to contain the repair material in the crack.

3.2.2 Application

3.2.2.1 Epoxy Injection

- a. Install the injection entry and venting ports using flush mounted or drilled fittings per proprietary manufacturer's instructions.
- b. Space the ports at 8 in maximum spacing.
- c. Inject the epoxy using material manufacturer's recommended equipment.
- d. Apply recommended manufacturer's injection pressure.
- e. For vertical or inclined cracks, apply injection by pumping epoxy into entry ports at the lowest elevation, cap, and move upward.
- f. For horizontal cracks, apply injection by proceeding from one end of the crack to the other until the crack is fully sealed.
- g. After 10 min., repeat injection procedure until all ports refuse injection.
- h. Remove ports and remove the surface seal by chipping, or grinding or other acceptable means after the injected epoxy has cured.

3.2.2.2 Gravity fill

- a. Mix resin or monomer per material manufacturer's instructions.
- b. Pre-fill cracks at least 0.125 in. wide with aggregate.
- c. Pour resin or monomer onto the surface, over the cracks and spread with brooms, rollers, or squeegees.
- d. Work material back and forth over the cracks to maximize fill in crack.
- e. Allow at least 20 minutes for material to penetrate cracks.
- f. Remove excess material once cracks have been filled to refusal.
- g. Allow material to cure per material manufacturer's recommendations.

3.3 CORROSION AND SURFACE REPAIR

3.3.1 Preparation

3.3.1.1 Identification of Extent of Concrete Removal

- a. Configure geometry of removal area to maximize the use of right-angle geometry, avoiding reentrant corners, and to obtain uniformity of depth. Determine the depth, location, and size of reinforcing bars prior to removal of concrete.

3.3.1.2 Shoring and Formwork

- a. Provide formwork per the paragraph titled Formwork.

3.3.1.3 Concrete Removal

- a. Remove concrete from repair areas to indicated depth and profile. Notify Contracting Officer if additional delaminated, fractured, or unsound concrete is present.
- b. Do not damage embedded reinforcing and adjacent concrete. The removal methods must produce minimal microcracking (bruising) of the prepared substrate surfaces. Avoid directly striking reinforcing steel with impact tools used for concrete removal.
- c. Provide perpendicular edges at perimeter of repair area. The perimeter of the repair areas must be saw cut to a depth of 0.50 to 0.75 in.. For vertical or overhead surfaces, provide 45-degree slope at repair boundaries to facilitate air and rebound escape. Do not cut or damage embedded reinforcement or other embedded items. If embedded reinforcing steel or other embedded items are too close to the surface to provide the perpendicular edge cut, notify the Contracting Officer for direction before proceeding.
- d. Extend concrete removal along the corroded reinforcing steel to a point where there is no further delamination, concrete cracking, or reinforcing steel corrosion, and where the reinforcement is bonded to the surrounding concrete.
- e. Remove concrete around the exposed layer of reinforcement to a uniform depth beyond within the repair areas to provide a minimum clearance between exposed reinforcing steel and surrounding concrete of 0.75 in. , or at least 0.25 in. larger than the maximum nominal size of the coarse aggregate in the repair material.

3.3.1.4 Preparation of Concrete Substrate Surface

- a. Confirm perpendicular edges at repair area perimeter, and reinstate if damaged by concrete removal process. Remove loosely bonded concrete, bruised or fractured concrete, and bond-inhibiting materials such as dirt, concrete slurry, or any other detrimental materials from the concrete substrate using approved methods. Where concrete has been removed by impact methods, abrasive blasting must be used to prepare the surface and remove bruised concrete.
- b. Provide substrate surface profiles as specified in the Contract Documents.
- c. Visually inspect and sound substrate surface to confirm that no further delaminations or otherwise unsound concrete remains. If encountered, notify the Contracting Officer.
- d. Clean the substrate per the paragraph titled Concrete preparation.

3.3.2 Application

3.3.2.1 Existing Reinforcement Preparation

- a. Clean existing reinforcement that will remain. Remove corrosion and/or

other laitance and notify the Contracting Officer if section loss is greater than 20%.

3.3.2.2 Placement of Concrete

- a. If portland cement concrete is used as the repair material, follow the requirements indicated in 03 30 00 CAST-IN-PLACE CONCRETE as well the Contract Document for proportioning, mixing, and placing concrete. For all other materials, follow material manufacturer's recommendations.
- b. Bristle broom a thin coat of the repair material into the saturated surface dry substrate filling roughened surface pores before placing the repair material in the repair area. Do not allow thin coat to dry before placing repair material.
- c. Consolidate the repair material after placement with a vibrating screed or internal vibrator.
- d. Finish the surface to match surface finish and texture requirements indicated in the Contract Document. Screed, float and trowel the repair material or broom the surface for non-slip texture. Follow the requirements of 03 30 00 CAST-IN-PLACE CONCRETE.

3.3.2.3 Placement of Other Repair Materials

- a. Equilibrate repair material(s) and substrate to the temperature, cleanliness of substrate and reinforcement, and moisture requirements of the repair material manufacturer's requirements.
- b. Comply with the repair material manufacturer's requirements for batching, mixing, placing and curing repair materials.
- c. Review consistency of the mixed repair material(s) relative to the parameters documented in the repair material manufacturer product data sheet. If non-conforming, adjust consistency in compliance with the repair material manufacturer's requirements.
- d. Apply or install repair material(s) within the application time frame (pot life) requirements of the repair material manufacturer's requirements, and place and consolidate to provide well-compacted repair.
- e. Finish and tool repair materials, finished in accordance with the repair material manufacturer's written instructions and as indicated in Contract Documents.
- f. Protect installed repair material(s) from damage, exposure to environmental conditions that are detrimental to the uncured or cured properties of the material. Cure in accordance with the requirements of the repair material manufacturer's requirements.

3.4 OVERLAYS

3.4.1 Preparation

3.4.1.1 Bonded Overlays

- a. Apply preparation requirements specified by the overlay material manufacturer

20-0075 Repair BEQ FC530

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SECTION 03 30 00

CAST-IN-PLACE CONCRETE

02/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 121R	(2008) Guide for Concrete Construction Quality Systems in Conformance with ISO 9001
ACI 301	(2016) Specifications for Structural Concrete
ACI 302.1R	(2015) Guide for Concrete Floor and Slab Construction
ACI 304.2R	(2017) Guide to Placing Concrete by Pumping Methods
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI 308.1	(2011) Specification for Curing Concrete
ACI SP-2	(2007; Abstract: 10th Edition) ACI Manual of Concrete Inspection
ACI SP-15	(2011) Field Reference Manual: Standard Specifications for Structural Concrete ACI 301-05 with Selected ACI References

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(1995; R 2004) Basic Hardboard
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ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A53/A53M	(2020) Standard Specification for Pipe,

	Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A934/A934M	(2016) Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31/C31M	(2019a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2020) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42/C42M	(2018a) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C78/C78M	(2018) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C94/C94M	(2020) Standard Specification for Ready-Mixed Concrete
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C311/C311M	(2018) Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans

	for Use in Portland-Cement Concrete
ASTM C330/C330M	(2017a) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C595/C595M	(2018) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C845/C845M	(2018) Standard Specification for Expansive Hydraulic Cement
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C989/C989M	(2018a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1012/C1012M	(2018b) Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
ASTM C1017/C1017M	(2013; E 2015) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1107/C1107M	(2017) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1157/C1157M	(2017) Standard Performance Specification for Hydraulic Cement
ASTM C1218/C1218M	(2017) Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
ASTM C1240	(2020) Standard Specification for Silica Fume Used in Cementitious Mixtures
ASTM C1260	(2014) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1293	(2008; R 2015) Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction

ASTM C1567	(2013) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602/C1602M	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C1778	(2016) Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2628	(1991; R 2016) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D3042	(2017) Standard Test Method for Insoluble Residue in Carbonate Aggregates
ASTM D5759	(2012) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
ASTM D6690	(2015) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials
ASTM E329	(2020) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
ASTM E1643	(2018a) Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
ASTM E1745	(2017) Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI 10MSP	(2018) Manual of Standard Practice
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CRSI RB4.1 (2016) Supports for Reinforcement Used in Concrete

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST PS 1 (2009) DOC Voluntary Product Standard PS 1-07, Structural Plywood

1.2 DEFINITIONS

- a. "Cementitious material" as used herein must include all portland cement, pozzolan, fly ash, and slag cement.
- b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to persons not responsible for operation or maintenance of the building.
- c. "Chemical admixtures" are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.
- d. "Supplementary cementing materials" (SCM) include coal fly ash, slag cement, natural or calcined pozzolans, and ultra-fine coal ash when used in such proportions to replace the portland cement that result in improvement to sustainability and durability and reduced cost.
- e. "Design strength" (f'_c) is the specified compressive strength of concrete at time(s) specified in this section to meet structural design criteria.
- f. "Mass Concrete" is any concrete system that approaches a maximum temperature of 158 degrees F within the first 72 hours of placement. In addition, it includes all concrete elements with a section thickness of 3 feet or more regardless of temperature.
- g. "Mixture proportioning" is the process of designing concrete mixture proportions to enable it to meet the strength, service life and constructability requirements of the project while minimizing the initial and life-cycle cost.
- h. "Mixture proportions" are the masses or volumes of individual ingredients used to make a unit measure (cubic meter or cubic yard) of concrete.
- i. "Pozzolan" is a siliceous or siliceous and aluminous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.
- j. "Workability (or consistence)" is the ability of a fresh (plastic) concrete mix to fill the form/mould properly with the desired work (vibration) and without reducing the concrete's quality. Workability depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

- Quality Control Plan
- Quality Control Personnel Certifications
- Quality Control Organizational Chart
- Laboratory Accreditation

SD-02 Shop Drawings

- Reinforcing Steel

SD-03 Product Data

- Joint Sealants
- Joint Filler
- Cementitious Materials
- Vapor Retarder
- Concrete Curing Materials
- Reinforcement
Admixtures
- Local/Regional Materials
- Nonshrink Grout

SD-05 Design Data

- Concrete Mix Design

SD-06 Test Reports

- Concrete Mix Design
- Fly Ash
- Pozzolan
- Slag Cement
- Aggregates
- Compressive Strength Tests
- Air Content
- Slump Tests

Water

SD-07 Certificates

Reinforcing Bars

Field Testing Technician and Testing Agency

Curing Compound

1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory. Interpret reference to the "Building Official," the "Structural Engineer," and the "Architect/Engineer" to mean the Contracting Officer.

1.5 DELIVERY, STORAGE, AND HANDLING

Follow ACI 301, ACI 304R and ASTM A934/A934M requirements and recommendations. Do not deliver concrete until vapor retarder, forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement. Do not store concrete curing compounds or sealers with materials that have a high capacity to adsorb volatile organic compound (VOC) emissions. Do not store concrete curing compounds or sealers in occupied spaces.

1.5.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

1.6 QUALITY ASSURANCE

1.6.1 Design Data

1.6.1.1 Concrete Mix Design

Sixty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, supplementary cementitious materials, and admixtures; and applicable reference specifications. Submit mill test and all other test for cement, supplementary cementitious materials, aggregates, and admixtures. Provide documentation of maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Provide mix proportion data using at least three different water-cementitious material ratios for each type of mixture, which produce a range of strength encompassing those required for each type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Resubmit data on concrete components if the qualities or source of components changes.

For previously approved concrete mix designs used within the past twelve months, the previous mix design may be re-submitted without further trial batch testing if accompanied by material test data conducted within the last six months. Obtain mix design approval from the contracting officer prior to concrete placement.

1.6.2 Shop Drawings

1.6.2.1 Reinforcing Steel

Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars. Reproductions of contract drawings are unacceptable.

1.6.3 Test Reports

1.6.3.1 Fly Ash and Pozzolan

Submit test results in accordance with ASTM C618 for fly ash and pozzolan. Submit test results performed within 6 months of submittal date.

1.6.3.2 Slag Cement

Submit test results in accordance with ASTM C989/C989M for slag cement. Submit test results performed within 6 months of submittal date.

1.6.3.3 Aggregates

Submit test results in accordance with ASTM C33/C33M, or ASTM C330/C330M for lightweight aggregate, and ASTM C1293 or ASTM C1567 as required in the paragraph titled ALKALI-AGGREGATE REACTION.

1.6.4 Field Samples

1.6.5 Quality Control Plan

Develop and submit for approval a concrete quality control program in accordance with the guidelines of ACI 121R and as specified herein. The plan must include approved laboratories. Provide direct oversight for the concrete qualification program inclusive of associated sampling and testing. All quality control reports must be provided to the Contracting Officer, Quality Manager and Concrete Supplier. Maintain a copy of ACI SP-15 and CRSI 10MSP at project site.

1.6.6 Quality Control Personnel Certifications

The Contractor must submit for approval the responsibilities of the various quality control personnel, including the names and qualifications of the individuals in those positions and a quality control organizational chart defining the quality control hierarchy and the responsibility of the various positions. Quality control personnel must be employed by the Contractor.

Submit American Concrete Institute certification for the following:

- a. CQC personnel responsible for inspection of concrete operations.

- b. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews.
- c. Field Testing Technicians: ACI Concrete Field Testing Technician, Grade I.

1.6.6.1 Quality Manager Qualifications

The quality manager must hold a current license as a professional engineer in a U.S. state or territory with experience on at least five similar projects. Evidence of extraordinary proven experience may be considered by the Contracting Officer as sufficient to act as the Quality Manager.

1.6.6.2 Field Testing Technician and Testing Agency

Submit data on qualifications of proposed testing agency and technicians for approval by the Contracting Officer prior to performing testing on concrete.

- a. Work on concrete under this contract must be performed by an ACI Concrete Field Testing Technician Grade 1 qualified in accordance with ACI SP-2 or equivalent. Equivalent certification programs must include requirements for written and performance examinations as stipulated in ACI SP-2.
- b. Testing agencies that perform testing services on reinforcing steel must meet the requirements of ASTM E329.
- c. Testing agencies that perform testing services on concrete materials must meet the requirements of ASTM C1077.

1.6.7 Laboratory Qualifications for Concrete Qualification Testing

The concrete testing laboratory must have the necessary equipment and experience to accomplish required testing. The laboratory must meet the requirements of ASTM C1077 and be Cement and Concrete Reference Laboratory (CCRL) inspected.

1.6.8 Laboratory Accreditation

Laboratory and testing facilities must be provided by and at the expense of the Contractor. The laboratories performing the tests must be accredited in accordance with ASTM C1077, including ASTM C78/C78M and ASTM C1260. The accreditation must be current and must include the required test methods, as specified. Furthermore, the testing must comply with the following requirements:

- a. Aggregate Testing and Mix Proportioning: Aggregate testing and mixture proportioning studies must be performed by an accredited laboratory and under the direction of a registered professional engineer in a U.S. state who is competent in concrete materials and must sign all reports and designs.
- b. Acceptance Testing: Furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Furnish and maintain boxes or other facilities suitable for storing and curing the specimens at the site while in the mold within the temperature range stipulated by ASTM C31/C31M.

- c. Contractor Quality Control: All sampling and testing must be performed by an approved, onsite, independent, accredited laboratory.

1.7 SUSTAINABLE DESIGN REQUIREMENTS

1.7.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

PART 2 PRODUCTS

2.1 FORMWORK MATERIALS

- a. Form-facing material in contact with concrete must be lumber, plywood, or metal.
- b. Design formwork to withstand pressure resulting from placement and vibration of concrete and to maintain specified tolerances.

2.1.1 Wood Forms

Provide lumber that is square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Provide plywood that complies with NIST PS 1, B-B concrete form panels or better or AHA A135.4, hardboard for smooth form lining.

2.1.1.1 Concrete Form Plywood (Standard Rough)

Provide plywood that conforms to NIST PS 1, B-B, concrete form, not less than 5/8-inch thick.

2.1.1.2 Overlaid Concrete Form Plywood (Standard Smooth)

Provide plywood that conforms to NIST PS 1, B-B, high density form overlay, not less than 5/8-inch thick.

2.1.2 Steel Forms

Provide steel form surfaces that do not contain irregularities, dents, or sags.

2.2 FORMWORK ACCESSORIES

- a. Use commercially manufactured formwork accessories, including ties and hangers.
- b. Form ties and accessories must not reduce the effective cover of the reinforcement.

2.2.1 Form Ties

- a. Use form ties with ends or end fasteners that can be removed without damage to concrete.

2.2.2 Chamfer Materials

Use lumber materials with dimensions of 3/4 x 3/4 in.

2.2.3 Construction and movement joints

- a. Submit details and locations of construction joints in accordance with the requirements herein.
- b. Make construction joints perpendicular to main reinforcement.
- c. Provide movement joints where indicated in Contract Documents or in accepted alternate locations.
- d. Submit location and detail of movement joints if different from those indicated in Contract Documents.
- e. Submit manufacturer's data sheet on expansion joint materials.

2.2.4 Other Embedded items

Use sleeves, inserts, anchors, and other embedded items of material and design indicated in Contract Documents.

2.3 CONCRETE MATERIALS

2.3.1 Cementitious Materials

2.3.1.1 Portland Cement

- a. Unless otherwise specified, provide cement that conforms to ASTM C150/C150M Type I or II.
- b. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.
- c. Submit information along with evidence demonstrating compliance with referenced standards. Submittals must include types of cementitious materials, manufacturing locations, shipping locations, and certificates showing compliance.
- de. Cementitious materials must be stored and kept dry and free from contaminants.

2.3.1.2 Blended Cements

- a. Blended cements must conform to ASTM C595/C595M Type IP or IS.
- b. Slag cement added to the Type IS blend must meet ASTM C989/C989M.
- c. The pozzolan added to the Type IP blend must be ASTM C618 Class F fly ash and must be interground with the cement clinker. The manufacturer must state in writing that the amount of pozzolan in the finished cement will not vary more than plus or minus 5 mass percent of the finished cement from lot-to-lot or within a lot. The percentage and type of pozzolan used in the blend must not change from that submitted for the aggregate evaluation and mixture proportioning.

2.3.1.3 Fly Ash

- a. ASTM C618, Class F, except that the maximum allowable loss on ignition must not exceed 6 percent.
- b. Fly ash content must be a minimum of 20 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level, provide the maximum amount of fly ash permittable that meets the code requirements for cement content. Report the chemical analysis of the fly ash in accordance with ASTM C311/C311M. Evaluate and classify fly ash in accordance with ASTM D5759.

2.3.1.4 Slag cement

ASTM C989/C989M, Grade 100. Slag content must be a minimum of 25 percent by weight of cementitious material.

2.3.1.5 Other Supplementary Cementitious Materials

Natural pozzolan must be raw or calcined and conform to ASTM C618, Class N, including the optional requirements for uniformity and effectiveness in controlling ASR and must have an ignition loss not exceeding 3 percent. Class N pozzolan for use in mitigating ASR must have a Calcium Oxide (CaO) content of less than 13 percent and total equivalent alkali content less than 3 percent.

Ultra Fine Fly Ash (UFFA) and Ultra Fine Pozzolan (UFP) must conform to ASTM C618, Class F or N, and the following additional requirements:

- a. The strength activity index at 28 days of age must be at least 95 percent of the control specimens.
- b. The average particle size must not exceed 6 microns.
- c. The sum of $\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3$ must be greater than 77 percent.

2.3.2 Water

- a. Water or ice must comply with the requirements of ASTM C1602/C1602M.
- b. Minimize the amount of water in the mix. Improve workability by adjusting the grading of the aggregate and using admixture rather than by adding water.
- c. Water must be potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.
- d. Protect mixing water and ice from contamination during storage and delivery.
- e. Submit test report showing water complies with ASTM C1602/C1602M.

2.3.3 Aggregate

2.3.3.1 Normal-Weight Aggregate

- a. Aggregates must conform to ASTM C33/C33M unless otherwise specified in the Contract Documents or approved by the contracting officer.
- b. Aggregates used in concrete must be obtained from the same sources and have the same size range as aggregates used in concrete represented by submitted field test records or used in trial mixtures.
- c. Provide sand that is at least 50 percent acid insoluble based on ASTM D3042.
- d. Store and handle aggregate in a manner that will avoid segregation and prevents contamination by other materials or other sizes of aggregates. Store aggregates in locations that will permit them to drain freely. Do not use aggregates that contain frozen lumps.
- e. Submit types, pit or quarry locations, producers' names, aggregate supplier statement of compliance with ASTM C33/C33M, and ASTM C1293 expansion data not more than 18 months old.

2.3.4 Admixtures

- a. Chemical admixtures must conform to ASTM C494/C494M.
- b. Air-entraining admixtures must conform to ASTM C260/C260M.
- c. Chemical admixtures for use in producing flowing concrete must conform to ASTM C1017/C1017M.
- d. Do not use calcium chloride admixtures.
- e. Use a corrosion-inhibiting admixture for concrete classified under exposure category C1.
- f. Admixtures used in concrete must be the same as those used in the concrete represented by submitted field test records or used in trial mixtures.
- g. Protect stored admixtures against contamination, evaporation, or damage.
- h. To ensure uniform distribution of constituents, provide agitating equipment for admixtures used in the form of suspensions or unstable solutions. Protect liquid admixtures from freezing and from temperature changes that would adversely affect their characteristics.
- i. Submit types, brand names, producers' names, manufacturer's technical data sheets, and certificates showing compliance with standards required herein.

2.4 MISCELLANEOUS MATERIALS

2.4.1 Concrete Curing Materials

Provide concrete curing material in accordance with ACI 301 Section 5 and ACI 308.1 Section 2. Submit product data for concrete curing compounds.

Submit manufactures instructions for placement of curing compound.

2.4.2 Nonshrink Grout

Nonshrink grout in accordance with ASTM C1107/C1107M.

2.4.3 Expansion/Contraction Joint Filler

ASTM D1751 or ASTM D1752 Type I or Type II. Material must be 1/2 inch thick, unless otherwise indicated.

2.4.4 Joint Sealants

Submit manufacturer's product data, indicating VOC content.

2.4.4.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D6690 or ASTM C920, Type M, Class 25, Use T.

2.4.4.2 Vertical Surfaces Greater Than 3 Percent Slope

ASTM C920, Type M, Grade NS, Class 25, Use T.

2.4.4.3 Preformed Polychloroprene Elastomeric Type

ASTM D2628.

2.4.5 Vapor Retarder

ASTM E1745 Class C polyethylene sheeting, minimum 15 mil thickness or other equivalent material with a maximum permance rating of 0.04 perms per ASTM E96/E96M.

Consider plastic vapor retarders and adhesives with a high recycled content, low toxicity low VOC (Volatile Organic Compounds) levels.

2.5 CONCRETE MIX DESIGN

2.5.1 Properties and Requirements

- a. Use materials and material combinations listed in this section and the contract documents.
- b. Cementitious material content must be adequate for concrete to satisfy the specified requirements for strength, w/cm, durability, and finishability described in this section and the contract documents.
- c. Selected target slump must meet the requirements this section, the contract documents, and must not exceed 9 in. Concrete must not show visible signs of segregation.
- d. The target slump must be enforced for the duration of the project. Determine the slump by ASTM C143/C143M. Slump tolerances must meet the requirements of ACI 117.
- e. The nominal maximum size of coarse aggregate for a mixture must not exceed three-fourths of the minimum clear spacing between reinforcement, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

- f. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3. The total air content must be in accordance with the requirements of the paragraph titled DURABILITY.
- g. Measure air content at the point of delivery in accordance with ASTM C173/C173M or ASTM C231/C231M.
- h. Concrete for slabs to receive a hard-troweled finish must not contain an air-entraining admixture or have a total air content greater than 3 percent.
- i. Concrete properties and requirements for each portion of the structure are specified in the table below. Refer to the paragraph titled DURABILITY for more details on exposure categories and their requirements.

	Minimum $f'c$ psi	Exposure
Footings / Foundations	3000 at 28 days	S0; C0; W0; F0
Exterior Slabs-on-ground / Equipment Pads	4500 at 28 days	S0; C2; W0; F2

2.5.2 Durability

2.5.2.1 Alkali-Aggregate Reaction

Do not use any aggregate susceptible to alkali-carbonate reaction (ACR). Use one of the three options below for qualifying concrete mixtures to reduce the potential of alkali-silica reaction (ASR):

- a. For each aggregate used in concrete, the expansion result determined in accordance with ASTM C1293 must not exceed 0.04 percent at one year.
- b. For each aggregate used in concrete, the expansion result of the aggregate and cementitious materials combination determined in accordance with ASTM C1567 must not exceed 0.10 percent at an age of 16 days.
- c. Alkali content in concrete (LBA) must not exceed 4 pounds per cubic yard for moderately reactive aggregate or 3 pounds per cubic yard for highly reactive aggregate. Reactivity must be determined by testing in accordance with ASTM C1293 and categorized in accordance with ASTM C1778. Alkali content is calculated as follows:

$$\text{LBA} = (\text{cement content, pounds per cubic yard}) \times (\text{equivalent alkali content of portland cement in percent}/100 \text{ percent})$$

2.5.2.2 Freezing and Thawing Resistance

- a. Provide concrete meeting the following requirements based on exposure class assigned to members for freezing-and-thawing exposure in Contract Documents:

Exposure class	Maximum w/cm^*	Minimum $f'c$, psi	Air content	Additional Requirements
F0	N/A	2500		N/A
F1	0.55	3500	Depends on aggregate size	N/A
F2	0.45	4500	Depends on aggregate size	See limits on maximum cementitious material by mass
F3	0.40	5000	Depends on aggregate size	See limits on maximum cementitious material by mass
F3 plain concrete	0.45	4500	Depends on aggregate size	See limits on maximum cementitious material by mass

- b. Concrete must be air entrained for members assigned to Exposure Class F1, F2, or F3. The total air content must meet the requirements of the following table:

Nominal maximum aggregate size, in.	Total air content, percent**	
	Exposure Class F2 and F3	Exposure Class F1
3/8	7.5	6.0
1/2	7.0	5.5
3/4	6.0	5.0

Nominal maximum aggregate size, in.	Total air content, percent**	
	Exposure Class F2 and F3	Exposure Class F1
1	6.0	4.5
1-1/2	5.5	4.5
2	5.0	4.0
3	5.5	3.5

*Tolerance on air content as delivered must be plus/minus 1.5 percent.
 ^For f'c greater than 5000 psi, reducing air content by 1.0 percentage point is acceptable.

- c. Submit documentation verifying compliance with specified requirements.
- d. For sections of the structure that are assigned Exposure Class F3, submit certification on cement composition verifying that concrete mixture meets the requirements of the following table:

Cementitious material	Maximum percent of total cementitious material by mass*
Fly ash or other pozzolans conforming to ASTM C618	25
Slag cement conforming to ASTM C989/C989M	50
Silica fume conforming to ASTM C1240	10
Total of fly ash or other pozzolans, slag cement, and silica fume	50^
Total of fly ash or other pozzolans and silica fume	35^

*Total cementitious material also includes ASTM C150/C150M, ASTM C595/C595M, ASTM C845/C845M, and ASTM C1157/C1157M cement. The maximum percentages above must include:

- i. Fly ash or other pozzolans present in ASTM C1157/C1157M or ASTM C595/C595M Type IP blended cement.
- ii. Slag cement present in ASTM C1157/C1157M or ASTM C595/C595M Type IS blended cement.
- iii. Silica fume conforming to ASTM C1240 present in ASTM C1157/C1157M or ASTM C595/C595M Type IP blended cement.

^Fly ash or other pozzolans and silica fume must constitute no more than 25 percent and 10 percent, respectively, of the total mass of the cementitious materials.

2.5.2.3 Corrosion and Chloride Content

- a. Provide concrete meeting the requirements of the following table based on the exposure class assigned to members requiring protection against

reinforcement corrosion in Contract Documents.

- b. Submit documentation verifying compliance with specified requirements.
- c. Water-soluble chloride ion content contributed from constituents including water, aggregates, cementitious materials, and admixtures must be determined for the concrete mixture by ASTM C1218/C1218M at age between 28 and 42 days.
- d. The maximum water-soluble chloride ion (Cl-) content in concrete, percent by mass of cement is as follows:

Exposure class	Maximum w/cm*	Minimum f'c, psi	Maximum water-soluble chloride ion (CL-) content in concrete, percent by mass of cement
Reinforced concrete			
C0	N/A	2500	1.00
C1	N/A	2500	0.30
C2	0.4	5000	0.15
Prestressed concrete			
C0	N/A	2500	0.06
C1	N/A	2500	0.06
C2	0.4	5000	0.06

*The maximum w/cm limits do not apply to lightweight concrete.

2.5.2.4 Sulfate Resistance

- a. Provide concrete meeting the requirements of the following table based on the exposure class assigned to members for sulfate exposure.

Exposure class	Maximum w/cm	Minimum f'c, psi	Required cementitious materials-types			Calcium chloride admixture
			ASTM C150/C150M	ASTM C595/C595M	ASTM C1157/C1157M	
S0	N/A	2500	N/A	N/A	N/A	No restrictions
S1	0.50	4000	II [^]	IP(MS); IS(<70)(MS); IT(MS)	MS	No restrictions
S2	0.45	4500	IV [^]	IP(HS); IS(<70)(HS); IT(HS)	HS	Not permitted

Exposure class	Maximum w/cm	Minimum f'c, psi	Required cementitious materials-types			Calcium chloride admixture
			ASTM C150/C150M	ASTM C595/C595M	ASTM C1157/C1157M	
S3	0.45	4500	V + pozzolan or slag cement**	IP(HS)+ pozzolan or slag cement^; IS (<70)(HS) + pozzolan or slag cement^; IT (HS) + pozzolan or slag cement**	HS + pozzolan or slag cement**	Not permitted

* For seawater exposure, other types of portland cements with tricalcium aluminate (C3A) contents up to 10 percent are acceptable if the w/cm does not exceed 0.40.

** The amount of the specific source of the pozzolan or slag cement to be used shall be at least the amount determined by test or service record to improve sulfate resistance when used in concrete containing Type V cement. Alternatively, the amount of the specific source of the pozzolan or slag used shall not be less than the amount tested in accordance with ASTM C1012/C1012M and meeting the requirements maximum expansion requirements listed herein.

^ Other available types of cement, such as Type III or Type I, are acceptable in exposure classes S1 or S2 if the C3A contents are less than 8 or 5 percent, respectively.

- b. The maximum w/cm limits for sulfate exposure do not apply to lightweight concrete.
- c. Alternative combinations of cementitious materials of those listed in this paragraph are acceptable if they meet the maximum expansion requirements listed in the following table:

Exposure class	Maximum expansion when tested using ASTM C1012/C1012M		
	At 6 months	At 6 months	At 18 months
S1	0.10 percent	N/A	N/A
S2	0.05 percent	0.10 percent^	N/A
S3	N/A	N/A	0.10 percent

^The 12-month expansion limit applies only when the measured expansion exceeds the 6-month maximum expansion limit.

2.5.2.5 Concrete Temperature

The temperature of concrete as delivered must not exceed 95°F.

2.5.2.6 Concrete permeability

- a. Provide concrete meeting the requirements of the following table based on exposure class assigned to members requiring low permeability in the Contract Documents.

Exposure class	Maximum w/cm*	Minimum f'c, psi	Additional minimum requirements
W0	N/A	2500	None
W1	0.5	4000	None

*The maximum w/cm limits do not apply to lightweight concrete.

- b. Submit documentation verifying compliance with specified requirements.

2.5.3 Trial Mixtures

Trial mixtures must be in accordance to ACI 301.

2.5.4 Ready-Mix Concrete

Provide concrete that meets the requirements of ASTM C94/C94M.

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by ASTM C94/C94M:

- a. Type and brand cement
- b. Cement and supplementary cementitious materials content in 94-pound bags per cubic yard of concrete
- c. Maximum size of aggregate
- d. Amount and brand name of admixtures
- e. Total water content expressed by water cementitious material ratio

2.6 REINFORCEMENT

- a. Bend reinforcement cold. Fabricate reinforcement in accordance with fabricating tolerances of ACI 117.
- b. When handling and storing coated reinforcement, use equipment and methods that do not damage the coating. If stored outdoors for more than 2 months, cover coated reinforcement with opaque protective material.
- c. Submit manufacturer's certified test report for reinforcement.

- d. Submit placing drawings showing fabrication dimensions and placement locations of reinforcement and reinforcement supports. Placing drawings must indicate locations of splices, lengths of lap splices, and details of mechanical and welded splices.
- e. Submit request with locations and details of splices not indicated in Contract Documents.

2.6.1 Reinforcing Bars

- a. Reinforcing bars must be deformed, except spirals, load-transfer dowels, and welded wire reinforcement, which may be plain.
- b. ASTM A615/A615M with the bars marked A, Grade 60.
- c. Submit mill certificates for reinforcing bars.

2.6.2 Wire

- a. Plain or deformed steel wire must conform to ASTM A1064/A1064M.

2.6.3 Welded wire reinforcement

- a. Use welded wire reinforcement specified in Contract Documents and conforming to one or more of the specifications given herein.
- b. Plain welded wire reinforcement must conform to ASTM A1064/A1064M, with welded intersections spaced no greater than 12 in. apart in direction of principal reinforcement.

2.6.4 Reinforcing Bar Supports

- a. Provide reinforcement support types within structure as required. Reinforcement supports must conform to CRSI RB4.1. Submit description of reinforcement supports and materials for fastening coated reinforcement if not in conformance with CRSI RB4.1.
- b. Legs of supports in contact with formwork must be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.

2.6.5 Dowels for Load Transfer in Floors

Provide greased dowels for load transfer in floors of the type, design, weight, and dimensions indicated. Provide dowel bars that are plain-billet steel conforming to ASTM A615/A615M, Grade 40. Provide dowel pipe that is steel conforming to ASTM A53/A53M.

Plate dowels must conform to ASTM A36/A36M, and must be of size and spacing indicated. Plate dowel system must minimize shrinkage restraint by using a tapered shape

PART 3 EXECUTION

3.1 EXAMINATION

- a. Do not begin installation until substrates have been properly constructed; verify that substrates are level.
- b. If substrate preparation is the responsibility of another installer,

notify Contracting Officer of unsatisfactory preparation before processing.

- c. Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify Contracting Officer and wait for instructions before beginning installation.

3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete before the concrete is poured.

3.2.1 General

- a. Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.
- b. Remove standing water without washing over freshly deposited concrete. Divert flow of water through side drains provided for such purpose.

3.2.2 Subgrade Under Foundations and Footings

- a. When subgrade material is semi-porous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited, or seal subgrade surface by covering surface with specified vapor retarder.
- b. When subgrade material is porous, seal subgrade surface by covering surface with specified vapor retarder.

3.2.3 Subgrade Under Slabs on Ground

- a. Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.
- b. Previously constructed subgrade or fill must be cleaned of foreign materials
- c. Finish surface of capillary water barrier under interior slabs on ground must not show deviation in excess of 1/4 inch when tested with a 10-foot straightedge parallel with and at right angles to building lines.
- d. Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation indicated.

3.2.4 Edge Forms and Screed Strips for Slabs

- a. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment.
- b. Align concrete surface to elevation of screed strips by use of

strike-off templates or approved compacting-type screeds.

3.2.5 Reinforcement and Other Embedded Items

- a. Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.
- b. When concrete is placed, reinforcement must be free of materials deleterious to bond. Reinforcement with rust, mill scale, or a combination of both will be considered satisfactory, provided minimum nominal dimensions, nominal weight, and minimum average height of deformations of a hand-wire-brushed test specimen are not less than applicable ASTM specification requirements.

3.3 FORMS

- a. Provide forms for concrete placement. Set forms mortar-tight and true to line and grade.
- b. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch. Place chamfer strips in corners of formwork to produce beveled edges on permanently exposed surfaces.
- c. Provide formwork with clean-out openings to permit inspection and removal of debris.
- d. Inspect formwork and remove foreign material before concrete is placed.
- e. At construction joints, lap form-facing materials over the concrete of previous placement. Ensure formwork is placed against hardened concrete so offsets at construction joints conform to specified tolerances.
- f. Fasten form wedges in place after final adjustment of forms and before concrete placement.
- g. Provide anchoring and bracing to control upward and lateral movement of formwork system.
- h. Construct formwork for openings to facilitate removal and to produce opening dimensions as specified and within tolerances.
- i. Position and support expansion joint materials, waterstops, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with removable material to prevent concrete entry into voids.
- j. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign materials before concrete placement.

3.3.1 Coating

- a. Cover formwork surfaces with an acceptable material that inhibits bond with concrete.
- b. If formwork release agent is used, apply to formwork surfaces in accordance with manufacturer's recommendations before placing reinforcement. Remove excess release agent on formwork prior to concrete placement.

- c. Do not allow formwork release agent to contact reinforcement or hardened concrete against which fresh concrete is to be placed.

3.3.2 Reuse

- a. Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised.
- b. Wood forms must not be clogged with paste and must be capable of absorbing high water-cementitious material ratio paste.
- c. Remove leaked mortar from formwork joints before reuse.

3.3.3 Forms for Standard Rough Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-1.0, for formed surfaces that are to be concealed by other construction.

3.3.4 Forms for Standard Smooth Form Finish

Provide formwork in accordance with ACI 301 Section 5 with a surface finish, SF-3.0, for formed surfaces that are exposed to view.

3.3.5 Tolerances for Form Construction

- a. Construct formwork so concrete surfaces conform to tolerances in ACI 117.
- b. Position and secure sleeves, inserts, anchors, and other embedded items such that embedded items are positioned within ACI 117 tolerances.
- c. To maintain specified elevation and thickness within tolerances, install formwork to compensate for deflection and anticipated settlement in formwork during concrete placement. Set formwork and intermediate screed strips for slabs to produce designated elevation, camber, and contour of finished surface before formwork removal. If specified finish requires use of vibrating screeds or roller pipe screeds, ensure that edge forms and screed strips are strong enough to support such equipment.

3.3.6 Removal of Forms and Supports

- a. If vertical formed surfaces require finishing, remove forms as soon as removal operations will not damage concrete.
- b. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform repairs and finishing operations required. If forms are removed before end of specified curing period, provide curing and protection.
- c. Form-facing material and horizontal facing support members may be removed before in-place concrete reaches specified compressive strength if shores and other supports are designed to allow facing removal without deflection of supported slab or member.

3.4 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

- a. Unless otherwise specified, placing reinforcement and miscellaneous materials must be in accordance to ACI 301. Provide bars, welded wire reinforcement, wire ties, supports, and other devices necessary to install and secure reinforcement.
- b. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.
- c. Cast-in-place concrete members must have concrete cover for reinforcement given in the following table unless otherwise indicated:

Concrete Exposure	Member	Reinforcement	Specified cover, in.
Cast against and permanently in contact with ground	All	All	3
Exposed to weather or in contact with ground	All	No. 6 through No. 18 bars	2
		No. 5 bar, W31 or D31 wire, and smaller	1-1/2
Not exposed to weather or in contact with ground	Slabs, joists, and walls	No. 14 and No. 18 bars	1-1/2
		No. 11 bar and smaller	3/4
	Beams, columns, pedestals, and tension ties	Primary reinforcement, stirrups, ties, spirals, and hoops	1-1/2

3.4.1 General

Provide details of reinforcement that are in accordance with the Contract Documents.

3.4.2 Vapor Retarder

- a. Install in accordance with ASTM E1643. Provide beneath the on-grade

concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12 inches and tape.

- b. Remove torn, punctured, or damaged vapor retarder material and provide with new vapor retarder prior to placing concrete. Concrete placement must not damage vapor retarder.

3.4.3 Reinforcement Supports

Provide reinforcement support in accordance with CRSI RB4.1 and ACI 301 Section 3 requirements.

3.4.4 Splicing

As indicated in the Contract Documents. For splices not indicated follow ACI 301. Do not splice at points of maximum stress.

3.4.5 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement and support against displacement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

3.4.6 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

- a. Provide fabrication tolerances that are in accordance with ACI 117.
- b. Provide hooks and bends that are in accordance with the Contract Documents.

Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Rebending of a reinforcing bar that has been bent incorrectly is not be permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

Do not use reinforcement that has any of the following defects:

- a. Bar lengths, depths, and bends beyond specified fabrication tolerances
- b. Bends or kinks not indicated on drawings or approved shop drawings
- c. Bars with reduced cross-section due to rusting or other cause

Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

3.4.7 Placing Reinforcement

Place reinforcement in accordance with ACI 301.

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire reinforcement on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

- a. Provide supports for reinforcing bars that are sufficient in number and have sufficient strength to carry the reinforcement they support, and in accordance with ACI 301 and CRSI 10MSP. Do not use supports to support runways for concrete conveying equipment and similar construction loads.
- b. Equip supports on ground and similar surfaces with sand-plates.
- c. Support welded wire reinforcement as required for reinforcing bars.
- d. Secure reinforcements to supports by means of tie wire. Wire must be black, soft iron wire, not less than 16 gage.
- e. Reinforcement must be accurately placed, securely tied at intersections, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to the Contract Documents.
- f. Bending of reinforcing bars partially embedded in concrete is permitted only as specified in the Contract Documents.

3.4.8 Spacing of Reinforcing Bars

- a. Spacing must be as indicated in the Contract Documents.
- b. Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to preapproval by the Contracting Officer.

3.4.9 Concrete Protection for Reinforcement

Additional concrete protection must be in accordance with the Contract Documents.

3.5 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

In accordance with ASTM C94/C94M, ACI 301, ACI 302.1R and ACI 304R, except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

3.5.1 Measuring

Make measurements at intervals as specified in paragraphs SAMPLING and TESTING.

3.5.2 Mixing

- a. Mix concrete in accordance with ASTM C94/C94M, ACI 301 and ACI 304R.
- b. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 84 degrees F.
- c. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 84 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and submitted water-cementitious material ratio are not exceeded and the required concrete strength is still met. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required.
- d. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch. Do not reconstitute concrete that has begun to solidify.

3.5.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

3.6 PLACING CONCRETE

Place concrete in accordance with ACI 301 Section 5.

3.6.1 Footing Placement

Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width must be a minimum of 4 inches greater than indicated.

3.6.2 Pumping

ACI 304R and ACI 304.2R. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed 2 inches at discharge/placement. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of course aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well-rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

3.6.3 Cold Weather

Cold weather concrete must meet the requirements of ACI 301 unless otherwise specified. Do not allow concrete temperature to decrease below 50 degrees F. Obtain approval prior to placing concrete when the ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 37 degrees F in any 1 hour and 50 degrees F per 24 hours after heat application.

3.6.4 Hot Weather

Hot weather concrete must meet the requirements of ACI 301 unless otherwise specified. Maintain required concrete temperature using Figure 4.2 in ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

3.7 WASTE MANAGEMENT

Provide as specified in the Waste Management Plan and as follows.

3.7.1 Mixing Equipment

Before concrete pours, designate on-site area to be paved later in project for cleaning out concrete mixing trucks. Minimize water used to wash equipment.

3.7.2 Hardened, Cured Waste Concrete

Use hardened, cured waste concrete as aggregate in concrete mix if approved by Contracting Officer.

3.7.3 Reinforcing Steel

Collect reinforcing steel and place in designated area for recycling.

3.7.4 Other Waste

Identify concrete manufacturer's or supplier's policy for collection or return of construction waste, unused material, deconstruction waste, and/or packaging material.

3.8 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

3.8.1 Defects

Repair surface defects in accordance with ACI 301 Section 5.

3.8.2 Formed Surfaces

3.8.2.1 Tolerances

Tolerances in accordance with ACI 117 and as indicated.

3.8.2.2 As-Cast Rough Form

Provide for surfaces not exposed to public view a surface finish SF-1.0. Patch holes and defects in accordance with ACI 301.

3.8.2.3 Standard Smooth Finish

Provide for surfaces exposed to public view a surface finish SF-3.0. Patch holes and defects in accordance with ACI 301.

3.9 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

In accordance with ACI 301 and ACI 302.1R, unless otherwise specified. Where straightedge measurements are specified, Contractor must provide straightedge.

3.9.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.

3.9.1.1 Floated

Use for exterior slabs where not otherwise specified. Finish concrete in accordance with ACI 301 Section 5 for a floated finish.

3.9.1.2 Steel Troweled

Use for floors intended as walking surfaces, and for reception of floor coverings. Finish concrete in accordance with ACI 301 Section 5 for a steel troweled finish.

3.9.1.3 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Finish concrete in accordance with ACI 301 Section 5 for a broomed finish.

3.9.1.4 Pavement

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a

straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by belting. Lay belt flat on the concrete surface and advance with a sawing motion; continue until a uniform but gritty nonslip surface is obtained. Round edges and joints with an edger having a radius of 1/8 inch.

3.9.2 Concrete Walks

Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints 1 inch deep, or one fourth the slab thickness whichever is deeper, with a jointing tool after the surface has been finished. Provide 0.5 inch thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every 50 feet maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/48. Limit variation in cross section to 1/4 inch in 5 feet.

3.10 JOINTS

3.10.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Joints must be perpendicular to main reinforcement. Reinforcement must be continued and developed across construction joints. Locate construction joints as follows:

3.10.1.1 Maximum Allowable Construction Joint Spacing

- a. In slabs on ground, so as to divide slab into areas not in excess of 1,200 square feet.

3.10.2 Isolation Joints in Slabs on Ground

- a. Provide joints at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
- b. Fill joints with premolded joint filler strips 1/2 inch thick, extending full slab depth. Install filler strips at proper level below finish floor elevation with a slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form a groove not less than 3/4 inch in depth where joint is sealed with sealing compound and not less than 1/4 inch in depth where joint sealing is not required. Remove wood strip after concrete has set. Contractor must clean groove of foreign matter and loose particles after surface has dried.

3.10.3 Contraction Joints in Slabs on Ground

- a. Provide joints to form panels as indicated.
- b. Sawcut contraction joints into slab on ground in accordance with ACI 301 Section 5.
- c. Sawcutting will be limited to within 12 hours after set and at 1/4 slab depth.

3.10.4 Sealing Joints in Slabs on Ground

- a. Contraction joints must be sealed with joint sealing compound after concrete curing period. Slightly underfill groove with joint sealing compound to prevent extrusion of compound. Remove excess material as soon after sealing as possible.

3.11 CURING AND PROTECTION

Curing and protection in accordance with ACI 301 Section 5, unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period. Provide moist curing for those areas receiving liquid chemical sealer, hardener, or epoxy coating.

3.11.1 Curing Periods

ACI 301 Section 5, except 10 days for retaining walls, pavement or chimneys. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

3.11.2 Curing Formed Surfaces

Accomplish curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, accomplish final curing of formed surfaces by any of the curing methods specified above, as applicable.

3.11.3 Curing Unformed Surfaces

- a. Accomplish initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, by membrane curing.
- b. Accomplish final curing of unformed surfaces by any of curing methods specified, as applicable.

3.11.4 Temperature of Concrete During Curing

When temperature of atmosphere is 41 degrees F and below, maintain temperature of concrete at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, make arrangements before start of concrete

placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete must be uniform and not exceed 37 degrees F in any 1 hour nor 80 degrees F in any 24-hour period.

3.11.5 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

3.11.6 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

3.12 FIELD QUALITY CONTROL

3.12.1 Sampling

ASTM C172/C172M. Collect samples of fresh concrete to perform tests specified. ASTM C31/C31M for making test specimens.

3.12.2 Testing

3.12.2.1 Slump Tests

ASTM C143/C143M. Take concrete samples during concrete placement/discharge. The maximum slump may be increased as specified with the addition of an approved admixture provided that the water-cementitious material ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

3.12.2.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

3.12.2.3 Compressive Strength Tests

ASTM C39/C39M. Make six 6 inch by 12 inch test cylinders for each set of tests in accordance with ASTM C31/C31M, ASTM C172/C172M and applicable requirements of ACI 305R and ACI 306R. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold two cylinder in reserve. Take samples for strength tests of each mix design of and for concrete placed each day not less than once a day, nor less than once for each 100 cubic

yards of concrete for the first 500 cubic yards, then every 500 cubic yards thereafter, nor less than once for each 5400 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. Concrete compressive tests must meet the requirements of this section, the Contract Document, and ACI 301. Retest locations represented by erratic core strengths. Where retest does not meet concrete compressive strength requirements submit a mitigation or remediation plan for review and approval by the contracting officer. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

3.12.2.4 Air Content

ASTM C173/C173M or ASTM C231/C231M for normal weight concrete. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

3.12.2.5 Strength of Concrete Structure

The strength of the concrete structure will be considered to be deficient if any of the following conditions are identified:

- a. Failure to meet compressive strength tests as evaluated.
- b. Reinforcement not conforming to requirements specified.
- c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.
- d. Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified.
- e. Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.
- f. Poor workmanship likely to result in deficient strength.

Where the strength of the concrete structure is considered deficient submit a mitigation or remediation plan for review and approval by the contracting officer.

3.12.2.6 Non-Conforming Materials

Factors that indicate that there are non-conforming materials include (but not limited to) excessive compressive strength, inadequate compressive strength, excessive slump, excessive voids and honeycombing, concrete delivery records that indicate excessive time between mixing and placement, or excessive water was added to the mixture during delivery and placement. Any of these indicators alone are sufficient reason for the Contracting Officer to request additional sampling and testing.

Investigations into non-conforming materials must be conducted at the Contractor's expense. The Contractor must be responsible for the investigation and must make written recommendations to adequately mitigate or remediate the non-conforming material. The Contracting Officer may accept, accept with reduced payment, require mitigation, or require removal and replacement of non-conforming material at no additional cost

to the Government.

3.12.2.7 Testing Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements or there are non-conforming materials, make cores drilled from hardened concrete for compressive strength determination in accordance with ASTM C42/C42M, and as follows:

- a. Take at least three representative cores from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Contracting Officer.
- b. Test cores after moisture conditioning in accordance with ASTM C42/C42M if concrete they represent is more than superficially wet under service.
- c. Air dry cores, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and test dry if concrete they represent is dry under service conditions.
- d. Strength of cores from each member or area are considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.

Fill core holes solid with patching mortar and finished to match adjacent concrete surfaces.

Correct concrete work that is found inadequate by core tests in a manner approved by the Contracting Officer.

3.13 REPAIR, REHABILITATION AND REMOVAL

Before the Contracting Officer accepts the structure the Contractor must inspect the structure for cracks, damage and substandard concrete placements that may adversely affect the service life of the structure. A report documenting these defects must be prepared which includes recommendations for repair, removal or remediation must be submitted to the Contracting Officer for approval before any corrective work is accomplished.

3.13.1 Crack Repair

Prior to final acceptance, all cracks in excess of 0.02 inches wide must be documented and repaired. The proposed method and materials to repair the cracks must be submitted to the Contracting Officer for approval. The proposal must address the amount of movement expected in the crack due to temperature changes and loading.

3.13.2 Repair of Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Concrete surfaces with weak surfaces less than 1/4 inch thick must be diamond ground to remove the weak surface. Surfaces containing weak surfaces greater than 1/4 inch thick must be removed and replaced or mitigated in a manner acceptable to

the Contracting Officer.

3.13.3 Failure of Quality Assurance Test Results

Proposed mitigation efforts by the Contractor must be approved by the Contracting Officer prior to proceeding.

-- End of Section --

SECTION 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE (**SIDEWALKS ONLY**)
05/14

PART 1 GENERAL

1.1 SUMMARY

Perform all work in accordance with ACI 318.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 301	(2016) Specifications for Structural Concrete
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
ACI 347R	(2014; Errata 1 2017) Guide to Formwork for Concrete
ACI SP-66	(2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31/C31M	(2019a) Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2020) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94/C94M	(2020) Standard Specification for Ready-Mixed Concrete
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C685/C685M	(2017) Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C1064/C1064M	(2017) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1602/C1602M	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM E96/E96M	(2016) Standard Test Methods for Water Vapor Transmission of Materials

ASTM E1745	(2017) Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials
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1.3 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

- Air-Entraining Admixture
- Water-Reducing or Retarding Admixture
- Curing Materials
- Expansion Joint Filler Strips, Premolded
- Conveying and Placing Concrete
- Formwork
- Mix Design Data
- Ready-Mix Concrete
- Mechanical Reinforcing Bar Connectors
- Air-Entraining Mixture
- Fly Ash

SD-06 Test Reports

- Aggregates
- Concrete Mixture Proportions
- Compressive Strength Testing
- Slump
- Air Content
- Water

SD-07 Certificates

- Cementitious Materials
- Pozzolan
- Aggregates
- Delivery Tickets

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

The Government retains the option to sample and test aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Obtain samples of aggregates at the point of batching in accordance with ASTM D75/D75M. Sample concrete in accordance with ASTM C172/C172M. Determine slump and air content in accordance with ASTM C143/C143M and ASTM C231/C231M, respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with ASTM C31/C31M. Test compression test specimens in accordance with ASTM C39/C39M. Take samples

for strength tests not less than once each shift in which concrete is produced. Provide a minimum of five specimens from each sample; two to be tested at 28 days (90 days if pozzolan is used) for acceptance, two will be tested at 7 days for information and one held in reserve.

2.1.1 Strength

Acceptance test results are the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f'_c , but not more than 20 percent, and no individual acceptance test result falls below f'_c by more than 500 psi.

2.1.2 Construction Tolerances

Apply a Class "C" finish to all surfaces except those specified to receive a Class "D" finish. Apply a Class "D" finish to all post-construction surfaces which will be permanently concealed. Surface requirements for the classes of finish required are as specified in ACI 117.

2.1.3 Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions must include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per yard of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. The specified compressive strength f'_c is 3,000 psi at 28 days (90 days if pozzolan is used). The maximum nominal size coarse aggregate is 3/4 inch, in accordance with ACI 304R. The air content must be between 4.5 and 7.5 percent with a slump between 2 and 5 inches. The maximum water-cementitious material ratio is 0.50. Submit the applicable test reports and mixture proportions that will produce concrete of the quality required, ten days prior to placement of concrete.

2.2 MATERIALS

Submit manufacturer's literature from suppliers which demonstrates compliance with applicable specifications for the specified materials.

2.2.1 Cementitious Materials

Submit Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Also, certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:

2.2.1.1 Portland Cement

ASTM C150/C150M, Type I, including false set requirements with tri-calcium aluminates (C3A) content less than 10 percent and a maximum cement-alkali content of 0.80 percent Na_2Oe (sodium oxide) equivalent.

2.2.1.2 Pozzolan

Provide pozzolan that conforms to ASTM C618, Class F, including requirements of Tables 1A and 2A.

2.2.2 Aggregates

For fine and coarse aggregates meet the quality and grading requirements of ASTM C33/C33M, Class Designations 4M or better. Submit certificates of compliance and test reports for aggregates showing the material(s) meets the quality and grading requirements of the specifications under which it is furnished.

2.2.3 Admixtures

Provide admixtures, when required or approved, in compliance with the appropriate specification listed. Retest chemical admixtures that have been in storage at the project site, for longer than 6 months or that have been subjected to freezing, at the expense of the Contractor at the request of the Contracting Officer and will be rejected if test results are not satisfactory.

2.2.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of ASTM C260/C260M.

2.2.3.2 Water-Reducing or Retarding Admixture

Provide water-reducing or retarding admixture meeting the requirements of ASTM C494/C494M, Type A, B, or D.

2.2.4 Water

Mixing and curing water in compliance with the requirements of ASTM C1602/C1602M; free of injurious amounts of oil, acid, salt, or alkali. Submit test report showing water complies with ASTM C1602/C1602M.

2.2.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of ASTM A615/A615M, Grade 60, deformed. Provide welded steel wire reinforcement conforming to the requirements of ASTM A1064/A1064M. Detail reinforcement not indicated in accordance with ACI 301 and ACI SP-66. Provide mechanical reinforcing bar connectors in accordance with ACI 301 and provide 125 percent minimum yield strength of the reinforcement bar.

2.2.6 Expansion Joint Filler Strips, Premolded

Expansion joint filler strips, premolded of sponge rubber conforming to ASTM D1752, Type I.

2.2.7 Formwork

Design and engineer the formwork as well as its construction in accordance with ACI 301 Section 2 and 5 and ACI 347R. Fabricate of wood, steel, or other approved material. Submit formwork design prior to the first concrete placement.

2.2.8 Form Coatings

Provide form coating in accordance with ACI 301.

2.2.9 Vapor Barrier

ASTM E1745 Class A polyethylene sheeting, minimum 10 mil thickness or other equivalent material with a maximum permeance rating of 0.04 perms per ASTM E96/E96M.

Consider plastic vapor retarders and adhesives with a high recycled content, low toxicity low VOC (Volatile Organic Compounds) levels.

2.2.10 Curing Materials

Provide curing materials in accordance with ACI 301, Section 5.

2.3 READY-MIX CONCRETE

Provide ready-mix concrete with mix design data conforming to ACI 301 Part 2. Submit delivery tickets in accordance with ASTM C94/C94M for each ready-mix concrete delivery, include the following additional information: .

- a. Type and brand cement
- b. Cement content in 94-pound bags per cubic yard of concrete
- c. Maximum size of aggregate
- d. Amount and brand name of admixture
- e. Total water content expressed by water cementitious material ratio

PART 3 EXECUTION

3.1 PREPARATION

Prepare construction joints to expose coarse aggregate. The surface must be clean, damp, and free of laitance. Construct ramps and walkways, as necessary, to allow safe and expeditious access for concrete and workmen. Remove snow, ice, standing or flowing water, loose particles, debris, and foreign matter. Satisfactorily compact earth foundations. Make spare vibrators available. Placement cannot begin until the entire preparation has been accepted by the Government.

3.1.1 Embedded Items

Secure reinforcement in place after joints, anchors, and other embedded items have been positioned. Arrange internal ties so that when the forms are removed the metal part of the tie is not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Prepare embedded items so they are free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. Provide all equipment needed to place, consolidate, protect, and cure the concrete at the placement site and in good operating condition.

3.1.2 Formwork Installation

Forms must be properly aligned, adequately supported, and mortar-tight. Provide smooth form surfaces, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Chamfer all exposed joints and edges , unless otherwise indicated.

3.1.3 Production of Concrete

3.1.3.1 Ready-Mixed Concrete

Provide ready-mixed concrete conforming to ASTM C94/C94M except as otherwise specified.

3.1.3.2 Concrete Made by Volumetric Batching and Continuous Mixing

Conform to ASTM C685/C685M.

3.2 CONVEYING AND PLACING CONCRETE

Convey and place concrete in accordance with ACI 301, Section 5.

3.2.1 Cold-Weather Requirements

Place concrete in cold weather in accordance with ACI 306R

3.2.2 Hot-Weather Requirements

Place concrete in hot weather in accordance with ACI 305R

3.3 FINISHING

3.3.1 Temperature Requirement

Do not finish or repair concrete when either the concrete or the ambient temperature is below 50 degrees F.

3.3.2 Finishing Unformed Surfaces

3.3.2.1 Expansion and Contraction Joints

Provide 1/2 inch thick transverse expansion joints where new work abuts an existing concrete. Provide expansion joints at a maximum spacing of 30 feet on center in sidewalks, unless otherwise indicated. Provide contraction joints at a maximum spacing of 5 linear feet in sidewalks, unless otherwise indicated. Cut contraction joints at a minimum of 1 inch(es) deep with a jointing tool after the surface has been finished.

3.4 CURING AND PROTECTION

Cure and protect in accordance with ACI 301, Section 5.

3.5 FORM WORK

Provide form work in accordance with ACI 301, Section 2 and Section 5.

3.5.1 Removal of Forms

Remove forms in accordance with ACI 301, Section 2.

3.6 STEEL REINFORCING

Reinforcement must be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.

3.6.1 Fabrication

Shop fabricate steel reinforcement in accordance with ACI 318 and ACI SP-66. Provide shop details and bending in accordance with ACI 318 and ACI SP-66.

3.6.2 Splicing

Perform splices in accordance with ACI 318 and ACI SP-66.

3.6.3 Supports

Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

3.7 EMBEDDED ITEMS

Before placing concrete, take care to determine that all embedded items are firmly and securely fastened in place. Provide embedded items free of oil and other foreign matter, such as loose coatings of rust, paint and scale. Embedding of wood in concrete is permitted only when specifically authorized or directed.

3.8 TESTING AND INSPECTING

Report the results of all tests and inspections conducted at the project site informally at the end of each shift. Submit written reports weekly. Deliver within three days after the end of each weekly reporting period. See Section 01 45 10 QUALITY CONTROL.

3.8.1 Field Testing Technicians

The individuals who sample and test concrete must have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.8.2 Preparations for Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement to certify that it is ready to receive concrete.

3.8.3 Sampling and Testing

- a. Obtain samples and test concrete for quality control during placement. Sample fresh concrete for testing in accordance with ASTM C172/C172M. Make six test cylinders.
- b. Test concrete for compressive strength at 7 and 28 days for each design mix and for every 100 cubic yards of concrete. Test two cylinders at 7 days; two cylinders at 28 days; and hold two cylinders in reserve. Conform test specimens to ASTM C31/C31M. Perform

compressive strength testing conforming to ASTM C39/C39M.

- c. Test slump at the site of discharge for each design mix in accordance with ASTM C143/C143M. Check slump twice during each shift that concrete is produced for each strength of concrete required.
- d. Test air content for air-entrained concrete in accordance with ASTM C231/C231M. Test concrete using lightweight or extremely porous aggregates in accordance with ASTM C173/C173M. Check air content at least twice during each shift that concrete is placed for each strength of concrete required.
- e. Determine temperature of concrete at time of placement in accordance with ASTM C1064/C1064M. Check concrete temperature at least twice during each shift that concrete is placed for each strength of concrete required.

3.8.4 Action Required

3.8.4.1 Placing

Do not begin placement until the availability of an adequate number of acceptable vibrators, which are in working order and have competent operators, has been verified. Discontinue placing if any lift is inadequately consolidated.

3.8.4.2 Air Content

Whenever an air content test result is outside the specification limits, adjust the dosage of the air-entrainment admixture prior to delivery of concrete to forms.

3.8.4.3 Slump

Whenever a slump test result is outside the specification limits, adjust the batch weights of water and fine aggregate prior to delivery of concrete to the forms. Make the adjustments so that the water-cementitious material ratio does not exceed that specified in the submitted concrete mixture proportion and the required concrete strength is still met.

-- End of Section --

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SECTION 04 20 00

UNIT MASONRY
11/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1019	(2014) Standard Test Method for Sampling and Testing Grout
ASTM C129	(2014a) Standard Specification for Nonloadbearing Concrete Masonry Units
ASTM C1384	(2012a) Standard Specification for Admixtures for Masonry Mortars
ASTM C207	(2018) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C216	(2015) Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C270	(2019) Standard Specification for Mortar for Unit Masonry
ASTM C476	(2010) Standard Specification for Grout for Masonry

THE MASONRY SOCIETY (TMS)

TMS MSJC	(2011) Masonry Standard Joint Committee's (MSJC) Book - Building Code Requirements and Specification for Masonry Structures, Containing TMS 402/ACI 530/ASCE 5, TMS 602/ACI 530.1/ASCE 6, and Companion Commentaries
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1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop DrawingsCut CMU Drawings

SD-03 Product Data

Hot Weather Procedures

Cold Weather Procedures

Clay or Shale Brick

Cement

Cementitious Materials

SD-04 Samples

Clay or Shale Brick

Concrete Masonry Units (CMU)

SD-05 Design Data

Masonry Compressive Strength

SD-07 Certificates

Concrete Masonry Units (CMU)

Cementitious Materials

Admixtures for Masonry Mortar

SD-08 Manufacturer's Instructions

Admixtures for Masonry Mortar

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver, store, handle, and protect material to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance and size of project site.

1.3.1 Masonry Units

Cover and protect masonry units from precipitation. Conform to handling and storage requirements of TMS MSJC.

- a. Mark prefabricated lintels on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.3.2 Reinforcement, Anchors, and Ties

Store steel reinforcing bars, coated anchors, ties, and joint reinforcement above the ground. Maintain steel reinforcing bars and uncoated ties free of loose mill scale and loose rust.

1.3.3 Cementitious Materials, Sand and Aggregates

Deliver cementitious and other packaged materials in unopened containers, plainly marked and labeled with manufacturers' names and brands. Store cementitious material in dry, weathertight enclosures or completely cover. Handle cementitious materials in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Store sand and aggregates in a manner to prevent contamination and segregation.

1.4 PROJECT/SITE CONDITIONS

Conform to TMS MSJC for hot and cold weather masonry erection.

1.4.1 Hot Weather Procedures

When ambient air temperature exceeds 100 degrees F, or exceeds 90 degrees F and the wind velocity is greater than 8 mph, comply with TMS MSJC Article 1.8 D for: preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

1.4.2 Cold Weather Procedures

When ambient temperature is below 40 degrees F, comply with TMS MSJC Article 1.8 C for: preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Performance - Verify Masonry Compressive Strength

Verify specified compressive strength of masonry using the "Unit Strength Method" of TMS MSJC. Submit calculations and certifications of unit and mortar strength.

2.2 MANUFACTURED UNITS

2.2.1 General Requirements

Do not change the source of materials, which will affect the appearance of the finished work, after the work has started except with Contracting Officer's approval. Submit test reports from an approved independent laboratory. Certify test reports on a previously tested material as the same materials as that proposed for use in this project. Submit certificates of compliance stating that the materials meet the specified requirements.

2.2.2 Clay or Shale Brick

2.2.2.1 General

2.2.2.1.1 Sample Submittal

Submit brick samples as specified, showing the color range and texture of clay or shale brick. Limit units used on the project to those that conform to the approved sample. Submit sample of colored mortar with applicable masonry unit and color samples of three stretcher units and one unit for each type of special shape.

2.2.2.1.2 Uniformity

Manufacture bricks at one time and from the same run. Deliver clay or shale brick units factory-blended to provide a uniform appearance and color range in the completed wall.

2.2.2.2 Solid Clay or Shale Brick

Provide solid clay or shale brick that conforms to ASTM C216, Type FBS .

Provide brick with specified sizes.

- a. Match existing brick. (Modular size, 3-5/8 inches thick, 2-1/4 inches high, and 7-5/8 inches long.)

2.2.3 Concrete Units

2.2.3.1 Concrete Masonry Units (CMU)

2.2.3.1.1 Cement

Use only cement that has a low alkali content and is of one brand.

2.2.3.1.2 Size

Provide units with specified dimension of 7-5/8" inches wide, 7-5/8" inches high, and 15-5/8" inches long.

2.2.3.1.3 Surfaces

Provide units with exposed surfaces that are smooth and of uniform texture.

2.2.3.1.4 Unit Types

- a. Hollow Non-Load-Bearing Units: ASTM C129, lightweight or medium weight. Load-bearing units may be provided in lieu of non-load-bearing units.

2.2.3.1.5 Jamb Units

Provide jamb units of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved.

Provide sash jamb units with a 3/4 by 3/4 inch groove near the center at end of each unit.

2.3 EQUIPMENT

2.3.1 Vibrators

Maintain at least one spare vibrator on site at all times.

2.3.2 Grout Pumps

Pumping through aluminum tubes is not permitted.

2.4 MATERIALS

2.4.1 Mortar Materials

2.4.1.1 Cementitious Materials

Provide cementitious materials that conform to those permitted by ASTM C270.

2.4.1.2 Hydrated Lime and Alternates

Provide lime that conforms to one of the materials permitted by ASTM C207 for use in combination with portland cement, hydraulic cement, and blended hydraulic cement. Do not use lime in combination with masonry cement or mortar cement.

2.4.1.3 Admixtures for Masonry Mortar

In cold weather, use a non-chloride based accelerating admixture that conforms to ASTM C1384, unless Type III portland cement is used in the mortar.

2.4.1.4 Aggregate and Water

Provide aggregate (sand) and water that conform to materials permitted by ASTM C270.

2.4.2 Grout and Ready-Mix Grout Materials

2.4.2.1 Cementitious Materials for Grout

Provide cementitious materials that conform to those permitted by ASTM C476.

2.4.2.2 Aggregate and Water

Provide fine and coarse aggregates and water that conform to materials permitted by ASTM C476.

2.5 MORTAR AND GROUT MIXES

2.5.1 Mortar Mix

- a. Provide Type N or S mortar for non-load-bearing, non-shear-wall interior masonry.

2.5.2 Grout and Ready Mix Grout Mix

Use grout that conforms to ASTM C476, fine. Use conventional grout with a slump between 8 and 11 inches. Use self-consolidating grout with slump flow of 24 to 30 inches and a visual stability index (VSI) not greater than 1. Provide minimum grout strength of 2000 psi in 28 days, as tested in accordance with ASTM C1019. Do not change proportions and do not use materials with different physical or chemical characteristics in grout for the work unless additional evidence is furnished that grout meets the specified requirements. Use ready-mixed grout that conforms to ASTM C476.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to start of work, verify the applicable conditions as set forth in TMS MSJC, inspection.

3.2 PREPARATION

3.2.1 Stains

Protect exposed surfaces from mortar and other stains. When mortar joints

are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

3.2.2 Loads

Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

3.2.3 Concrete Surfaces

Where masonry is to be placed, clean concrete of laitance, dust, dirt, oil, organic matter, or other foreign materials and slightly roughen to provide a surface texture with a depth of at least 1/8 inch. Sandblast, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.4 Shelf Angles

Adjust shelf angles as required to keep the masonry level and at the proper elevation.

3.3 ERECTION

3.3.1 General

- a. Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Lay masonry units in running bond pattern. Lay facing courses level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances is plus or minus 1/2 inch. Adjust each unit to its final position while mortar is still soft and has plastic consistency.
- b. Remove and clean units that have been disturbed after the mortar has stiffened, and relay with fresh mortar. Keep air spaces, cavities, chases, expansion joints, and spaces to be grouted free from mortar and other debris. Select units to be used in exposed masonry surfaces from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work.
- c. When necessary to temporarily discontinue the work, step (rack) back the masonry for joining when work resumes. Toothing may be used only when specifically approved by the Contracting Officer. Before resuming work, remove loose mortar and thoroughly clean the exposed joint. Cover the top of walls subjected to rain or snow with nonstaining waterproof covering or membrane when work is not in process. Extend the covering a minimum of 610 mm 2 feet down on each side of the wall and hold securely in place.
- d. UnitEnsure that units being laid and surfaces to receive units are free of water film and frost. Lay solid units in a nonfurrowed full bed of mortar. Bevel mortar for veneer wythes and slope down toward the cavity side. Shove units into place so that the vertical joints are tight. Completely fill vertical joints between solid units with mortar, except where indicated at control, expansion, and isolation joints. Place hollow units so that mortar extends to the depth of the face shell at heads and beds, unless otherwise indicated. Mortar will be permitted to protrude up to 1/2 inch into the space or cells to be

grouted. Provide means to prevent mortar from dropping into the space below or clean grout spaces prior to grouting.

3.3.1.1 Jointing

Tool mortar joints when the mortar is thumbprint hard. Tool horizontal joints after tooling vertical joints. Brush mortar joints to remove loose and excess mortar.

3.3.1.1.1 Tooled Joints

Tool mortar joints in exposed exterior and interior masonry surfaces concave, using a jointer that is slightly larger than the joint width so that complete contact is made along the edges of the unit. Perform tooling so that the mortar is compressed and the joint surface is sealed. Use a jointer of sufficient length to obtain a straight and true mortar joint.

3.3.1.1.2 Flush Joints

Flush cut mortar joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas. Finish flush cut joints by cutting off the mortar flush with the face of the wall. Point joints in unparged masonry walls below grade tight. For architectural units, such as fluted units, completely fill both the head and bed joints and flush cut.

3.3.1.1.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 3/8 inch.

3.3.1.1.4 Joint Widths

- a. Construct brick masonry with mortar joint widths equal to the difference between the specified and nominal dimensions of the unit, within tolerances permitted by TMS MSJC.
- b. Provide 3/8 inch wide mortar joints in concrete masonry, except for prefaced concrete masonry units.
- c. Provide 3/8 inch wide mortar joints on unfaced side of prefaced concrete masonry units and not less than 3/16 inch nor more than 1/4 inch wide on prefaced side.
- d. Maintain mortar joint widths within tolerances permitted by TMS MSJC

3.3.1.2 Cutting and Fitting

Use full units of the proper size wherever possible, in lieu of cut units. Locate cut units where they would have the least impact on the architectural aesthetic goals of the facility. Perform cutting and fitting, including that required to accommodate the work of others, by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Before being placed in the work, dry wet-cut units to the same surface-dry appearance as uncut units being laid in the wall. Provide cut edges that are clean, true and sharp.

- a. Carefully make openings in the masonry so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Provide reinforced masonry lintels above openings over 12 inches wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.
- b. Do not reduce masonry units in size by more than one-third in height and one-half in length. Do not locate cut products at ends of walls, corners, and other openings.

3.3.1.3 Unfinished Work

Rack back unfinished work for joining with new work. Tooothing may be resorted to only when specifically approved by the Contracting Officer. Remove loose mortar and thoroughly clean the exposed joints before laying new work.

3.3.1.4 Clay Masonry Expansion Joints

Provide clay masonry expansion joints as indicated. Construct by leaving a gap. Ensure that no mortar or other noncompressible materials are within the joint. Install backer rod and sealant in accordance with Section 07 92 00 JOINT SEALANTS.

3.3.2 Reinforced, Single Wythe Concrete Masonry Units Walls3.3.2.1 Concrete Masonry Unit Placement

- a. Fully bed units used to form piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout in mortar under both face shells and webs. Provide mortar beds under both face shells for other units. Mortar head joints for a distance in from the face of the unit not less than the thickness of the face shell.
- b. Stiffen double walls at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of each wall within the double wall. Adequately reinforce walls and partitions for support of wall-hung plumbing fixtures when chair carriers are not specified.
- c. Submit drawings showing elevations of walls exposed to view and indicating the location of all cut CMU products.

3.3.3 Lintels

3.3.3.1 Masonry Lintels

Construct masonry lintels with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated. Extend lintel reinforcement beyond each side of masonry opening 40 bar diameters or 24 inches, whichever is greater. Support reinforcing bars in place prior to grouting and locate 1/2 inch above the bottom inside surface of the lintel unit.

3.4 INSTALLATION

3.4.1 Placing Grout

3.4.1.1 General

Fill cells containing reinforcing bars with grout. Solidly grout hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces. Solidly grout cells under lintel bearings on each side of openings for full height of openings. Solidly grout walls below grade, lintels, and bond beams. Units other than open end units may require grouting each course to preclude voids in the units.

Discard site-mixed grout that is not placed within 1-1/2 hours after water is first added to the batch or when the specified slump is not met without adding water after initial mixing. Discard ready-mixed grout that does not meet the specified slump without adding water other than water that was added at the time of initial discharge. Allow sufficient time between grout lifts to preclude displacement or cracking of face shells of masonry units. Provide a grout shear key between lifts when grouting is delayed and the lower lift loses plasticity. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, tear down the wall and rebuild.

3.4.1.2 Vertical Grout Barriers for Multi-Wythe Composite Walls

In multi-wythe composite walls, provide grout barriers in the collar joint not more than 30 feet apart, or as required, to limit the horizontal flow of grout for each pour.

3.4.1.3 Horizontal Grout Barriers

Embed horizontal grout barriers in mortar below cells of hollow units receiving grout.

3.4.1.4 Grout Holes and Cleanouts

3.4.1.4.1 Grout Holes

Provide grouting holes in slabs, spandrel beams, and other in-place overhead construction. Locate holes over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Provide additional openings spaced not more than 16 inches on centers where grouting of hollow unit masonry is indicated. Form such openings not less than 4 inches in diameter or 3 by 4 inches in horizontal dimensions. Upon completion of grouting operations, plug and finish grouting holes to match surrounding surfaces.

3.4.1.4.2 Cleanouts for Hollow Unit Masonry Construction

For hollow masonry units, provide cleanout holes at the bottom of every grout pour in cores containing vertical reinforcement when the height of the grout pour exceeds 5 feet 4 inches. Where all cells are to be grouted, construct cleanout courses using bond beam units in an inverted position to permit cleaning of all cells. Provide cleanout holes at a maximum spacing of 32 inches where all cells are to be filled with grout.

Establish a new series of cleanouts if grouting operations are stopped

for more than 4 hours. Provide cleanouts not less than 3 by 3 inch by cutting openings in one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Do not cleanout holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.4.1.4.3 Cleanouts for Multi-Wythe Composite Masonry Construction

Provide cleanouts for construction of walls that incorporate a grout filled cavity between solid masonry wythes, provide cleanouts at the bottom of every pour by omitting every other masonry unit from one wythe. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Do not plug cleanout holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.4.1.5 Grout Placement

A grout pour is the total height of masonry to be grouted prior to erection of additional masonry. A grout lift is an increment of grout placement within a grout pour. A grout pour is filled by one or more lifts of grout.

- a. Lay masonry to the top of a pour permitted by TMS MSJC Table 7, based on the size of the grout space and the type of grout. Prior to grouting, remove masonry protrusions that extend 1/2 inch or more into cells or spaces to be grouted. Provide grout holes and cleanouts in accordance with paragraph GROUT HOLES AND CLEANOUTS above when the grout pour height exceeds 5 feet 4 inches. Hold reinforcement, bolts, and embedded connections rigidly in position before grouting is started. Do not prewet concrete masonry units.
- b. Place grout using a hand bucket, concrete hopper, or grout pump to fill the grout space without segregation of aggregate. Operate grout pumps to produce a continuous stream of grout without air pockets, segregation, or contamination.
- c. If the masonry has cured at least 4 hours, grout slump is maintained between 10 to 11 inches, and no intermediate reinforced bond beams are placed between the top and bottom of the pour height, place conventional grout in lifts not exceeding 12 feet 8 inches. For the same curing and slump conditions but with intermediate bond beams, limit conventional grout lift to the bottom of the lowest bond beam that is more than 5 feet 4 inches above the bottom of the lift, but do not exceed 12 feet 8 inches. If masonry has not cured at least 4 hours or grout slump is not maintained between 10 to 11 inches, place conventional grout in lifts not exceeding 5 feet 4 inches.
- d. Consolidate conventional grout lift and reconsolidate after initial settlement before placing next lift. For grout pours that are 12 inches or less in height, consolidate and reconsolidate grout by mechanical vibration or puddling. For grout pours that are greater than 12 inches in height, consolidate and reconsolidate grout by mechanical vibration. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation. If previous lift is not

permitted to set, dip vibrator into previous lift. Do not insert vibrators into lower lifts that are in a semi-solidified state. If lower lift sets prior to placement of subsequent lift, form a grout key by terminating grout a minimum of 1-1/2 inch below a mortar joint. Vibrate each vertical cell containing reinforcement in partially grouted masonry. Do not form grout keys within beams.

- e. If the masonry has cured 4 hours, place self-consolidating grout (SCG) in lifts not exceeding the pour height. If masonry has not cured for at least 4 hours, place SCG in lifts not exceeding 5 feet 4 inches. Do not mechanically consolidate self-consolidating grout. Place self-consolidating grout in accordance with manufacturer's recommendations.
- f. Upon completion of each day's grouting, remove waste materials and debris from the equipment, and dispose of outside the masonry.

3.5 APPLICATION

3.5.1 Interface with Other Products

3.5.1.1 Built-In Items

Fill spaces around built-in items with mortar. Point openings around flush-mount electrical outlet boxes in wet locations with mortar. Embed anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in as the masonry work progresses. Fully embed anchors, ties and joint reinforcement in the mortar. Fill cells receiving anchor bolts and cells of the first course below bearing plates with grout, unless otherwise indicated.

3.5.1.2 Door and Window Frame Joints

On the exposed interior and exterior sides of exterior frames, rake joints between frames and abutting masonry walls to a depth of 3/8 inch.

3.5.2 Tolerances

Lay masonry plumb, true to line, with courses level within the tolerances of TMS MSJC, Article 3.3 F.

3.6 FIELD QUALITY CONTROL

3.6.1 Tests

3.7 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, completely remove mortar and grout daubs and splashings from masonry-unit surfaces that will be exposed or painted. Before completion of the work, rake out defects in joints of masonry to be exposed or painted, fill with mortar, and tool to match existing joints. Immediately after grout work is completed, remove scum and stains that have percolated through the masonry work using a low pressure stream of water and a stiff bristled brush. Do not clean masonry surfaces, other than removing excess surface mortar, until mortar in joints has hardened. Leave masonry surfaces clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Do not use metal tools and metal brushes for cleaning.

3.7.1 Dry-Brushing Concrete Masonry

Dry brush exposed concrete masonry surfaces at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.8 PROTECTION

Protect facing materials against staining. Cover top of walls with nonstaining waterproof covering or membrane to protect from moisture intrusion when work is not in progress. Continue covering the top of the unfinished walls until the wall is waterproofed with a complete roof or parapet system. Extend covering a minimum of 2 feet down on each side of the wall and hold securely in place. Before starting or resuming work, clean top surface of masonry in place of loose mortar and foreign material.

-- End of Section --

SECTION 05 51 33

METAL LADDERS

02/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System
for Aluminum Finishes

AMERICAN LADDER INSTITUTE (ALI)

ALI A14.3 (2008; R 2018) Ladders - Fixed - Safety
Requirements

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M (2019) Standard Specification for Carbon
Structural Steel

ASTM A47/A47M (1999; R 2018; E 2018) Standard
Specification for Ferritic Malleable Iron
Castings

ASTM A53/A53M (2020) Standard Specification for Pipe,
Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless

ASTM A123/A123M (2017) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

ASTM A153/A153M (2016a) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A500/A500M (2020) Standard Specification for
Cold-Formed Welded and Seamless Carbon
Steel Structural Tubing in Rounds and
Shapes

ASTM A653/A653M (2019) Standard Specification for Steel
Sheet, Zinc-Coated (Galvanized) or
Zinc-Iron Alloy-Coated (Galvannealed) by
the Hot-Dip Process

ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A924/A924M	(2020) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B26/B26M	(2014; E 2015) Standard Specification for Aluminum-Alloy Sand Castings
ASTM B108/B108M	(2019) Standard Specification for Aluminum-Alloy Permanent Mold Castings
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B221	(2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM D1187/D1187M	(1997; E 2011; R 2011) Asphalt-Base Emulsions for Use as Protective Coatings for Metal

MASTER PAINTERS INSTITUTE (MPI)

MPI 79	(Oct 2009) Alkyd Anti-Corrosive Metal Primer
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SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3	(2018) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.23	(Nov 2016) Ladders
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1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Ladders, Installation Drawings

SD-03 Product Data

Ladders

1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Structural Carbon Steel

ASTM A36/A36M.

2.1.2 Structural Tubing

ASTM A500/A500M.

2.1.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A47/A47M.

2.1.5 Aluminum Alloy Products

Conform to ASTM B209 for sheet plate, ASTM B221 for extrusions and ASTM B26/B26M or ASTM B108/B108M for castings, as applicable. Provide aluminum extrusions at least 1/8 inch thick and aluminum plate or sheet at least 0.050 inch thick.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A123/A123M, ASTM A153/A153M, ASTM A653/A653M or ASTM A924/A924M, G90, as applicable.

2.2.2 Galvanize

Anchor bolts, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780/A780M or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6/NACE No.3. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean.

2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's printed instructions.

2.2.5 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

2.2.6 Aluminum Surfaces

2.2.6.1 Surface Condition

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces.

2.2.6.2 Aluminum Finishes

Unexposed plate and extrusions may have mill finish as fabricated. Sandblast castings' finish, medium, AA DAF45. Unless otherwise specified, provide all other aluminum items with standard mill finish.. Provide a coating thickness not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF45.

2.3 LADDERS

Fabricate vertical ladders conforming to 29 CFR 1910.23 and Section 5 of ALI A14.3. Ladders shall be capable of supporting their maximum intended load. Use 2 1/2 by 3/8 inch steel flats for stringers and 3/4 inch diameter steel rods for rungs. Ladder rungs, step and cleats must be spaced not less than 10 inches and not more than 16 inches wide (measured before installation of ladder safety system), spaced no more than 14 inches apart, plug welded or shouldered and headed into stringers. Install ladders so that the maximum perpendicular distance from the centerline of the steps or rungs, or grab bars, or both, to the nearest permanent object in the back of the ladder or to the finished wall surface will not be less than 7 inches, except for the elevator pit ladders, which have a minimum perpendicular distance of 4.5 inches. Provide heavy clip angles riveted or bolted to the stringer and drilled for not less than two 1/2 inch diameter expansion bolts as indicated. Provide intermediate clip angles not over 48 inches on centers. The top rung of the ladder must be level with the top of the access level, parapet or landing served by the ladder except for hatches or wells. Extend the side rails of through or side step ladders 42 inches above the access level. Provide ladder access

protective swing gates at the top of access/egress level. The drawings must indicate ladder locations and details of critical dimensions and materials.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Provide Exposed fastenings of compatible materials, generally matching in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners will be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports must provide strength and stiffness. Formed joints exposed to the weather to exclude water. Items listed below require additional procedures.

3.2 WORKMANSHIP

Metalwork must be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching must produce clean true lines and surfaces. Continuously weld along the entire area of contact. Do not tack weld exposed connections of work in place. Grid smooth exposed welds. Provide smooth finish on exposed surfaces of work in place, unless otherwise approved. Where tight fits are required, mill joints. Cope or miter corner joints, well formed, and in true alignment. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion anchors, and powder-actuated fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine bolts, carriage bolts and powder-actuated threaded studs for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

3.4 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections. Grind visible welds smooth in the finished installation.

3.5 FINISHES

3.5.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D1187/D1187M,

asphalt-base emulsion.

3.5.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, must be free of rust, grease, dirt and other foreign matter.

3.5.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

3.6 LADDERS

Secure to the adjacent construction with the clip angles attached to the stringer. Secure to masonry or concrete with not less than two 1/2 inch diameter expansion bolts. Install intermediate clip angles not over 48 inches on center. Install brackets as required for securing of ladders welded or bolted to structural steel or built into the masonry or concrete. Ends of ladders must not rest upon floor.

-- End of Section --

SECTION 05 52 00

METAL RAILINGS

02/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 314 (1990; R 2008) Standard Specification for
Steel Anchor Bolts

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2017) Standard Specification for Zinc
(Hot-Dip Galvanized) Coatings on Iron and
Steel Products

ASTM A153/A153M (2016a) Standard Specification for Zinc
Coating (Hot-Dip) on Iron and Steel
Hardware

ASTM A283/A283M (2013) Standard Specification for Low and
Intermediate Tensile Strength Carbon Steel
Plates

ASTM A36/A36M (2019) Standard Specification for Carbon
Structural Steel

ASTM A53/A53M (2020) Standard Specification for Pipe,
Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless

ASTM C514 (2004; E 2009; R 2009) Standard
Specification for Nails for the
Application of Gypsum Board

ASTM E488/E488M (2010) Standard Test Methods for Strength
of Anchors in Concrete and Masonry Elements

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 521 (2001) Pipe Railing Manual

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Pre-Installation Meetings

Within 30 days of Contract Award, submit fabrication drawings to the Contracting Officer for the following items:

- a. Steel Shapes, Plates, Bars and Stripsb. Steel Railings and Handrails
- b. Anchorage and fastening systems

Submit manufacturer's catalog data, including two copies of manufacturers specifications, load tables, dimension diagrams, and anchor details for the following items:

- a. Structural steel plates, shapes, and bars
- b. Protective coating
- c. Steel railings and handrails
- d. Anchorage and fastening systems

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings

Steel Shapes, Plates, Bars and Strips

SD-03 Product Data

Structural Steel Plates, Shapes, and Bars

Protective Coating

MASONRY ANCHORAGE DEVICES

STEEL RAILINGS AND HANDRAILS

Anchorage and Fastening Systems

Samples

Design Data

SD-07 Certificates

Welder Qualification

SD-08 Manufacturer's Instructions

Installation Instructions

1.4 QUALITY ASSURANCE

1.4.1 Welder Qualification

Submit certified welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition be performed on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, make an immediate retest of two test welds and ensure each test weld passes. Failure in the immediate retest will require that the welder be retested after further practice or training and make a complete set of test welds.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide complete, detailed fabrication and installation drawings for all steel shapes, plates, bars and strips used in accordance with the design specifications referenced in this section.

Pre-assemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and application of surface finishes, including zinc coatings.

Submit the following prior to construction: Protective coating, Steel railings and handrails, anchorage and fastening systems, Samples, and Design Data

2.2 GENERAL FABRICATION

Provide railings and handrails detail plans and elevations at not less than 1 inch to 1 foot. Provide details of sections and connections at not less than 3 inches to 1 foot. Also detail setting drawings, diagrams, templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchors.

Use materials of size and thicknesses indicated or, if not indicated, of required size and thickness to produce adequate strength and durability in finished product for intended use. Work materials to dimensions indicated on approved detail drawings, using proven details of fabrication and support. Use type of materials indicated or specified for the various components of work.

Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ensure all exposed edges are eased to a radius of approximately 1/32 inch. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flathead (countersunk) screws or bolts.

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified to be fabricated from cold-finished or cold-rolled stock.

2.3 STRUCTURAL STEEL PLATES, SHAPES AND BARS

Provide structural-size shapes and plates, except plates to be bent or cold-formed, conforming to ASTM A36/A36M, unless otherwise noted.

Provide steel plates, to be bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Provide steel bars and bar-size shapes conforming to ASTM A36/A36M, unless otherwise noted.

2.4 STEEL PIPE

Provide pipe conforming to ASTM A53/A53M, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

2.5 MASONRY ANCHORAGE DEVICES

Provide masonry anchorage devices consisting of expansion shields complying with AASHTO M 314, ASTM E488/E488M and ASTM C514 as follows:

Provide lead expansion shields for machine screws and bolts 1/4 inch and smaller; head-out embedded nut type, single unit class, Group I, Type 1, Class 1.

Provide lead expansion shields for machine screws and bolts larger than 1/4 inch in size; head-out embedded nut type, multiple unit class, Group I, Type 1, Class 2.

2.6 FASTENERS

Provide galvanized zinc-coated fasteners in accordance with ASTM A153/A153M used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

2.7 PROTECTIVE COATING

Provide hot dipped galvanized steelwork as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

2.8 STEEL RAILINGS AND HANDRAILS

Design handrails to resist a concentrated load of 250 lbs in any direction at any point of the top of the rail or 20 lbs per foot applied horizontally to top of the rail, whichever is more severe. NAAMM AMP 521, provide the same size rail and post. Provide pipe collars of the same material and finish as the handrail and posts. Provide series 300 stainless steel pipe collars.

2.8.1 Steel Handrails

Provide steel handrails, including inserts in concrete, steel pipe conforming to ASTM A53/A53M, Grade A or B of equivalent strength. Provide steel railings of 1 1/2 inches nominal size, hot-dip galvanized.

a. Fabrication: Joint posts, rail, and corners by one of the following methods:

- (1) Flush-type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 3/8 inch hexagonal-recessed-head setscrews.
- (2) Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight fitting interior sleeve not less than 6 inches long.
- (3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

Provide kickplates between railing posts where indicated, and consist of 1/8-inch steel flat bars not less than 6 inches high. Secure kickplates as indicated.

Provide galvanized railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components.

PART 3 EXECUTION

3.1 INSTALLATION INSTRUCTIONS

Submit manufacturer's installation instructions for the following products to be used in the fabrication of stair railing and hand rail work:

- a. Structural steel plates, shapes, and bars
- b. Protective coating
- c. Masonry anchorage devices
- d. Steel railings and handrails
- e. Anchorage and fastening systems

Provide complete, detailed fabrication and installation drawings for all steel shapes, plates, bars and strips used in accordance with the design specifications referenced in this section.

3.2 PREPARATION

Adjust stair railings and handrails prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than 4 feet on center. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

Anchor posts in concrete by means of pipe sleeves set and anchored into concrete. Provide sleeves of galvanized, standard weight, steel pipe, not less than 6 inches long, and having an inside diameter not less than 1/2-inch greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to the bottom of the sleeve, with closure width and length not less than 1-inch greater than the outside diameter of the sleeve. After posts have been inserted into sleeves, fill the annular space between post and sleeve with molten lead, sulfur, or a quick-setting hydraulic cement. Cover anchorage joint with a round steel flange welded to the post.

Secure handrails to walls by means of wall brackets and wall return fitting at handrail ends. Provide brackets of malleable iron castings, with not less than 3-inch projection from the finish wall surface to the center of the pipe drilled to receive one 3/8-inch bolt. Locate brackets not more than 60 inches on center. Provide wall return fittings of cast iron castings, flush-type, with the same projection as that specified for wall brackets. Secure wall brackets and wall return fittings to building construction as follows:

For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.

For hollow masonry and stud partition anchorage, use toggle bolts having square heads.

Install toe boards and brackets where indicated. Make splices, where required, at expansion joints. Install removable sections as indicated.

3.3 STEEL HANDRAIL

Install in pipe sleeves embedded in concrete and filled with non-shrink grout or quick setting anchoring cement with anchorage covered with standard pipe collar pinned to post. Secure rail ends by steel pipe flanges anchored by expansion shields and bolts.

3.4 FIELD WELDING

Ensure procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work comply with AWS D1.1/D1.1M.

-- End of Section --

SECTION 06 10 00

ROUGH CARPENTRY

11/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN FOREST & PAPER ASSOCIATION (AF&PA)

AF&PA T10 (2001) Wood Frame Construction Manual for One- and Two-Family Dwellings

AF&PA T101 (2001) National Design Specification (NDS) for Wood Construction

AMERICAN LUMBER STANDARDS COMMITTEE (ALSC)

ALSC PS 20 (2010) American Softwood Lumber Standard

APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA E30 (2005) Engineered Wood Construction Guide

APA E445S (2001; R 2002) Performance Standards and Qualification Policy for Structural-Use Panels (APA PRP-108)

APA F405L (1999) Performance Rated Panels

APA PS 1 (1995) Voluntary Product Standard for Construction and Industrial Plywood

APA PS 2 (2004) Voluntary Product Standard for Wood-Based Structural-Use Panels

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (1996; Addenda A 1999; Errata 2003; R 2005) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B18.5.2.1M (2006; R 2011) Metric Round Head Short Square Neck Bolts

ASME B18.5.2.2M (1982; R 2010) Metric Round Head Square Neck Bolts

ASME B18.6.1 (1981; R 2008) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A 307	(2007b) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A653/A653M	(2019) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 687	(1993) Standard Specification for High-Strength Nonheaded Steel Bolts and Studs
ASTM C 1136	(2009) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 79/C 79M	(2004a) Treated Core and Nontreated Core Gypsum Sheathing Board
ASTM E 96/E 96M	(2005) Standard Test Methods for Water Vapor Transmission of Materials
ASTM F 1667	(2005) Driven Fasteners: Nails, Spikes, and Staples
ASTM F 547	(2006) Nails for Use with Wood and Wood-Base Materials

FM GLOBAL (FM)

FM DS 1-49	(2000) Perimeter Flashing
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NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules	(2007) Rules for the Measurement & Inspection of Hardwood & Cypress
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NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules	(2006) Standard Grading Rules for Northeastern Lumber
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REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)

RIS Grade Use	(1998) Redwood Lumber Grades and Uses
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SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Spec	(1986; Supple. No. 1, Aug 1993) Standard Specifications for Grades of Southern Cypress
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SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (2002) Standard Grading Rules for Southern Pine Lumber

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923 (Rev A; Notice 1) Shield, Expansion (Lag, Machine and Externally Threaded Wedge Bolt Anchors)

CID A-A-1924 (Rev A; Notice 1) Shield, Expansion (Self Drilling Tubular Expansion Shell Bolt Anchors)

CID A-A-1925 (Rev A; Notice 1) Shield Expansion (Nail Anchors)

FS FF-B-588 (Rev E) Bolt, Toggle: and Expansion Sleeve, Screw

FS FF-T-1813 (Basic) Tack

FS UU-B-790 (Rev A) Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17 (2000) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5 (1998) Western Lumber Grading Rules

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Nailers and Nailing Strips

SD-03 Product Data

Oriented Strand Board

Plywood

SD-07 Certificates

Certificates of grade Manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material not normally grade marked meet the specified requirements. Certificate of Inspection for grade marked material by an American Lumber Standards Committee (ALSC) recognized inspection agency prior to shipment.

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure. Store wood I-beams and glue-laminated beams and joists on edge. Adhere to requirements for stacking, lifting, bracing, cutting, notching, and special fastening requirements. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting station and area of work.

1.4 GRADING AND MARKING

1.4.1 Lumber

Mark each piece of framing and board lumber or each bundle of small pieces of lumber with the grade mark of a recognized association or independent inspection agency. Such association or agency shall be certified by the Board of Review, American Lumber Standards Committee, to grade the species used. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

1.4.2 Plywood

Mark each sheet with the mark of a recognized association or independent inspection agency that maintains continuing control over the quality of the plywood. The mark shall identify the plywood by species group or span rating, exposure durability classification, grade, and compliance with APA PS 1. Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

1.5 SIZES AND SURFACING

ALSC PS 20 for dressed sizes of yard and structural lumber. Lumber shall be surfaced four sides. Size references, unless otherwise specified, are nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced. Other measurements are IP or SI standard.

1.6 MOISTURE CONTENT

Air-dry or kiln-dry lumber. Kiln-dry treated lumber after treatment. Maximum moisture content of wood products shall be as follows at the time of delivery to the job site:

- a. Framing lumber and boards - 19 percent maximum
- b. Timbers 5 inches and thicker - 25 percent maximum

1.7 QUALITY ASSURANCE

1.7.1 Certificates of Grade

Submit certificates attesting that products meet the grade requirements

specified in lieu of grade markings where appearance is important and grade marks will deface material.

PART 2 PRODUCTS

2.1 LUMBER

2.1.1 Framing Lumber

Framing lumber such as studs, plates, caps, collar beams, cant strips, bucks, sleepers, nailing strips, and nailers and board lumber such as subflooring and wall and roof sheathing shall be one of the species listed in the table below. Minimum grade of species shall be as listed.

Table of Grades for Framing and Board Lumber

<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
WWPA G-5 standard grading rules	Aspen Douglas Fir-Larch Douglas Fir South Engelmann Spruce -Lodgepole Pine Engelmann Spruce Hem-Fir Idaho White Pine Lodgepole Pine Mountain Hemlock Mountain Hemlock -Hem-Fir Ponderosa Pine -Sugar Pine Ponderosa Pine -Lodgepole Pine Subalpine Fir White Woods Western Woods Western Cedars Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common
WCLIB 17 standard grading rules	Douglas Fir-Larch Hem-Fir Mountain Hemlock Sitka Spruce Western Cedars Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: Standard
SPIB 1003 standard grading rules	Southern Pine	Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	No. 2 Boards
SCMA Spec standard	Cypress	No. 2 Common	No. 2 Common

Table of Grades for Framing and Board Lumber

<u>Grading Rules specifications</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
NELMA Grading Rules standard grading rules	Balsam Fir Eastern Hemlock -Tamarack Eastern Spruce Eastern White Pine Northern Pine Northern Pine Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common except Standard for Eastern White and Northern Pine
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	Construction Heart
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

2.2 PLYWOOD, STRUCTURAL-USE, AND ORIENTED STRAND BOARD (OSB) PANELS

APA PS 1, APA PS 2, APA E445S, and APA F405L respectively.

2.2.1 Subflooring

2.2.1.1 Plywood

C-D Grade, Exposure 1 durability classification, Span rating of 24/16 or greater.

2.3 OTHER MATERIALS

2.3.1 Gypsum Wall Sheathing

ASTM C 79/C 79M, 5/8 inch thick ; 4 feet wide with square edge for supports 16 inches o.c. with or without corner bracing of framing ; 2 feet wide with V-tongue and groove (T&G) edge for supports 16 inches o.c. with corner bracing of framing.

2.3.2 Building Paper

FS UU-B-790, Type I, Grade D, Style 1.

2.3.3 Miscellaneous Wood Members

2.3.3.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

Member	Size (inch)
Bridging	1 x 3 or 1 x 4 for use between members 2 x 12 and smaller; 2 x 4 for use between members larger than 2 x 12.
Corner bracing	1 x 4.
Furring	1 x 2 .
Grounds	Plaster thickness by 1-1/2.
Nailing strips	1 x 3 or 1 x 4 when used as shingle base or interior finish, otherwise 2 inch stock.

2.4 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware shall be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials shall be as recommended by the product manufacturer unless otherwise indicated or specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs shall be zinc-coated.

2.4.1 Bolts, Nuts, Studs, and Rivets

ASME B18.2.1, ASME B18.5.2.1M, ASME B18.5.2.2M, ASME B18.2.2, and ASTM A 687.

2.4.2 Anchor Bolts

ASTM A 307, size as indicated, complete with nuts and washers.

2.4.3 Expansion Shields

CID A-A-1923, CID A-A-1924, and CID A-A-1925. Except as shown otherwise, maximum size of devices shall be 3/8 inch.

2.4.4 Lag Screws and Lag Bolts

ASME B18.2.1.

2.4.5 Toggle Bolts

FS FF-B-588.

2.4.6 Wood Screws

ASME B18.6.1.

2.4.7 Nails

ASTM F 547, size and type best suited for purpose. For sheathing and subflooring, length of nails shall be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails shall be used for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails shall be used for nailing through 2 inch thick lumber. Nails used with treated lumber and sheathing shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in AF&PA T10. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AF&PA T101. Reasonable judgment backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

2.4.8 Wire Nails

ASTM F 1667.

2.4.9 Tacks

FS FF-T-1813.

2.4.10 Clip Angles

Steel, 3/16 inch thick, size best suited for intended use; or zinc-coated steel or iron commercial clips designed for connecting wood members.

2.4.11 Door Buck Anchors

Metal anchors, 1/8 by 1 1/4 inch steel, 12 inches long, with ends bent 2 inches, except as indicated otherwise. Anchors shall be screwed to the backs of bucks and built into masonry or concrete. Locate 8 inches above sills and below heads and not more than 24 inches intermediately between.

2.4.12 Metal Bridging

Where not indicated or specified otherwise, No. 16 U.S. Standard gage, cadmium-plated or zinc-coated.

2.4.13 Toothed Rings and Shear Plates

AF&PA T101.

2.4.14 Metal Framing Anchors

Construct anchors to the configuration shown using hot dip zinc-coated steel conforming to ASTM A653/A653M, G90. Steel shall be not lighter than

18 gage. Special nails supplied by the manufacturer shall be used for all nailing.

2.4.15 Panel Edge Clips

Extruded aluminum or galvanized steel, H-shaped clips to prevent differential deflection of roof sheathing.

2.5 AIR INFILTRATION BARRIER

Air infiltration barrier shall be building paper meeting the requirements of ASTM C 1136, Type IV, style optional or a tear and puncture resistant olefin building wrap (polyethylene or polypropylene) with a moisture vapor transmission rate of 125 g per square meter per 24 hours in accordance with ASTM E 96/E 96M, Desiccant Method at 23 degrees C or with a moisture vapor transmission rate of 670 g per square meter per 24 hours in accordance with ASTM E 96/E 96M, Water Method at 23 degrees C.

PART 3 EXECUTION

3.1 INSTALLATION

Conform to AF&PA T10 unless otherwise indicated or specified. Select lumber sizes to minimize waste. Fit framing lumber and other rough carpentry, set accurately to the required lines and levels, and secure in place in a rigid manner.

3.1.1 Wood Sheathing

Sheathing end joints shall be made over framing members and so alternated that there will be at least two boards between joints on the same support. Each board shall bear on at least three supports.

3.1.2 Building Paper

Provide building paper where indicated. Apply paper shingle fashion, horizontally, beginning at the bottom of the wall. Lap edges 4 inches, and nail with one inch, zinc-coated roofing nails, spaced 12 inches o.c. and driven through tin discs.

3.1.3 Plywood and Structural-Use Panel Roof Sheathing

Install with the grain of the outer plies or long dimension at right angles to supports. Stagger end joints and locate over the centerlines of supports. Allow 1/8 inch spacing at panel ends and 1/4 inch at panel edges. Nail panels with 8-penny common nails or 6-penny annular rings or screw-type nails spaced 6 inches o.c. at supported edges and 12 inches o.c. at intermediate bearings. Do not use staples in roof sheathing. Where the support spacing exceeds the maximum span for an unsupported edge, provide adequate blocking, tongue-and-groove edges, or panel edge clips, in accordance with APA E30.

3.2 MISCELLANEOUS

3.2.1 Wood Roof Nailers, Edge Strips, Crickets, Curbs, and Cants

Provide sizes and configurations indicated or specified and anchored securely to continuous construction.

3.2.1.1 Roof Edge Strips and Nailers

Provide at perimeter of roof, around openings through roof, and where roofs abut walls, curbs, and other vertical surfaces. Except where indicated otherwise, nailers shall be 6 inches wide and the same thickness as the insulation. Anchor nailers securely to underlying construction. Anchor perimeter nailers in accordance with FM DS 1-49.

3.2.2 Temporary Centering, Bracing, and Shoring

Provide for the support and protection of masonry work. Forms and centering for cast-in-place concrete work are specified in Section 03 30 50 CAST-IN-PLACE CONCRETE.

-- End of Section --

SECTION 06 61 16

SOLID POLYMER (SOLID SURFACING) FABRICATIONS
08/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D2583	(2007) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM E84	(2018) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G21	(2015) Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS
(IAPMO)

IAPMO Z124.3	(2005) Plastic Lavatories
IAPMO Z124.6	(2007) Plastic Sinks

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA LD 3	(2005) Standard for High-Pressure Decorative Laminates
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NSF INTERNATIONAL (NSF)

NSF/ANSI 51	(2012) Food Equipment Materials
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TILE COUNCIL OF NORTH AMERICA (TCNA)

TCA Hdbk	(2010) Handbook for Ceramic Tile Installation
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1.2 SYSTEM DESCRIPTION

- a. Work under this section includes countertops and window sills utilizing solid polymer (solid surfacing) fabrication as shown on the

drawings and as described in this specification. Do not change source of supply for materials after work has started, if the appearance of finished work would be affected.

- b. In most instances, installation of solid polymer fabricated components and assemblies will require strong, correctly located structural support provided by other trades. To provide a stable, sound, secure installation, close coordination is required between the solid polymer fabricator/installer and other trades to ensure that necessary structural wall support, cabinet counter top structural support, proper clearances, and other supporting components are provided for the installation of wall panels, countertops, shelving, and all other solid polymer fabrications to the degree and extent recommended by the solid polymer manufacturer.
- c. Appropriate staging areas for solid polymer fabrications. Allow variation in component size and location of openings of plus or minus 1/8 inch.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

Installation

SD-03 Product Data

Solid polymer material

Qualifications

Fabrications

SD-04 Samples

Material

SD-06 Test Reports

Solid polymer material

SD-07 Certificates

Fabrications

Qualifications

SD-10 Operation and Maintenance Data

Clean-up

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

To ensure warranty coverage, solid polymer fabricators shall be certified to fabricate by the solid polymer material manufacturer being utilized. Mark all fabrications with the fabricator's certification label affixed in an inconspicuous location. Fabricators shall have a minimum of 5 years of experience working with solid polymer materials. Submit solid polymer manufacturer's certification attesting to fabricator qualification approval.

1.4.2 Mock-ups

Submit Detail Drawings indicating locations, dimensions, component sizes, fabrication and joint details, attachment provisions, installation details, and coordination requirements with adjacent work.

1.5 DELIVERY, STORAGE, AND HANDLING

Do not deliver materials to project site until areas are ready for installation. Deliver components and materials to the site undamaged, in containers clearly marked and labeled with manufacturer's name. Materials shall be stored indoors and adequate precautions taken to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation, for duration of project.

1.6 WARRANTY

Provide manufacturer's warranty of ten years against defects in materials, excluding damages caused by physical or chemical abuse or excessive heat. Warranty shall provide for material and labor for replacement or repair of defective material for a period of ten years after component installation.

PART 2 PRODUCTS

2.1 MATERIAL

Provide solid polymer material that is a homogeneous filled solid polymer; not coated, laminated or of a composite construction; meeting IAPMO Z124.3 and IAPMO Z124.6 requirements. Material shall have minimum physical and performance properties specified. Superficial damage to a depth of 0.01 inch shall be repairable by sanding or polishing. Material thickness shall be as indicated on the drawings. In no case shall material be less than 1/4 inch in thickness. Submit a minimum 4 by 4 inch sample of each color and pattern for approval. Samples shall indicate full range of color and pattern variation. Approved samples shall be retained as a standard for this work. Submit test report results from an independent testing laboratory attesting that the submitted solid polymer material meets or exceeds each of the specified performance requirements.

2.1.1 Cast, 100 Percent Acrylic Polymer Solid Surfacing Material

Cast, 100 percent acrylic solid polymer material shall be composed of acrylic polymer, mineral fillers, and pigments and shall meet the following minimum performance requirements:

PROPERTY	REQUIREMENT (min. or max.)	TEST PROCEDURE
Tensile Strength	4000 psi (max.)	ASTM D638
Hardness	55-Barcol Impressor (min.)	ASTM D2583
Thermal Expansion	.000023 in/in/F (max.)	ASTM D 696
Boiling Water Surface Resistance	No Change	ANSI/NEMA LD 3-3.05
High Temperature Resistance	No Change	ANSI/NEMA LD 3-3.06
Impact Resistance (Ball drop)		ANSI/NEMA LD 3-303
1/4 inch sheet	36 inches, 1/2 lb ball, no failure	
1/2 inch sheet	140 inches, 1/2 lb ball, no failure	
3/4 inch sheet	200 inches, 1/2 lb ball, no failure	
Mold & Mildew Growth	No growth	ASTM G21
Bacteria Growth	No growth	ASTM G21
Liquid Absorption (Weight in 24 hrs.)	0.1 percent max.	ASTM D570
Flammability		ASTM E84
Flame Spread	25 max.	
Smoke Developed	30 max.	
Sanitation	"Food Contact" approval	NSF/ANSI 51

2.1.2 Material Patterns and Colors

Patterns and colors for all solid polymer components and fabrications shall be as indicated on drawings. Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the solid polymer material.

2.1.3 Surface Finish

Exposed finished surfaces and edges shall receive a uniform appearance. Exposed surface finish shall be matte; gloss rating of 5-20.

2.2 ACCESSORY PRODUCTS

Accessory products, as specified below, shall be manufactured by the solid polymer manufacturer or shall be products approved by the solid polymer manufacturer for use with the solid polymer materials being specified.

2.2.1 Seam Adhesive

Seam adhesive shall be a two-part adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between solid polymer materials and components to create a monolithic appearance of the fabrication. Adhesive shall be approved by the solid polymer manufacturer. Adhesive shall be color-matched to the surfaces being bonded where solid-colored, solid polymer materials are being bonded together. The seam adhesive shall be clear or color matched where particulate patterned, solid polymer materials are being bonded together.

2.2.2 Panel Adhesive

Panel adhesive shall be neoprene based panel adhesive meeting TCA Hdbk, Underwriter's Laboratories (UL) listed. Use this adhesive to bond solid polymer components to adjacent and underlying substrates.

2.2.3 Silicone Sealant

Sealant shall be a mildew-resistant, FDA and OSHA Nationally Recognized Testing Laboratory (NRTL) listed silicone sealant or caulk in a clear formulation. The silicone sealant shall be approved for use by the solid polymer manufacturer. Use sealant to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures.

2.2.4 Conductive Tape

Conductive tape shall be manufacturer's standard foil tape, 4 mils thick, applied around the edges of cut outs containing hot or cold appliances.

2.2.5 Mounting Hardware

Provide mounting hardware, including sink/bowl clips, inserts and fasteners for attachment of undermount sinks and lavatories.

2.3 FABRICATIONS

Components shall be factory or shop fabricated to sizes and shapes indicated, to the greatest extent practical, in accordance with approved Shop Drawings and manufacturer's requirements. Provide factory cutouts for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii shall be routed to template, with edges smooth. Defective and inaccurate work will be rejected. Submit product data indicating product description, fabrication information, and compliance with specified performance requirements for solid polymer, joint adhesive, sealants, and heat reflective tape. Both the manufacturer of materials and the fabricator shall submit a detailed description of operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality,

and other production techniques supporting sustainable design and products.

2.3.1 Joints and Seams

Form joints and seams between solid polymer components using manufacturer's approved seam adhesive. Joints shall be inconspicuous in appearance and without voids to create a monolithic appearance.

2.3.2 Edge Finishing

Rout and finish component edges to a smooth, uniform appearance and finish. Edge shapes and treatments, including any inserts, shall be as detailed on the drawings. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

2.3.3 Counter and Vanity Top Splashes

Fabricate backsplashes and end splashes from 1/2 inch thick solid surfacing material to be 4 inches high in conformance with dimensions and shapes as indicated on the drawings. Backsplashes and end splashes shall be provided for all counter tops and vanity tops at locations indicated on the drawings. Backsplashes shall be shop fabricated and be loose, to be field attached.

2.3.3.1 End Splashes

End splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed.

2.3.4 Counter and Vanity Tops

Fabricate all solid surfacing, solid polymer counter top and vanity top components from 1/2 inch thick material. Edge details, dimensions, locations, and quantities shall be as indicated on the Drawings. Counter tops will not include a solid surface back splash. Attach 2 inch wide reinforcing strip of polymer material under each horizontal counter top seam. Submit a minimum 1 foot wide by 6 inch deep, full size sample for each type of counter top shown on the project drawings. The sample shall include the edge profile as detailed on the project drawings. Solid polymer material shall be of a pattern and color as indicated on the drawings. Sample shall include at least one seam. Approved sample shall be retained as standard for this work.

2.3.4.1 Counter Top With Sink

- a. Stainless Steel Sink. Countertops with sinks shall include cutouts to template as furnished by the sink manufacturer. Manufacturer's standard sink mounting hardware for stainless steel installation shall be provided. Seam between sink and counter top shall be sealed with silicone sealant. Sink, faucet, and plumbing requirements shall be in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.
- b. Solid polymer sinks shall be a manufacturer's standard, pre-molded product specifically designed for attachment to solid polymer counter tops.

2.3.4.2 Vanity Tops With Bowls

- a. Solid polymer bowls shall be a solid polymer manufacturer's standard,

pre-molded product specifically designed for attachment to solid polymer counter tops.

- b. One-piece vanity top and bowl fabrications shall be a standard pre-fabricated product provided by the solid polymer manufacturer. Each unit shall include a vanity top with integral backsplash and sink bowl.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Components

Install all components and fabricated units plumb, level, and rigid. Make field joints between solid polymer components using solid polymer manufacturer's approved seam adhesives, to provide a monolithic appearance with joints inconspicuous in the finished work. Attach metal or vitreous china sinks and lavatory bowls to counter tops using solid polymer manufacturer's recommended clear silicone sealant and mounting hardware. Solid polymer sinks and bowls shall be installed using a color-matched seam adhesive. Plumbing connections to sinks and lavatories shall be made in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.1.2 Silicone Sealant

Use a clear, silicone sealant or caulk to seal all expansion joints between solid polymer components and all joints between solid polymer components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures. Sealant bead shall be smooth and uniform in appearance and shall be the minimum size necessary to bridge any gaps between the solid surfacing material and the adjacent surface. Bead shall be continuous and run the entire length of the joint being sealed.

3.1.3 Plumbing

Make plumbing connections to sinks and lavatories in accordance with Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.2 CLEAN-UP

Components shall be cleaned after installation and covered to protect against damage during completion of the remaining project items. Components damaged after installation by other trades will be repaired or replaced at the General Contractor's cost. Component supplier will provide a repair/replace cost estimate to the General Contractor who shall approve estimate before repairs are made. Submit a minimum of three copies of maintenance data indicating manufacturer's care, repair and cleaning instructions. Maintenance video shall be provided, if available. Maintenance kit for matte finishes shall be submitted.

-- End of Section --

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SECTION 07 57 13

SPRAYED POLYURETHANE FOAM (SPF) INSULATION
05/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (AIHA)

AIHA Z88.6 (2006) Respiratory Protection - Respirator Use-Physical Qualifications for Personnel

ASTM INTERNATIONAL (ASTM)

ASTM C177	(2010) Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
ASTM C273/C273M	(2011) Shear Properties of Sandwich Core Materials
ASTM C518	(2010) Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM D1621	(2010) Compressive Properties of Rigid Cellular Plastics
ASTM D1622	(2008) Apparent Density of Rigid Cellular Plastics
ASTM D1623	(2009) Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
ASTM D2126	(2009) Response of Rigid Cellular Plastics to Thermal and Humid Aging
ASTM D2842	(2006) Water Absorption of Rigid Cellular Plastics
ASTM D5469	(2000; R 2005) Application of New Spray Applied Polyurethane Foam and Coated Roofing Systems
ASTM D6226	(2010) Standard Test Method for Open Cell Content of Rigid Cellular Plastics
ASTM E84	(2018) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E96/E96M (2016) Standard Test Methods for Water Vapor Transmission of Materials

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1 (2010) Occupational and Educational Personal Eye and Face Protection Devices

SPRAY POLYURETHANE FOAM ALLIANCE (SPFA)

SPFA AY-104 (1994; R 2000) Spray Polyurethane Foam Systems for New and Remedial Roofing

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Spray urethane foam

Submit literature including material description, physical properties, recommended storage conditions, Material Safety Data Sheets, and shelf life expiration date.

Protective coating

Submit literature including material description, physical properties, recommended storage conditions, Material Safety Data Sheets, and shelf life expiration date.

Primer

Submit literature including material description, physical properties, recommended storage conditions, Material Safety Data Sheets, and shelf life expiration date.

Sealants

Submit literature including material description, physical properties, recommended storage conditions, Material Safety Data Sheets, and shelf life expiration date.

SD-07 Certificates

Qualification of Manufacturer

Qualification of Applicator

SD-08 Manufacturer's Instructions

SPRAY URETHANE FOAM

PROTECTIVE COATING

Polyurethane foam

Submit manufacturer's complete application instructions and

details, and to include storage, handling, and warnings or precautions on flammability and toxicity. Include manufacturer's written recommendations for primers and for surface preparation of metals, concrete, roofing, and other materials and surface substrates over which sprayed polyurethane foam and coating system will be applied.

Primers

Submit manufacturer's complete application instructions and details, and to include storage, handling, and warnings or precautions on flammability and toxicity. Include manufacturer's written recommendations for primers and for surface preparation of metals, concrete, roofing, and other materials and surface substrates over which sprayed polyurethane foam and coating system will be applied.

Surface preparation

Submit manufacturer's complete application instructions and details, and to include storage, handling, and warnings or precautions on flammability and toxicity. Include manufacturer's written recommendations for primers and for surface preparation of metals, concrete, roofing, and other materials and surface substrates over which sprayed polyurethane foam and coating system will be applied.

1.3 QUALITY ASSURANCE

1.3.1 Qualification of Manufacturer

Sprayed polyurethane foam and elastomeric coating products manufacturer shall have a minimum of 10 years experience in the manufacture of polyurethane foam and elastomeric coating products.

1.3.2 Qualification of Applicator

The roof system applicator shall have prior manufacturer training in the application of sprayed polyurethane foam and coating materials. Applicator shall be certified and approved by the foam and coating manufacturer to apply the specified materials and provide the specified manufacturer warranty. Applicator shall have a minimum of 5 years experience in application of the specified materials and minimum of 10 years experience in the application of sprayed polyurethane foam roof systems. Mechanics applying the foam and coating materials shall have minimum 3 years prior experience in handling and spraying the type of materials specified and spray equipment must be operated by or under the direct full-time supervision of manufacturer-trained personnel.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver and store materials in sufficient quantity to allow for uninterrupted flow of work. Materials shall be delivered to the jobsite in their original unopened packages, clearly marked with the manufacturer's name, brand name, description of contents, and shelf life of containerized materials.

1.4.2 Storage

Materials shall be stored in clean, dry areas, away from excessive heat, sparks, and open flame. Storage area shall be ventilated to prevent build-up of flammable gases. Maintain temperatures in the storage area below the materials' flash point and within limits recommended by the manufacturer's printed instructions.

1.4.3 Handling

Handle materials and containers during application work safely and in accordance with manufacturer recommendations. Store liquids in airtight containers and keep containers closed except when removing materials. Do not use equipment or containers containing remains of dissimilar materials. Do not expose foam component containers to direct sunlight for periods of time sufficient to cause contents to exceed 80 degrees F. Mark and remove from job site materials which have been exposed to moisture or that exceed shelf life limits. Not more than half the shelf life shall have expired when materials are applied.

1.5 CONTRACTOR'S FOAM SPRAY EQUIPMENT

1.5.1 Applicator

Use an airless foam spray gun of the mechanical, self-cleaning type, that does not require a flushing solvent during the spray operation.

1.5.2 Equipment Calibration

Fully calibrate the foam metering equipment to monitor each liquid component to within 2 percent of the foam material manufacturer's required metering ratio. Calibrate spray equipment each day at start of operations, after each restart if spraying operations have been terminated for more than one hour, whenever there is a change in fan pattern or pressure, whenever slow curing areas are noticed, whenever a change is made in hose length or working height, and after changeover between materials. Calibration shall consist of demonstrating that the equipment is adjusted to deliver components in proper mix and proportion. Calibration test shall be done on cardboard or plywood on the roof adjacent to the area to be sprayed.

1.5.3 Metering Equipment Requirements

Use foam metering equipment capable of developing and maintaining the foam manufacturer's required liquid component pressures and temperatures. Foam metering equipment shall have gages for visual monitoring. Equipment shall provide temperature control of foam components to within the temperature ranges recommended by the foam manufacturer's printed instructions.

1.5.4 Moisture Protection

Protect the surfaces of component supply containers or tanks used to feed the foam metering equipment from moisture.

1.5.5 Compressed Air

Supply compressed air in contact with foam components during mixing or atomization through moisture traps that are continuously bled.

1.5.6 Dispense Excess Materials

Do not deposit materials used for cleaning of equipment or materials dispensed for calibration purposes and establishment of spray gun pattern on interior surfaces. Dispense such materials into scrap containers or onto plastic film, or cardboard, and dispose of in compliance with safety requirements and jobsite regulations.

1.6 SPECIAL SAFETY PROVISIONS

During application, the following shall be required unless in conflict with the manufacturer's recommendations or requirements of a recognized legal authority, in which case, the manufacturer's recommendations or the legal authority's requirements take precedence:

1.6.1 Special Equipment

1.6.1.1 Air Masks

Wear fresh air supply masks when applying foam or when handling hazardous liquid materials. Respiratory protective devices shall be as recommended by AIHA Z88.6. Instruct personnel required to use respiratory protective devices in the use of the devices. Maintain such equipment and inspect regularly.

1.6.1.2 Eye and Face Masks

Use eye and face protection during materials application. Eye and face protective equipment shall meet the requirements of ANSI/ISEA Z87.1.

1.6.1.3 Clothing and Gloves

Wear protective clothing and gloves during materials application. Skin areas not covered by clothing shall be protected by protective creams.

1.6.2 Handling Precautions

1.6.2.1 Venting of Material Containers

Partially unscrew material container and drum caps to gradually vent the containers prior to opening. Do not inhale vapors. Decontaminate empty component containers by filling with water and allowing to stand for 48 hours with bung caps removed. Under no circumstances seal, stop, or close the containers which have been emptied of the foam component.

PART 2 PRODUCTS

2.1 SPRAY URETHANE FOAM

Urethane foam shall be standard product of the manufacturer, and containers shall be factory marked with the manufacturer's name or trademark. The foam material shall be of a formulation suitable for the environmental and climatic conditions in which foam will be applied. Urethane foam shall meet the following requirements:

<u>Properties in Inch-Pound Units</u>			
<u>Properties</u>	<u>ASTM Test</u>	<u>Value</u>	<u>Units</u>
Density (Sprayed in Place)	ASTM D1622	0.5 (minimum)	lb./ft ³
K-Factor (aged)	ASTM C177 ASTM C518	3.7 (maximum)	BTU per SF/hr; degrees F per inch
Compressive Strength Parallel to Foam Rise	ASTM D1621	n/a	lb/in ²
Shear Strength	ASTM C273/C273M	n/a	lb/in ²
Tensile Strength Parallel to Foam Rise	ASTM D1623	n/a	lb/in ²
Dimensional Stability (Humid Aging) 7 days volume change 160 degrees F, 100 relative humidity	ASTM D2126	0 (maximum)	percent net
Water Vapor Permeability	ASTM E96/E96M	11.0 (maximum)	per inch
Closed Cell Content	ASTM D6226	90 (minimum)	percent by volume
Water Absorption	ASTM D2842	0.05 (maximum)	lb./ft ²
Flammability	ASTM E84	Flame spread of 20 or less	---

2.2 PRIMER

Primers used shall be as required and recommended by the coating and spray foam materials manufacturer for the substrate to be covered.
Rust-inhibiting primer shall be used for ferrous metal surfaces. Cut-back asphalt primers are prohibited.

2.3 SEALANTS

Sealants shall be as recommended by the coating manufacturer. PART 3
EXECUTION

3.1 PROTECTION OF PROPERTY

Protect the building structure, equipment, and other surfaces adjacent to

the work from overspray from foam and coating materials. Protective coverings shall be secured and vented to prevent collection of moisture on covered surfaces. Use protective shields or barriers when spraying along open roof edges and walls to prevent uncontrolled overspray. Any surfaces damaged by roof system products shall be restored or replaced to the satisfaction of the Government at no additional expense to the Government.

3.1.1 Masking

Provide masking protection to protect surfaces immediately adjacent to foam and coating terminations at time of application. Adjust or provide new masking protection at roof perimeter to protect surfaces immediately adjacent to coating terminations and to provide for clean smooth coating termination lines.

3.2 SPECIAL PRECAUTIONS AND INSTRUCTIONS

3.2.1 Primers

Do not dilute primers or other materials unless required and recommended by the manufacturer. Do not use cleaning solvents for thinning primers or other materials.

3.2.2 Material Handling

Handle materials and containers during application work safely and in accordance with recommendations of the manufacturer. Store liquids in airtight containers and keep containers closed except when removing materials. Do not use equipment or containers containing remains of dissimilar materials or products.

3.2.3 Fire and Explosion Hazards

Prohibit open flames, sparks, welding, and smoking in the application area. Provide and maintain a fire extinguisher of appropriate type and size in the application area.

3.3 SURFACE PREPARATION FOR FOAM APPLICATION

Surfaces that are to be primed or receive spray foam application shall be dry; completely cured; free of grease, oils, dirt and other foreign matter or contaminants which will interfere with total adhesion of primer and polyurethane foam. Prior to foam application, fill or otherwise seal openings where foam spray may damage or contaminate interior items or surfaces.

3.3.1 Wood Surfaces

Prime untreated and unpainted surfaces. If painted, inspect surfaces for adhesion problems.

3.4 SPRAY FOAM APPLICATION

3.4.1 Spray Foam

Apply foam to provide a minimum finished thickness of 1 inch. Apply spray pass at right angle to the surface to the extent practicable. Check foam thickness during application by probing depth with probe wire. Adjust application procedures as necessary to develop required foam

thickness.

3.4.2 Terminations

Unless otherwise indicated, conform with manufacturer's standard details, for foam thickness around penetrations and other terminations. Transitions between horizontal and vertical surfaces shall be smooth and sprayed at a nominal angle of 45 degrees.

3.4.3 Surface Uniformity

Do not exceed the minimum thickness of the foam by more than 1/2 inch, except as necessary at transitions and penetrations, or as otherwise approved by the Contracting Officer.

3.4.4 Finish Appearance and Texture

The finished surface of applied foam shall be free of ridges, bumps, pinholes, depressions, crevices, voids, or oxidation and shall be "course orange peel" or smoother in conformance with photographic standards of ASTM D5469 or SPFA AY-104. Soft, spongy, delaminating, brittle, or otherwise non-complying areas of foam shall be removed and replaced.

3.4.5 Foam Finish Correction

If the sprayed foam skin is removed to correct surface texture or to remove excess foam thickness, respray the cut surface with foam formation at least 1/2 inch thick to provide a protective foam skin prior to application of the protective coating.

3.4.6 Finish Removal

Remove foam that is not bonded, of poor cell structure, wet, or otherwise does not meet the material quality specifications.

3.4.7 Application Time Limits

Do not start foam application on an area larger than can be brought to the specified full foam thickness, cured, and coated with the base coat of the coating system on the same day. No applied foam, except for leading edges, shall stand uncoated overnight. Inspect the leading edge of foam before resuming work the next day. Remove and replace damaged or wet foam material.

3.4.8 Curing Time

Cure the applied foam for a minimum of 2 hours and as otherwise recommended by the foam manufacturer prior to application of the protective coating.

3.4.9 Spray Foam Clean Up

Remove overspray masking materials and coverings upon completion of the spray foam application and prior to the application of the protective coating. Do not remove the masking over air intake vents until two hours after application of the foam. Remove foam overspray found on adjacent surfaces not scheduled to application of the protective coating.

3.5 FIELD QUALITY CONTROL

3.5.1 Construction Monitoring

During progress of the roof work, Contractor shall make visual inspections as necessary to insure compliance with specified parameters. Additionally, verify the following:

- a. Protection measures are in place.
- b. Equipment is in working order. Metering devices are accurate.
- c. Materials are not installed in adverse weather.
- d. Surfaces are cleaned and primed and substrates are in acceptable condition prior to application of materials.
- e. Materials comply with specified requirements.
- f. All materials are properly stored, handled and protected from moisture or other damages.
- g. Foam material is applied in minimum of two passes, or lifts, applied perpendicular to the subsequent pass and in thickness from 1/2 inch to 1-1/2 inches per lift.
- h. Foam is free of blistering in its formation and the surface texture is as specified.
- j. Foam is cured minimum of 2 hours and in accordance with manufacturer requirements prior to coating application.

3.6 CORRECTION OF DEFICIENCIES

Correction of deficiencies shall be as directed by the Contracting Officer at no additional cost to the Government.

3.7 CLEAN-UP AND DISPOSAL

All waste material, material containers, and debris shall be cleaned up daily and placed in appropriate trash containers. At completion of the work all waste material, debris, and containers shall be removed from the job site and disposed of as required by local regulations.

-- End of Section --

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SECTION 07 60 00

FLASHING AND SHEET METAL
05/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.2/D1.2M (2014) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A480/A480M (2017) Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

ASTM A653/A653M (2019) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B209 (2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B221 (2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM B32 (2008; R 2014) Standard Specification for Solder Metal

ASTM B370 (2012) Standard Specification for Copper Sheet and Strip for Building Construction

ASTM B69 (2013) Standard Specification for Rolled Zinc

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
(SMACNA)

SMACNA 1793 (2012) Architectural Sheet Metal Manual, 7th Edition

1.2 GENERAL REQUIREMENTS

Finished sheet metal assemblies must form a weathertight enclosure without waves, warps, buckles, fastening stresses or distortion, while allowing for expansion and contraction without damage to the system. The sheet metal installer is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal modifications required to

accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with roofing with roofing work to permit continuous, uninterrupted roofing operations.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Exposed Sheet Metal

Gutters

Downspouts

Gravel Stops and Fasciae

Flashing at Roof Penetrations and Equipment Supports

Reglets

SD-08 Manufacturer's Instructions

Quality Control Plan

1.4 MISCELLANEOUS REQUIREMENTS

1.4.1 Product Data

Indicate thicknesses, dimensions, fastenings, anchoring methods, expansion joints, and other provisions necessary for thermal expansion and contraction. Scaled manufacturer's catalog data may be submitted for factory fabricated items.

1.5 DELIVERY, HANDLING, AND STORAGE

Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot be restored to like-new condition. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until installation.

PART 2 PRODUCTS

2.1 MATERIALS

Do not use lead, lead-coated metal, or galvanized steel. Use any metal listed by SMACNA 1793 for a particular item, unless otherwise indicated. Provide materials, thicknesses, and configurations in accordance with SMACNA 1793 for each material. Different items need not be of the same metal, except that contact between dissimilar metals must be avoided.

Furnish sheet metal items in 8 to 10 foot lengths. Single pieces less than 8 feet long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum 12 inch legs. Provide accessories and other items essential

to complete the sheet metal installation. Provide accessories made of the same or compatible materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage, thickness, or weight shown in Table I at the end of this section. Provide sheet metal items with mill finish unless specified otherwise. Where more than one material is listed for a particular item in Table I, each is acceptable and may be used, except as follows:

2.1.1 Exposed Sheet Metal Items

Must be of the same material. Consider the following as exposed sheet metal: gutters, including hangers; downspouts; gravel stops and fasciae; cap, valley, steeped, base, and eave flashings and related accessories.

2.1.2 Drainage

Do not use copper for an exposed item if drainage from that item will pass over exposed masonry, stonework or other metal surfaces. In addition to the metals listed in Table I, lead-coated copper may be used for such items.

2.1.3 Copper, Sheet and Strip

Provide in accordance with ASTM B370, cold-rolled temper, H 00 (standard).

2.1.4 Steel Sheet, Zinc-Coated (Galvanized)

Provide in accordance with ASTM A653/A653M.

2.1.5 Zinc Sheet and Strip

Provide in accordance with ASTM B69, Type I, a minimum of 0.024 inch thick.

2.1.6 Stainless Steel

Provide in accordance with ASTM A480/A480M, Type 302 or 304, 2D Finish, fully annealed, dead-soft temper.

2.1.7 Aluminum Alloy Sheet and Plate

Provide in accordance with ASTM B209 color, as selected from manufacturers standard colors, form alloy, and temper appropriate for use.

2.1.7.1 Alclad

When fabricated of aluminum, fabricate the following items with Alclad 3003, Alclad 3004, or Alclad 3005, clad on one side unless otherwise indicated.

- a. Gutters, downspouts, and hangers
- b. Gravel stops and fasciae
- c. Flashing

2.1.8 Aluminum Alloy, Extruded Bars, Rods, Shapes, and Tubes

ASTM B221.

2.1.9 Solder

Provide in accordance with ASTM B32, 95-5 tin-antimony.

2.1.10 Reglets

2.1.10.1 Metal Reglets

Provide factory fabricated caulked type or friction type reglets with a minimum opening of 1/4 inch and a depth of 1-1/4 inch, as approved.

2.1.10.1.1 Caulked Reglets

Provide with rounded edges, temporary reinforcing cores, and accessories as required for securing to adjacent construction. Provide built-up mitered corner pieces for inside and outside corners.

2.1.10.1.2 Friction Reglets

Provide with flashing receiving slots not less than 5/8 inch deep, one inch jointing tongues, and upper and lower anchoring flanges installed at 24 inch maximum snap-lock type receiver.

2.1.11 Scuppers

Line interiors of scupper openings with sheet metal. Provide a drip edge at bottom edges with returns of not less than one inch against the face of the outside wall at the top and sides. Provide the perimeter of the lining approximately 1/2 inch less than the perimeter of the scupper.

2.1.12 Conductor Heads

Provide conductor heads and screens in the same material as downspouts. Provide outlet tubes not less than 4 inches long.

2.1.13 Copings

Unless otherwise indicated, provide copings in copper sheets, 8 or 10 feet long, joined by a 3/4 inch locked and soldered seam.

2.1.14 Fasteners

Use the same metal as, or a metal compatible with the item fastened. Use stainless steel fasteners to fasten. Confirm compatibility of fasteners and items to be fastened to avoid galvanic corrosion due to dissimilar materials.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Workmanship

Make lines and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth,

dry, and free of defects and projections. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793, Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight. Join sheet metal items together as shown in Table II.

3.1.2 Welding and Mechanical Fastening

Use welding for aluminum of thickness greater than 0.040 inch. Aluminum 0.040 inch or less in thickness must be butted and the space backed with formed flashing plate; or lock joined, mechanically fastened, and filled with sealant as recommended by the aluminum manufacturer.

3.1.2.1 Welding of Aluminum

Use welding of the inert gas, shield-arc type. For procedures, appearance and quality of welds, and the methods used in correcting welding work, conform to AWS D1.2/D1.2M.

3.1.2.2 Mechanical Fastening of Aluminum

Use No. 12, aluminum alloy, sheet metal screws or other suitable aluminum alloy or stainless steel fasteners. Drive fasteners in holes made with a No. 26 drill in securing side laps, end laps, and flashings. Space fasteners 12 inches maximum on center. Where end lap fasteners are required to improve closure, locate the end lap fasteners not more than 2 inches from the end of the overlapping sheet.

3.1.3 Protection from Contact with Dissimilar Materials

3.1.3.1 Copper or Copper-bearing Alloys

Paint with heavy-bodied bituminous paint surfaces in contact with dissimilar metal, or separate the surfaces by means of moistureproof building felts.

3.1.3.2 Aluminum

Do not allow aluminum surfaces in direct contact with other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint. Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a non-lead pigmented paint.

3.1.3.3 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.1.3.4 Wood or Other Absorptive Materials

Paint surfaces that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

3.1.4 Expansion and Contraction

Provide expansion and contraction joints at not more than 32 foot intervals for aluminum and at not more than 40 foot intervals for other metals. Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval. Space joints evenly. Join extruded aluminum gravel stops and fasciae by expansion and contraction joints spaced not more than 12 feet apart.

3.1.5 Metal Reglets

Keep temporary cores in place during installation. Ensure factory fabricated caulked type or friction type, reglets have a minimum opening of 1/4 inch and a minimum depth of 1-1/4 inch, when installed.

3.1.5.1 Caulked Reglets

Wedge flashing in reglets with lead wedges every 18 inches, caulked full and solid with an approved compound.

3.1.5.2 Friction Reglets

Install flashing snap lock receivers at 24 inches on center maximum. When flashing has been inserted the full depth of the slot, caulk the slot, lock with wedges, and fill with sealant.

3.1.6 Gutters

The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation. Bead with hemmed edge or reinforce the outer edge of gutter with a stiffening bar not less than 3/4 by 3/16 inch of material compatible with gutter. Fabricate gutters in sections not less than 8 feet. Lap the sections a minimum of one inch in the direction of flow or provide with concealed splice plate 6 inches minimum. Join the gutters, other than aluminum, by riveted and soldered joints. Join aluminum gutters with riveted sealed joints. Provide expansion-type slip joints midway between outlets. Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on adjustable hangers spaced not more than 30 inches on center. Adjust gutters to slope uniformly to outlets, with high points occurring midway between outlets. Fabricate hangers and fastenings from compatible metals.

3.1.7 Downspouts

Space supports for downspouts according to the manufacturer's recommendation for the masonry or steel substrate. Types, shapes and sizes are indicated. Provide complete including elbows and offsets. Provide downspouts in approximately 10 foot lengths. Provide end joints to telescope not less than 1/2 inch and lock longitudinal joints. Provide gutter outlets with wire ball strainers for each outlet. Provide strainers to fit tightly into outlets and be of the same material used for gutters. Keep downspouts not less than one inch away from walls. Fasten to the walls at top, bottom, and at an intermediate point not to exceed 5 feet on center with leader straps or concealed rack-and-pin type fasteners. Form straps and fasteners of metal compatible with the

downspouts.

3.1.7.1 Terminations

Neatly fit into the drainage connection the downspouts terminating in drainage lines and fill the joints with a portland cement mortar cap sloped away from the downspout. Provide downspouts terminating in splash blocks with elbow-type fittings. Provide splash pans as specified.

3.1.8 Flashing at Roof Penetrations and Equipment Supports

Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck.

3.1.9 Single Pipe Vents

See Table I, footnote (d). Set flange of sleeve in bituminous plastic cement and nail 3 inches on center. Bend the top of sleeve over and extend down into the vent pipe a minimum of 2 inches. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed metal housing. Set metal housing with a metal sleeve having a 4 inches roof flange in bituminous plastic cement and nailed 3 inches on center. Extend sleeve a minimum of 8 inches above the roof deck and lapped a minimum of 3 inches by a metal hood secured to the vent pipe by a draw band. Seal the area of hood in contact with vent pipe with an approved sealant.

3.2 PAINTING

Touch ups in the field may be applied only after metal substrates have been cleaned and pretreated in accordance with manufacturer's written instructions and products.

Field-paint sheet metal for separation of dissimilar materials.

3.2.1 Aluminum Surfaces

Clean with solvent and apply one coat of zinc-molybdate primer and one coat of aluminum paint.

3.3 CLEANING

Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub-clean. Free the exposed metal surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

3.4 REPAIRS TO FINISH

Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Repair damaged surfaces caused by scratches, blemishes, and variations of color and surface texture. Replace items which cannot be repaired.

3.5 FIELD QUALITY CONTROL

Establish and maintain a Quality Control Plan for sheet metal used in

conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Remove work that is not in compliance with the contract and replace or correct. Include quality control, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- b. Verification that specified material is provided and installed.
- c. Inspection of sheet metalwork, for proper size(s) and thickness(es), fastening and joining, and proper installation.

3.5.1 Procedure

Submit for approval prior to start of roofing work. Include a checklist of points to be observed. Document the actual quality control observations and inspections. Furnish a copy of the documentation to the Contracting Officer at the end of each day.

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES					
Sheet Metal Items	Copper kilograms per square foot	Aluminum, inch	Stainless Steel, inch		
Building Expansion Joints					
Cover	16	.032	.015	.015	24
Covering on minor flat, pitched or curved surfaces	20	.040	.018	.018	-
Downspouts and leaders	16	.032	.015	.015	24
Downspout clips and anchors	-	.040 clip .125 anchor	-	-	-
Downspout straps, 2-inch	48 (a)	.060	.050	-	-
Conductor heads	16	.032	.015	.015	-
					-

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES					
Sheet Metal Items	Copper kilograms per square foot	Aluminum, inch	Stainless Steel, inch		
Flashings:					
Base	20	.040	.018	.018	24
Stepped	16	.032	.015	.015	-
Pipe vent sleeve (d)					
Gravel stops and fasciae:					
Extrusions	-	.075	-	-	-
Sheets, corrugated	16	.032	.015	.015	-
Sheets, smooth	20	.050	.018	.018	24
Edge strip	24	.050	.025	-	-
Gutters:					
Gutter section	16	.032	.015	.015	24
Continuous cleat	16	.032	.015	.015	24
Hangers, dimensions	1 inch by 1/8 inch (a)	1 inch by inch (c)	.01 inch by .01 inch	-	-
Joint Cover plates (See Table II)	16	.032	.015	.015	24
	10	-	.010	.010	-

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES					
Sheet Metal Items	Copper kilograms per square foot	Aluminum, inch	Stainless Steel, inch		
	16	.040	.018	.018	-
(a) Brass.					
(b) May be lead weighing 4 pounds per square foot.					
(c) May be polyvinyl chloride.					
(d) 2.5 pound minimum lead sleeve with 4 inch flange. Where lead sleeve is impractical, refer to paragraph SINGLE PIPE VENTS for optional material.					

-- End of Section --

SECTION 07 61 15.00 20

ALUMINUM STANDING SEAM ROOFING

08 March 2021

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA ADM-105 (2005; Errata 2005) Aluminum Design Manual

AA ASM-35 (2000) Specifications for Aluminum Sheet Metal Work in Building Construction, Construction Manual Series Section 5

AMERICAN FOREST & PAPER ASSOCIATION (AF&PA)

AF&PA T101 (2005) National Design Specification (NDS) for Wood Construction

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3 (2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

ASTM INTERNATIONAL (ASTM)

ASTM B117 (2011) Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM B209 (2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B209M (2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

ASTM D1654 (2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D2247 (2011) Testing Water Resistance of Coatings in 100% Relative Humidity

ASTM D226/D226M (2009) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

ASTM D2565 (1999; R 2008) Xenon Arc Exposure of Plastics Intended for Outdoor Applications

ASTM D4214	(2007) Standard Test Method for Evaluating the Degree of Chalking of Exterior Paint Films
ASTM D522	(1993a; R 2008) Mandrel Bend Test of Attached Organic Coatings
ASTM D523	(2008) Standard Test Method for Specular Gloss
ASTM D714	(2002; R 2009) Evaluating Degree of Blistering of Paints
ASTM D968	(2005; R 2010) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM E1592	(2005) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference
ASTM E84	(2012) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM G152	(2006) Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	(2004; R 2010) Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM 1646	Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
ASTM1680	Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA Details	(2003) NRCA Roof Perimeter Flashing Systems Construction Details for Class 1 Roof Construction
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SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1013

(2012) Architectural Sheet Metal Manual,
7th Edition

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA RSDM

(2000) Metal Roofing Systems Design Manual

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA 0409

(2006) Architectural Sheet Metal and Metal
Roofing Manual

NRCA RoofMan

(2012) The NRCA Roofing Manual

PORCELAIN ENAMEL INSTITUTE (PEI)

PEI 1001

(1996) Specification for Architectural

Porcelain Enamel (ALS-100)
PEI CG-3

Ref Title
(2005) Color Guide for Architectural
Porcelain Enamel

UNDERWRITERS LABORATORIES (UL)

UL 580

(2006; Reprint Jul 2009) Tests for Uplift
Resistance of Roof Assemblies

UL Bld Mat Dir

(2012) Building Materials Directory

FM GLOBAL (FM)

FM 4471

(2010) Class I Panel Roofs

1.2 DEFINITIONS

1.2.1 Roof Truss system Type A

Building has roof trusses built out of wood. Typical spacing of trusses is 24" OC. Field verify.

1.2.2 Roof Truss system Type B

Building has trusses made of light gage steel c-channels spot welded back to back. Original decking was attached by nails driven into the gap of the back to back channels. Typical spacing is 24" OC. Field verify.

1.2.3 Roof Truss system Type C

Building has trusses made of a single light gage steel C-channel. The decking is attached by driving a nail into a nailing slot in the flange of the channel. Typical spacing is 24" OC but this has not been observed to

be consistent. Field verify

1.2.5 Roofing System

The roofing system is defined as the assembly of roofing components, including roofing panels, flashing, fasteners, and accessories which, when assembled properly result in a watertight installation.

1.3 SYSTEM DESCRIPTION

1.3.1 Design Requirements

- a. Provide continuous length panels with no joints or seams, except where indicated. Individual panels shall be removable for replacement of damaged material.
- b. There shall be no exposed or penetrating fasteners except where shown on the approved shop drawings. Fasteners shall be of materials compatible with aluminum as recommended by the manufacturer. Length and diameter of screws shall be sufficient to meet the design loads with a suitable factor of safety for the material to which the roofing components are attached. Calculate fastener capacity in accordance with AISI SG03-3, AA ADM-105 or AF&PA T101 as applicable.
- c. Roof panel standing seam shall include a capillary break and be mechanically locked closed by the manufacturer's locking tool. The seam shall include a continuous sealant when required by the manufacturer to withstand the rainfall and wind specified in paragraph entitled "Manufacturer's Requirements."
- d. Roof panel anchor clips shall be concealed and designed to allow for thermal movement of the panels, except where specific fixed points are indicated.
- e. The system shall resist the positive and negative loads specified herein in accordance with "Sheet Building Sheathing Design Guide" of the AA ADM-105.
- f. Panels shall support walking loads without excessive distortion or telegraphing of the structural supports. Panels shall support a 115 kilogram 250 pound load concentrated on a 2500 square millimeter (mm) four square inch area at the center of the panel without buckling or permanent distortion.

1.3.2 Performance Requirements

1.3.2.1 Static pressure air infiltration (Roof panels)

Pressure Leakage Rate per ASTM E1680:

- a. 1.57 PSF 0.0012 cfm/ sq. ft.
- b. 6.24 PSF 0.0001 cfm/ sq. ft.
- c. 20.0 PSF 0.0011 cfm/ sq. ft.

1.3.2.2 Static pressure water infiltration (Roof panels)

Text Pressure Result per ASTM E1646:

- a. 5 Gal. / Hr. per S.F. and Static NO LEAKAGE
- b. Pressure of 20.0 PSF for 15 Minutes NO LEAKAGE

1.3.2.3 Tests

Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within the range or test data. Extrapolations for conditions outside test range are not acceptable.

1.3.2.4 Water penetration (dynamic pressure):

No water penetration, other than condensation, when exposed to dynamic rain and 70 mph wind velocities for not less than five minutes duration, when tested in accord with principles of AAMA 501.1.

1.3.2.5 Wind and wind driven rain resistance

No water penetration, other than condensation, when exposed to dynamic rain and 70 mph wind velocities for not less than five minutes duration, when tested in accord with principles of AAMA 501.1.

1.3.2.6 Roof pressures

The installed roof system assembly shall show that it can resist the calculated roof pressure in section 1.11.B in accordance with the test results of TAS 125.

1.3.2.7 Water penetration in low slope application

No water penetration or panel movement when subject to 6" head of water for 6 hours when tested in accordance with the ASTM E2140 and when subject to 6" head of water for 7 days when tested in accordance with the TAS 114 appendix

1.3.2.8 Hydrostatic Head Resistance

No water penetration when tested according to ASTM E2140. Submit Leakage test report upon completion of installation with submittal data.

1.3.2.9 Wind Uplift Resistance

Provide metal roof panel system that conform to the requirements of ASTM E1592 and UL580. Uplift force due to wind action governs the design for panels. Submit wind uplift test report prior to commencing installation. Submit licensed Wind uplift calculations engineer's and substantiating data to validate any non-rated roof system. Base wind uplift measurements on a design wind speed of 209 km/h 150mph in accordance with ASCE 7 and/or other applicable building code requirements. Metal roof panels and component materials must also comply with the requirements in FM4471 as part of a panel roofing system as listed in Factory Mutual Guide (FMG) "Approval Guide" for class 1 or noncombustible construction, as applicable. Identify all materials with FMG Markings.

1.3.2.10 Standing Seam Water - Stop test:

Comply with ASTM E1680, ASTM E1646, AAMA 501.1, and ASTM E2140.

1.3.2.11 Fire Test

When required comply with ASTM E108 or UL 790.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section

01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roofing panels; G

Gutter / Downspout System; G

Submit drawings as necessary to supplement the instructions and diagrams. Drawings shall include design and erection drawings containing an isometric view of the roof showing the design uplift pressures and dimensions of edge, ridge and corner zones. Show typical and special conditions including flashings, accessory installation, materials and thicknesses, all dimensions, anchoring methods, sealant locations, sealant tape locations, fastener layout, sizes, spacing, provisions for thermal movement, terminations, penetrations, and attachments. Details of installation shall be in accordance with the manufacturer's Standard Instructions and details or the SMACNA 1013. The manufacturer's technical engineering department shall approve the drawings before they are submitted.

SD-03 Product Data

Roofing panels; G

Attachment clips; G

Closures

Accessories

Underlayment

Fasteners

Pressure Sensitive Tape

Gaskets

Sealing

Compounds

Sample warranty certificate; G

Submit for all materials to be provided. Submit data sufficient to indicate conformance to specified requirements.

SD-04 Samples

Roofing panels

Submit a 300 mm 12 inch long section of typical panel in color selected.

When colors are not indicated, submit samples of not less than six different manufacturer's standard colors for selection.

Accessories

Submit each type of accessory item used in the project including, but not limited to: each type of anchor clip, closures, fasteners and leg clamps.

SD-05 Design Data

Load calculations; G

SD-06 Test Reports

Structural performance; G

Panel finish (Color); G

Leakage Test Reports

Wind Uplift Test Report

Factory Finish and Color Performance Requirements

Submit reports of the tests required by this section.

Manufacturer's field inspection; G

Submit manufacturer's technical representative's inspection reports as required in paragraph entitled "Manufacturer's Field Inspection."

SD-07 Certificates

Technical representative

Qualification of Installer

Submit documentation proving the installer is factory-trained, has the specified experience and is authorized by the manufacturer to install the products specified.

Coil stock compatibility

Provide certification of coil compatibility with roll forming

machinery to be used for forming panels without warping, waviness, and rippling not part of panel profile; to be done without damage, abrasion or marking of finish coating.

Qualification of Manufacturer

Qualifications of Applicator

SD-08 Manufacturer's Instructions

Sealant

Submit manufacturer's sealant requirements for making the standing seam watertight when subjected to 125 mm 5 inches of rainfall per hour simultaneous with 200 km/h 124 mph winds.

Installation manual

Submit manufacturer's printed installation manual/instructions and standard details.

SD-11 Closeout Submittals

Information card

For each roofing installation, submit a typewritten card or photoengraved aluminum card containing the information listed on Form 1 located at the end of this section.

1.5 LOAD CALCULATIONS

Submit load calculations for the following by a structural engineer registered as a Professional Engineer in any jurisdiction verifying that the system supplied meets the design loads indicated. Coordinate calculations with manufacturer's test results.

- a. Wind load uplift design pressure at roof locations specified in paragraph entitled "Wind Loads."
- b. Clip spacing and allowable load per clip calculations.
- c. The fastening of clips to structure or intermediate support spacing.
- d. Intermediate support spacing and fastening to structure when required.
- e. Allowable panel span at anchorage spacing indicated.
- f. Safety factor used in determining loading.

1.6 QUALITY ASSURANCE

1.6.1 Preroofing Conference

After submittals are received and approved but before roofing and insulation work, including associated work, is preformed, the Contractor shall hold a preroofing conference to review the following:

- a. The drawings and specifications
- b. Procedure for on site inspection and acceptance of the roofing substrate and pertinent structural details relating to the roofing system
- c. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing
- d. Safety requirements.

The preroofing conference shall be attended by the Contractor and personnel directly responsible for the roofing and insulation installation, mechanical and electrical work, and the roofing manufacturer's technical representative. Conflicts among those attending the preroofing conference shall be resolved and confirmed in writing before roofing work, including associated work, is begun. Prepare written minutes of the preroofing conference and submit to the Contracting Officer.

1.6.2 Manufacturer's Technical Representative

The representative shall have authorization from manufacturer to approve field changes and be thoroughly familiar with the products and with installations in the geographical area where construction will take place. The manufacturer's representative shall be an employee of the manufacturer with at least 5 years experience in installing the roof system. The representative shall be available to perform field inspections and attend meetings as required herein, and as requested by the Contracting Officer.

When the project is in progress, the roofing system manufacturer shall provide the following:

1.6.2.1 Work Progress

Keep the Owner informed as to the progress and quality of the work as observed. Photographic Inspection Report to be turned in on a weekly basis to the Owner.

1.6.2.2 Inspections

Provide job site inspections a minimum of THREE days a week.

1.6.2.3 Reports

Report to the Owner in writing any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.

1.6.2.4 Confirmation of work done

Confirm after completion that manufacturer has observed no application procedures in conflict with the specifications other than those that may have been previously reported and corrected.

1.6.2.5 Annual Inspection

The roofing manufacturer must inspect the roof on an annual basis and submit an annual inspection report to Public Works at MC Base Camp Lejeune

and MCAS New River.

1.6.2.6 Manufacturer Inspector

The manufacturer's inspector must be a full time employee of the manufacturer with a minimum 5 years experience inspecting the specified roof system. A signed copy to attest to the full time employ and tenure of the inspector by the president of the manufacturing company will accompany submittals.

1.6.3 Qualification of Installer

The roofing system installer shall be factory-trained, approved by the metal roofing system manufacturer to install the system, and shall have a minimum of five (5) years experience as an approved applicator with that manufacturer. The applicator shall have applied five installations of similar size and scope to this project within the previous 3 years.

1.6.4 Single Source

Provide roofing panels, clips, closures and other accessories from a single manufacturer. Provide the most recent design of the manufacturer to operate as a complete system for the intended use.

1.6.5 Manufacturer

The SSMRS shall be the product of a metal roofing industry recognized SSMRS manufacturer who has been in the practice of manufacturing SSMRS for a period of not less than 5 years and who has been involved in at least 5 projects similar in size and complexity to this project.

1.6.6 Qualifications for Welding Work

Welding procedures must conform to AWS D1.1/D1.1M for steel or AWS D1.2/D1.2M for aluminum.

Operators are permitted to make only those types of weldments for which each is specifically qualified.

1.6.7 Field Verification

Prior to the preparation of drawings and fabrication, verify location of roof framing, roof openings and penetrations, and any other special conditions. Indicate all special conditions and measurements on final shop drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

Deliver, store, and handle preformed panels, bulk roofing products and other manufactured items in a manner to prevent damage or deformation.

1.7.1 Delivery

Provide adequate packaging to protect materials during shipment. Do not uncrate materials until ready for use except for inspection. Immediately upon arrival of materials at jobsite, inspect materials for damage, dampness, and staining. Replace damaged or permanently stained materials that cannot be restored to like-new condition with new material. If materials are wet, remove moisture, restack and protect panels until used.

1.7.2 Handling

Handle material carefully to avoid damage to surfaces, edges and ends.

1.7.3 Storage

Stack materials stored on the site on platforms or pallets and cover with tarpaulins or other suitable weathertight coverings which prevent water trapping or condensation. Store panels so that water which might have accumulated during transit or storage will drain off. Do not store the panels in contact with materials that might cause staining, such as mud, lime, cement, fresh concrete or chemicals. Protect stored panels from wind damage.

1.8 Warranty

Furnish manufacturer's no dollar limit materials and workmanship warranty for the roofing system. The warranty period shall be not less than 30 years from the date of Government acceptance of the work. The warranty shall be issued directly to the Government. The warranty shall provide that if within the warranty period the metal roofing system becomes non-watertight or shows evidence of corrosion, perforation, peeling paint, rupture or excess weathering due to deterioration of the roofing system resulting from defective materials or workmanship the repair or replacement of the defective materials and correction of the defective workmanship shall be the responsibility of the roofing system manufacturer. Repairs that become necessary because of defective materials and workmanship while roofing is under warranty shall be performed within 7 days after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within the specified period of time will constitute grounds for having the repairs performed by others and the cost billed to the manufacturer and contractor as described herewith. Contractor shall also provide a 2 year contractor installation warranty during which time the materials are covered by the manufacturer per the warranty period described above. Provide coverage for damage to the roofing system caused by sustained winds having a velocity up to and including 130 mph.

Applications over existing structures: Up to and including 130 mph.

New Construction: Up to and including 150 mph.

PART 2 PRODUCTS

2.1 ROOFING PANELS

2.1.1 Material

3004 aluminum, ASTM B209M ASTM B209 and AA AD1. All products must be American made and manufactured in a plant owned and operated by the roofing manufacturer listed in the submittals. Product re-labeling will not be acceptable.

2.1.1.1 Thickness

1.0 mm 0.040 inch minimum.

2.1.1.2 Finish

Exposed Coil-Coated Finish: 2-Coat Fluoropolymer. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Manufacturers' approved applicator to prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

Coating system shall provide nominal 1.0 mil (0.025 mm) dry film thickness, consisting of primer and color coat.

Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.1.1.3 Texture

Smooth with raised intermediate ribs for added stiffness.

2.1.1.4 Color

As selected from the Manufacturer full array of offered colors and textures.

2.1.1.5 Configuration

a. Provide panels of continuous lengths from ridge to eaves or from top to eaves on shed roof designs. Panels from coil stock shall be formed without warping, waviness or ripples not a part of the panel profile, and shall be free of damage to the finish coating system.

b. Provide panels with UNLIMITED thermal movement.

c. Profile: 2 3/8" high seam at 16" o.c.; mechanically seamed "T" seam; continuous length, no splicing; Concealed 16 GA one piece stainless steel clip not to come in contact with seam sealant.

d. Panel/Cap configuration must have a total of four (4) layers of aluminum surrounding anchor clip for prevention of water infiltration and increased system strength designed to limit potential for panel blow-off.

e. Profile of panel shall have mesas every two (2) inches on center continuous throughout the panel which are a minimum of one and one half (1-1/2) inches wide.

f. Seam must be two and three-eighths (2 3/8) inches minimum height for added upwared pressures and aesthetic appeal. Seam shall have continuous anchor reveals to allow anchor clips to resist positive and negative loading and allow unlimited expansion and contraction of panels due to thermal changes. Integral (not mechanically sealed) seams are unacceptable.

g. Seam cap: Snap on cap shall be a minimum of 1" wide "T" shaped of continuous length up to forty five (45) feet according to job conditions and field seamed by means of manufacturer's standard seaming machine.

h. Cap shall be designed to receive two (2) beads of continuous gasketing sealant, which will be applied independent of of anchor clip, to allow unlimited thermal movement of panel without serious damage to cap sealant.

i. Stiffening ribs : Located in flat of panel to minimize oil canning and telegraphing of structural members.

j. Replaceability: Panels shall be of a symmetrical design with snap on, mechanically seamed cap configuration such that individual panels may be removable for replacement without removing adjacent panels and uncrimping the existing seam (Panels will be removed by replacing the batten seam cap only to maintain the structural integrity of the panel and seam. Uncrimping and recrimping a mechanical seam is unacceptable.

k. Panel ends shall be panned at ridge, headwall, and hip conditions, or where applicable.

l. Panel length: Full length without joints, including bends.

2.2 ATTACHMENT CLIPS

Provide one-piece clips of compatible materials to aluminum roof panels. Size, shape, thickness and capacity must meet the thickness and design load criteria specified. Two piece clips are not acceptable.

2.3 ACCESSORIES

Sheet metal flashings, trim, moldings, closure strips, caps, preformed crickets, equipment curbs, gutters, down spouts, and other similar sheet metal accessories provided in conjunction with preformed metal panels shall be of the same material and finish as panels, except that such items which will be concealed after installation may be provided without the finish if they are aluminum or stainless steel. Provide ridge and rib closures, as specified. Metal shall be of thickness not less than that of panels. Molded closure strips shall be closed-cell synthetic rubber, neoprene, or polyvinyl chloride premolded to match configurations of preformed metal panels. Thermal spacer blocks and other thermal barriers at concealed fasteners shall be as recommended by the roofing panel manufacturer.

2.3.1 Closures

2.3.1.1 Ridge Closure

Metal-clad foam or metal closure with foam secondary closure matching panel configuration for installation on surface of roof panel between panel ribs at ridge and headwall roof panel flashing conditions and terminations. Foam material shall not absorb water.

2.3.1.2 Rib Closure

Aluminum, closed-cell or solid-cell synthetic rubber, neoprene or polyvinyl chloride pre-molded to match configuration of rib opening. Material for closures shall not absorb water.

2.3.2 Fasteners

Series 300 stainless steel with composite metal and neoprene composition washers. Fasteners for attachment to structural supports and fasteners for attachment of panels shall be as approved and in accordance with manufacturer's recommendation. Unless specified otherwise herein, fasteners shall be either self-tapping screws, bolts and nuts, or

self-locking bolts. Design fastening system to withstand design loads indicated. Fasteners shall not be over-torqued and shall develop full capacity of attachment clips.

2.3.2.1 Screws

Concealed fasteners: Corrosion resistant steel screws, #10 minimum diameter x length appropriate for substrate, hex washer head or pancake head. Use self-drilling, self-tapping for metal substrate or A-point for plywood substrate.

Exposed fasteners: 3xx series stainless steel screws (cadmium or zinc coatings are not acceptable) with neoprene sealing washer, or 1/8-inch- (3-mm-) diameter stainless steel rivets.

2.3.2.2 Bolts

Provide not less than 6 mm 1/4 inch diameter, shouldered or plain shank as required, with proper nuts.

2.3.2.3 Automatic End-Welded Studs

Provide shouldered type with a shank diameter of not less than 5 mm 3/16 inch and cap or nut for holding covering against the shoulder.

2.3.2.4 Explosive Driven Fasteners

Provide fasteners to be driven with explosive actuated tools and with a shank diameter of not less than 13 mm 1/2 inch for fastening to steel and not less than 25 mm one inch for fastening to concrete.

2.3.2.5 Rivets

Blind rivets shall be aluminum with 5 mm 3/16 inch nominal diameter shank or stainless steel with 3 mm 1/8 inch nominal diameter shank. Rivets shall be threaded stem type if used for other than fastening trim. Rivets with hollow stems shall have closed ends.

2.3.3 Sealant

Provide manufacturer's recommended elastometric exposed sealant. Provide non-hardening, non-shrinking concealed sealants. Silicone-based sealants shall not be used in contact with finished metal panels and components unless approved otherwise by the Contracting Officer.

2.3.4 Sealant Tape

Polyvinyl chloride closed cell foam tape or composed of 99 percent solids in a base of butyl polyisobutylene rubber with the following properties and characteristics:

- a. Webbing and Elongation: 100 percent minimum at 25 degrees C 77 degrees F
- b. Adhesion: Excellent to surfaces used
- c. U-V light exposure: No effect

- d. Ozone: No effect
- e. Weathering: 1000 hours in QUV Test Apparatus - Excellent, no cracking, bleeding, or significant changes.
- f. Moisture Transmission: 0.05 to 0.15 grams per 62500 square mm 100 square inches in 24 hours.
- g. Service Temperature Tests: Bending over 13 mm 1/2 inch mandrel at minus 50 degrees C minus 60 degrees F with no cracking. Expose sealed typical metal lap joint to plus 176 degrees C plus 350 degrees F for 24 hours with no significant loss of original properties.
- h. Reaction to Metals: Non-corrosive to metals

2.4 UNDERLAYMENT FOR WOOD SUBSTRATES

Apply Self-adhering rubberized asphaltic membrane over the entire roof area. Minimum of 1 mm 40 mils thick, high temperature as recommended by the standing seam manufacturer for use over entire roof and flashing conditions. Products shall meet or exceed the performance criteria of ASTM D1970/D197M. For areas subjected to excessive humidity generated by building equipment or occupant usage (such as swimming pools, locker rooms, etc), submit a synthetic, vapor permeable, UV-resistant membrane for approval.

2.5 LABORATORY TESTS FOR PANEL FINISH

Previously manufactured panels of the same type and finish as proposed for the project shall have been tested by an approved testing laboratory to ensure conformance to specifications. The term "appearance of base metal" refers to the aluminum base metal. Panels shall meet the following test requirements.

2.5.1 Salt Spray Test

Panels shall withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM B117, including the scribe requirement in the test. Immediately upon removal of the panel from the test, coating shall receive a rating of 10, no blistering, as determined by ASTM D714; and a rating of 7, 2 mm 1/16 inch failure at scribe, as determined by ASTM D1654, Rating Schedule No. 1.

2.5.2 Formability Test

For formability test, when subjected to a 180 degree bend over a 3 mm 1/8 inch diameter mandrel in accordance with ASTM D522, exterior coating film shall show only microchecking of the exterior film and there shall be no loss of adhesion.

2.5.3 Accelerated Weathering Test

Panels shall withstand an accelerated weathering test for a minimum of 2000 hours in accordance with ASTM G152, ASTM G153 or ASTM D2565 without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with a penknife blade or similar instrument

shall be considered to indicate loss of adhesion.

2.5.4 Chalking Resistance

After the 2000-hour weatherometer test, exterior coating shall not chalk greater than No. 8 rating when measured in accordance with [ASTM D4214](#) test procedures.

2.5.5 Abrasion Resistance Test for Color Coating

When subjected to the falling sand test in accordance with [ASTM D968](#), coating system shall withstand a minimum of 100 liters of sand per 0.025 mm mil of coating thickness before appearance of base metal.

2.5.6 Humidity Test

When subjected to a humidity cabinet test in accordance with [ASTM D2247](#) for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage, or corrosion.

2.5.7 Fire Hazard

The finish on factory-fabricated panels shall have a flame spread rating of not more than 25 when tested in accordance with [ASTM E84](#).

2.5.8 Gloss

The gloss of the finish shall be 30 plus or minus 5 at an angle of 60 degrees, when measured in accordance with [ASTM D523](#).

2.5.9 Glare Resistance

Surfaces of panels that will be exposed to the exterior shall have a specular reflectance of not more than 10 when measured in accordance with [ASTM D523](#) at an angle of 85 degrees. Requirements specified under "Formability Test" will be waived if necessary to conform to this requirement.

2.6 LINER PANELS

Fabricate liner panels of the same material as roof panels, and formed or patterned to prevent waviness and distortion. Liner panels shall have a factory applied, 0.025 mm one mil thick minimum painted coating on the inside face, and a prime coat on the liner side.

2.7 Retrofit Framing Over Existing Roofs

2.7.1 Shop Drawings

Show roof framing system with accessories in plan, sections and details. Include complete drawing/description of each framing component and fastener, including metal thickness and finishes, connection details, anchorage details, and special fabrication provisions. Indicate relationships with adjacent and interfacing work. Indicate fastener types and spacing; and provide fastener pullout values.

2.7.2 Product Data

Include manufacturer's detailed material and system description, engineering performance data and finish specifications. Indicate fastener types and spacing; and required fastener pullout values.

2.7.3 Design Loads

Submit copy of manufacturer's minimum design load calculations according to ASCE 7. All loading types shall be considered: dead, live, snow, wind, and seismic.

2.7.4 System Certification

Provide statement certifying the proposed system's capacity to safely resist the calculated design loads. Statement shall be provided by a registered professional engineer and co-signed by an officer of the manufacturing company.

2.7.5 Warranties

Owner shall receive one (1) warranty from manufacturer of each roof framing system covering all of the following criteria. Ten (10) year material coverage. Warranty shall commence on date of substantial completion. Owner shall receive one (1) warranty from the installer of the roof framing systems covering installation and workmanship for a period of three (3) years from date of substantial completion.

2.7.6 Notched Purlin Type Framing System

Shall be 16 gauge minimum galvanized steel meeting all requirements of STM A653, Grade 33 (minimum) with a hot dipped galvanized coating per ASTM A924, class G90.

Notched purlin profile shall be a stiffened zee shape with notched bottom flange and web to match the profile of the existing metal panel. The top flange shall be one and three quarters ($1\frac{3}{4}$) inch wide (minimum) to provide for attachment of the standing seam panel clips.

The web height of the notched purlin shall be as required for installation over the existing metal panels, and to accomplish the panel lap detail for replacement standing seam roof panels as detailed on drawings.

2.7.7 Framing System Installation

Install notched purlin type framing system over existing standing seam roof panels. Locate new framing directly above existing purlin locations, per manufacturer's recommendations.

All details will be shown on manufacturer's shop drawings; install framing system in accordance with approved shop drawings and manufacturer's product data, within specified erection tolerances.

Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and components.

Limit exposed fasteners to extent indicated on shop drawings.

Attach framing system to existing roof structure using fasteners of size and spacing as determined by manufacturer's design analysis to resist all specified design loads.

Installed system shall be true to line and plane and free of dents, and physical defects.

Maximum variation from true planes or lines shall be one quarter ($1/4$) inch in twenty (20) feet and three eighths ($3/8$) inch in forty (40) feet or

more. Remove damaged work and replace with new, undamaged components. Touch up exposed fasteners using paint furnished by roofing panel manufacturer and matching exposed panel surface finish. Remove all miscellaneous materials and debris from roof.

2.8 Standing Seam System over existing Roof Shingles

2.8.1 Demolition

Demolish all the roofing system to the existing substrate, including but not limited to shingles, asphalt paper, flashing, ridge caps, gutters, downspouts, soffits, fascia, etc.

2.8.2 Repair existing substrate

Remove all substrate items (Tongue and groove wood boards - Field Verify) that are damaged and / or are not structurally sound. Match existing materials, shapes and thicknesses.

2.8.3 Re-Deck

Install over the entire existing substrate one layer of 5/8" thick CDX plywood. Fasten as necessary per design described below. Note: Where existing decking consists of 5/8" (or thicker) CDX plywood, additional CDX overlay is not required. In such case, remove any damaged or rotted CDX material and replace with new before installation of self-adhering membrane and metal roofing components over existing CDX plywood decking.

Type A - Wood. Overlay CDX plywood on existing roof surface using APA fastening pattern for wind uplift resistance based on 150 mph winds.

Type B - Steel Double C-Channel. Fasten CDX plywood to double C-Channel by using #12 self-drilling screws at 6" OC. Ensure self-drilling screws penetrate flange of C-Channel. Do not drive self-drilling screws between steel C-channels as weld may break. Ensure self-drilling screws penetrate C-channel flanges only (either flange is satisfactory). Alternative approach: Install 2x4 nailers under decking and C-channel flange parallel to upper chord of truss. Fasten with #12 x 2 1/2" deck screws at 6" on center.

Type C - Steel Single C-Channel. Fasten CDX plywood to single C-channel by using #12 self-drilling screws at 6" on center. Ensure self-drilling screws penetrate C-channel flanges only.

2.8.4 Re-Deck (complete replacement of existing deck)

Note: Applies only to conditions where existing wood roof decking is called for to be completely demolished and replaced with metal pan: Install new metal pan deck over existing roof structure to conform with ASTM A792/A792M or ASTM A1008/A1008M for metal deck. Fabricate zinc-coated metal in conformance with ASTM A653/A653M, Z275 G90 coating class roof deck. Deck profile, thickness, and fastening to be designed by a registered structural engineer to accommodate allowable deflection under applicable dead and live load criteria.

2.8.5 Roof Board over metal deck:

Note: Applies only to conditions where metal pan decking is installed per Paragraph 2.8.4 above: Install 1/2" Roof Board fire barrier with moisture resistant, non-combustible Gypsum core and with fiberglass matts. Flame spread 0, smoke developed 0, when tested in accordance with ASTM E84 or CAN/ULC-S102. Noncombustible when tested in accordance with ASTM E136.

PART 3 EXECUTION

3.1 EXAMINATION

Examine surfaces to receive standing seam metal roofing and flashing. Provide plumb and true surfaces, clean, even, smooth and as dry as possible. Ensure that surfaces are free from defects and projections which might affect the installation. Report unsuitable conditions to Contracting Officer.

3.2 PROTECTION OF DISSIMILAR METALS

Where an aluminum component is in contact with, fastened to, or contacted by drainage from dissimilar metals other than stainless steel, give such dissimilar metals one of the following treatments:

- a. A heavy brush coat of primer followed by two coats of aluminum metal and masonry paint.
- b. A heavy coat of alkali-resistant bituminous paint.
- c. Separate contact surfaces with non-absorptive tape or gasket.

3.2.1 Contact with Masonry

Where aluminum is in contact with masonry, concrete, or plaster, apply a heavy coat of alkali-resistant bituminous paint.

3.2.2 Contact with Wood

Where aluminum is in contact with wood or other absorptive material subject to wetting, or with wood treated with a preservative not compatible with aluminum, seal joints with sealing compound and apply one heavy brushcoat of aluminum pigmented bituminous paint.

3.3 INSTALLATION

Install in accordance with approved manufacturer's erection instructions shop drawings, and diagrams, except as specified otherwise herein. Provide panels in full and firm contact with clips. Obtain approval prior to installation on prefinished panels cut in the field, and factory applied coverings or coatings that were repaired after being abraded or damaged during handling or installation. Make repairs with material of same color as weather coating. Completely seal openings through panels. Correct defects or errors in materials in an approved manner. Replace materials which cannot be corrected in an approved manner with new materials. Provide molded closure strips where indicated and where necessary for weathertight construction. Use shims as required to ensure clip line is true. Use a spacing gage at each row of panels to ensure that panel width is not

stretched or shortened. Provide one layer of synthetic underlayment with side laps down slope. Overlap side end laps 75 mm 3 inches.

3.3.1 Roof Panels

Apply roofing panels with standing seams parallel to slope of roof. Provide roofing panels in full lengths from ridge to eaves (top to eaves on shed roofs), with no transverse joints except at the junction of ventilators, curbs, skylights, chimneys, and similar openings. Form interlocking rib type panel seams in the field with an automatic mechanical seamer approved by the manufacturer. Attach panels to structure with concealed clips which are incorporated into the panel seams. Clip attachment shall allow roof to move freely and independently of the structure, except at fixed points as indicated.

All "Curving, S-Curbing, and Tapering" shall be mechanically done only. Curved panels must be mechanically factory curved to the exact radius of each curved roof area. Tapered panels must be formed from a single piece of metal. Performance tests must be applicable for the greatest panel width. Any other method shall not be allowed. Provide Manufacturer's methods for lifting of large panels to prevent panel deformation during its installation. Use manufacturer's spreader bar where applicable to prevent kinking and damage to panels. Field formed panels shall be done with the same factory machinery and methods. Field form machinery must be calibrated daily. For field forming of panels, the manufacturer must use the same equipment used in the factory to form the panels onsite. Manufacturer must engage a factory authorized service representative to form the panels on site and comply with the following:

- a. Roll form operator is to be factory trained and authorized to provide job site operations of the panel forming process with quality control standards.
- b. The panel profile shall be checked and verified to be within acceptable forming tolerances as called for under the factory defined panel quality control fabrication standards (Quality control sheets). These standards define the upper and lower acceptable forming tolerances. The actual forming dimensions shall be on or within these acceptable standards.
- c. Dimensional checks shall be conducted at the beginning of the operation and at the beginning of each new slit coil. This process ensures proper panel profile is being produced with each new slit coil and consistency throughout the project.
- d. These panel dimensions shall be recorded on site in the Daily Report and returned to the factory for quality control review.
- e. Panels shall be formed on heavy duty factory type roll former with no fewer than 16 forming stations to improve quality and minimize oil canning.
- f. Panels shall be of identical profile and characteristics as factory formed panels and specimens used as the basis of performance tests.
- g. Sealant shall be factory applied in a separate factory formed snap on cap. Site/field applied seam sealant is unacceptable. Seam caps may be shipped in 45 feet (11.4 m) or less length and lap spliced over full length panels in accordance with manufacturer's system details.
- h. Site roll-forming equipment shall be owned and maintained by the panel

manufacturer and operated by the panel manufacturer's trained full-time experienced technician. The installer must provide additional personnel to handle raw materials and finished product as necessary.

3.3.2 Flashings

Provide flashing and related closures and accessories in connection with preformed metal panels [as indicated] and as necessary to provide a weathertight installation. Install flashing to ensure positive water drainage away from roof penetrations. Flash and seal roof at ridge, eaves and rakes, at projections through roof, and elsewhere as necessary. Accomplish placement of closure strips, flashing, and sealing material in an approved manner that will ensure complete weathertightness. Details of installation which are not indicated shall be in accordance with the [NRCA Details](#), [SMACNA 1793](#), [AA ASM-35](#), panel manufacturer's printed instructions and details of the approved shop drawings. Installation shall allow for expansion and contraction of flashing.

3.3.3 Flashing Fasteners

Fastener spacings shall be in accordance with the panel manufacturer's recommendations and as necessary to withstand the indicated design loads. Install fasteners in roof valleys as recommended by the manufacturer of the panels. Install fasteners in straight lines within a tolerance of [13 mm](#) [1/2 inch](#) in the length of a bay. Drive exposed penetrating type fasteners normal to the surface and to a uniform depth to seat gasketed washers properly and drive so as not to damage factory applied coating. Exercise extreme care in drilling pilot holes for fastenings to keep drills perpendicular and centered. Do not drill through sealant tapes. After drilling, remove metal filings and burrs from holes prior to installing fasteners and washers. Torque used in applying fasteners shall not exceed that recommended by the manufacturer. Remove panels deformed or otherwise damaged by over-torqued fastenings, and provide new panels.

3.3.4 Closure/Closure Strips

Set closure/closure strips in joint sealant material.

3.4 CLEANING

Clean exposed sheet metal work at completion of installation. Remove metal shavings, filings, nails, bolts, and wires from roofs on completion to prevent discoloration and harm to the panels and flashing. Remove grease and oil films, excess sealants handling marks, contamination from steel wool, fittings and drilling debris and scrub the work clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks.

3.5 MANUFACTURER'S FIELD INSPECTION

Manufacturer's technical representative shall visit the site as necessary [but not less than three \(3\) days a week](#) during the installation process to assure panels, flashings, and other components are being installed in a satisfactory manner. [Refer to 1.6.2.6 for Manufacturer's technical representative field inspections](#) and at substantial completion prior to issuance of warranty. Each inspection visit shall include a review of the entire installation to date. After each inspection, a report, signed by the manufacturer's technical representative, shall be submitted to the

Contracting Officer noting the overall quality of work, deficiencies and any other concerns, and recommended corrective actions in detail. Notify Contracting Officer a minimum of 2 working days prior to site visit by manufacturer's technical representative.

3.6 COMPLETED WORK

Completed work shall be plumb and true without oil canning, dents, ripples, abrasion, rust, staining, or other damage detrimental to the performance or aesthetics of the completed roof assembly.

3.7 INFORMATION CARD

For each roof, provide a typewritten card, laminated in plastic and framed for interior display or a photoengraved 0.8 mm thick 0.032 inch thick aluminum card for exterior display. Card to be 220 by 280 mm 8 1/2 by 11 inches minimum and contain the information listed on Form 1 at end of this section. Install card near point of access to roof, or where indicated. Send a photostatic paper copy to [LANTNAVFACENGCOM, Code 1613, 1510 Gilbert Street, Norfolk, VA 23511-2699] [NORTHNAVFACENGCOM, Code 103A, 10 Industrial Highway, Mail Stop #82, Lester, PA 19113-2090] [PACNAVFACENGCOM, Code 102, Pearl Harbor, HI 96860-7300] [SOUTHNAVFACENGCOM, Code 0535, P.O. Box 190010, North Charleston, SC 29419-9010] [SOUTHWESTNAVFACENGCOM, Code 133SB, 1220 Pacific Highway, San Diego, CA 92132-5190].

3.8 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of English unit measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The English and metric units for the measurements shown are as follows:

<u>PRODUCTS</u>	<u>ENGLISH UNITS</u>	<u>METRIC UNITS</u>
a. Sheet Aluminum	0.040 inch	1.0 mm
b. Panels	16 inches	406 mm
- vertical legs	2 3/8 inches	60 mm
- stiffening ribs	4 inches	100 mm
c. Screws	No. 14	0.242 mm
	No. 12	0.216 mm
d. Bolts	1/4 inch	6 mm
e. Studs	3/16 inch	5 mm
f. Fasteners	1/2 inch	13 mm
	One inch	25 mm

g. Rivets	1/16 inch	5 mm
	1/8 inch	3 mm

3.9 FORM ONE

FORM 1 - PREFORMED STEEL STANDING SEAM ROOFING SYSTEM COMPONENTS

1. Contract Number:
2. Building Number & Location:
3. NAVFAC Specification Number:
4. Deck/Substrate Type:
5. Slopes of Deck/Roof Structure:
6. Insulation Type & Thickness:
7. Insulation Manufacturer:
8. Vapor Retarder: () Yes () No
9. Vapor Retarder Type:
10. Preformed Steel Standing Seam Roofing Description:
 - a. Manufacturer (Name, Address, & Phone No.):
 - b. Product Name:
 - c. Width:
 - d. Gage:
 - e. Base Metal:
 - f. Method of Attachment:
11. Repair of Color Coating:
 - a. Coating Manufacturer (Name, Address & Phone No.):
 - b. Product Name:
 - c. Surface Preparation:
 - d. Recoating Formula:
 - e. Application Method:
12. Statement of Compliance or Exception: _____

13. Date Roof Completed:
14. Warranty Period: From _____ To _____

15. Roofing Contractor (Name & Address):

16. Prime Contractor (Name & Address):

Contractor's Signature _____ Date:

Inspector's Signature _____ Date:

-- End of Section --

SECTION 07 72 33

ROOF HATCHES

08/20

PART 1 GENERAL

1.1 SUMMARY

Provide factory-fabricated roof hatches for ladder access.

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Product Data

SD-11 Closeout Submittals

Warranty

1.3 QUALITY ASSURANCE

1.3.1 Qualifications

- A. Manufacturer: A minimum of 5 years experience manufacturing similar products.
- B. Installer: A minimum of 2 years experience installing similar products.
- C. Manufacturer's Quality System: Registered to ISO 9001 Quality standards including in-house engineering for product design activities.
- D. Submit Product Data that meets the criteria found in 2.1 System Description.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.5 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Furnish and install where indicated on plans metal roof hatch Type S, size as indicated on plans. Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.
- B. Performance characteristics:
 - 1. Cover shall be reinforced to support a minimum live load of 40 ps (195kg/m²) with a maximum deflection of 1/150th of the span and a 140 psf (684 kg/m²) wind uplift for galvanized steel (Type S-20) and galvanized steel curb (Type S-40).
 - 2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
 - 3. Operation of the cover shall not be affected by temperature.
 - 4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.
 - 5. Galvanized steel (Type S-20) and aluminum (Type S-50) roof hatches shall be Miami-Dade Product approved (NOA No. 18-0226.04 Expiration Date: December 2, 2019), meeting large and small missile impact requirements. Florida Product Approval #FL15110.
- C. Cover: Shall be select: 14 gauge (1.9mm) paint bond G-90 galvanized steel with a 3" (76mm) beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.
- D. Cover insulation: Shall be fiberglass of 1" (25mm) thickness, fully covered and protected by a metal liner 22 gauge (.8mm) paint bond G-90 galvanized steel.
- E. Curb: Shall be 12" (305mm) in height and of 14 gauge (1.9mm) paint bond G-90 galvanized steel. The curb shall be formed with a 3-1/2" (89mm) flange with 7/16" (11.1mm) holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6" (153mm) on center, to be bent inward to hold single ply roofing membrane securely in place.
- F. Curb insulation: Shall be rigid, high-density fiberboard of 1" (25mm) thickness on outside of curb.
- G. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe through bolted to the curb assembly.

H. Hardware

1. Heavy pintle hinges shall be provided.
2. Cover shall be equipped with a spring latch with interior and exterior turn handles.
3. Roof hatch shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25mm) diameter red vinyl grip handle to permit easy release for closing.
6. All hardware shall be Type 316 stainless steel hardware.
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

I. Finishes: Factory finish shall be alkyd based red oxide primed steel.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected

3.2 INSTALLATION

- A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
 1. Test units for proper function and adjust until proper operation is achieved.
 2. Repair finishes damaged during installation.
 3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

- A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

-- End of Section --

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SECTION 07 84 00

FIRESTOPPING
05/10

PART 1 GENERAL

1.1 SUMMARY

Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

- a. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.
- b. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E119	(2018) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E1399/E1399M	(1997; R 2017) Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E1966	(2015) Fire-Resistive Joint Systems
ASTM E2174	(2014b) Standard Practice for On-Site Inspection of Installed Fire Stops
ASTM E2307	(2015a) Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
ASTM E2393	(2010a) Standard Practice for On-Site Inspection of Installed Fire Resistive

Joint Systems and Perimeter Fire Barriers

ASTM E699 (2009) Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components

ASTM E814 (2013a; R 2017) Standard Test Method for Fire Tests of Penetration Firestop Systems

ASTM E84 (2018) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM 4991 (2013) Approval of Firestop Contractors

FM APP GUIDE (updated on-line) Approval Guide
<http://www.approvalguide.com/>

UNDERWRITERS LABORATORIES (UL)

UL 1479 (2015) Fire Tests of Through-Penetration Firestops

UL 2079 (2004; Reprint Dec 2014) Tests for Fire Resistance of Building Joint Systems

UL 723 (2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials

UL Fire Resistance (2014) Fire Resistance Directory

1.3 SEQUENCING

Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials. at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material shall be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping System

SD-03 Product Data

Firestopping Materials

SD-06 Test Reports

Inspection

SD-07 Certificates

Inspector Qualifications

Firestopping Materials

Installer Qualifications

1.5 QUALITY ASSURANCE

1.5.1 Installer

Engage an experienced Installer who is:

- a. FM Research approved in accordance with FM 4991, operating as a UL Certified Firestop Contractor, or
- b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products in accordance with specified requirements. Submit documentation of this experience. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. The installer shall obtain from the manufacturer and submit written certification of training, and retain proof of certification for duration of firestop installation.

1.5.2 Inspector Qualifications

The inspector shall meet the criteria contained in ASTM E699 for agencies involved in quality assurance and shall have a minimum of two years experience in construction field inspections of firestopping systems, products, and assemblies. The inspector shall be completely independent of, and divested from, the installer, the manufacturer, and the supplier of any material or item being inspected. The inspector shall not be a competitor of the installer, the contractor, the manufacturer, or supplier of any material or item being inspected. Include in the qualifications submittal a notarized statement assuring compliance with the requirements stated herein.

1.6 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, protected from damage and exposure to elements and temperatures in accordance with manufacturer requirements. Remove damaged or deteriorated materials from the site. Use materials within their indicated shelf life.

PART 2 PRODUCTS

2.1 FIRESTOPPING SYSTEM

Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal must indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F" "T" and "L" ratings, and type of application.

Also, submit a written report indicating locations of and types of penetrations and types of firestopping used at each location; record type by UL list printed numbers.

2.2 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic products FM APP GUIDE approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

2.2.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resistance or by a nationally recognized testing laboratory.

2.2.2 Toxicity

Material shall be nontoxic and carcinogen free to humans at all stages of application or during fire conditions and shall not contain hazardous chemicals or require harmful chemicals to clean material or equipment.

2.2.3 Fire Resistance Rating

Firestop systems shall be UL Fire Resistance listed or FM APP GUIDE approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems shall also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected.

2.2.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph SUMMARY, shall provide "F", "T" and "L" fire resistance ratings in accordance with ASTM E814 or UL 1479. Fire resistance ratings shall be as follows:

2.2.3.1.1 Penetrations of Fire Resistance Rated Walls and Partitions

F Rating = (1) hour of Rating of wall or partition being penetrated.

2.2.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SUMMARY, and gaps such as those between floor slabs and curtain walls shall be the same as the construction in which they occur. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E119, ASTM E1966 or UL 2079 to meet the required fire resistance rating. Curtain wall joints shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E2307 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E1399/E1399M or UL 2079. All joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly shall provide a minimum class II movement capability.

2.2.4 Material Certification

Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer shall provide certification of compliance with UL 1479.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping must be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement must be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

3.2 INSTALLATION

Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or more in any direction must be capable of supporting the same load as the floor is designed to support or be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
- b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
- c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.

- d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- e. Construction joints in floors and fire rated walls and partitions.
- f. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Replace thermal insulation with a material having equal thermal insulating and firestopping characteristics.

3.2.2 Fire Dampers

Install and firestop fire dampers in accordance with Section 23 73 30 HEATING, VENTILATION, AND COOLING SYSTEM. Firestop installed with fire damper must be tested and approved for use in fire damper system. Firestop installed with fire damper must be tested and approved for use in fire damper system.

3.2.3 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products.

3.2.3.1 Re-Enterable Devices

Firestopping devices shall be pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants; while maintaining "L" rating of <10 cfm/sf measured at ambient temperature and 400 degrees F at 0 percent to 100 percent visual fill.

3.2.3.2 Re-Sealable Products

Provide firestopping pre-manufactured modular products, containing self-sealing intumescent inserts. Firestopping products shall allow for cable moves, additions or changes. Devices shall be capable of maintaining the fire resistance rating of the penetrated membrane at 0 percent to 100 percent visual fill of penetrants.

3.3 INSPECTION

For Navy projects, install one of each type of penetration and have it inspected and accepted by the ROICC Division, Naval Facilities Engineering Command, Fire Protection Engineer prior to the installation of the remainder of the penetrations. For all projects, the remainder of the firestopped areas shall not be covered or enclosed until inspection is complete and approved by the Contracting Officer. The inspector must inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the

manufacturer's written instructions and the specified requirements.
Submit written reports indicating locations of and types of penetrations
and types of firestopping used at each location; type shall be recorded by
UL listed printed numbers.

3.3.1 Inspection Standards

Inspect all firestopping in accordance with ASTM E2393 and ASTM E2174 for
firestop inspection, and document inspection results to be submitted.

3.3.2 Inspection Reports

Submit inspection report stating that firestopping work has been inspected
and found to be applied according to the manufacturer's recommendations
and the specified requirements.

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SECTION 07 92 00

JOINT SEALANTS

01/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C 734	(2006) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C 834	(2005) Latex Sealants
ASTM C 919	(2008) Use of Sealants in Acoustical Applications
ASTM C 920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D 217	(2002; R 2008) Cone Penetration of Lubricating Grease
ASTM E84	(2018) Standard Test Method for Surface Burning Characteristics of Building Materials

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants

Primers

Bond breakers

Backstops

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). Provide a copy of the Material Safety Data Sheet for each solvent, primer or sealant material.

SD-07 Certificates

Sealant

Certificates of compliance stating that the materials conform to

the specified requirements.

1.3 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between 40 and 90 degrees F.

1.4 DELIVERY AND STORAGE

Deliver materials to the job site in unopened manufacturers' external shipping containers, with brand names, date of manufacture, color, and material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Carefully handle and store materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 90 degrees F or less than 0 degrees F.

1.5 QUALITY ASSURANCE

1.5.1 Compatibility with Substrate

Verify that each of the sealants are compatible for use with joint substrates.

1.5.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

1.6 SPECIAL WARRANTY

Guarantee sealant joint against failure of sealant and against water penetration through each sealed joint for five years.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant that has been tested and found suitable for the substrates to which it will be applied.

2.1.1 Interior Sealant

Provide ASTM C 834 . Location(s) and color(s) of sealant for the following:

LOCATION	COLOR
a. Small voids between walls or partitions and adjacent lockers, casework, shelving, door frames, built-in or surface-mounted equipment and fixtures, and similar items.	As selected
b. Perimeter of frames at doors, windows, and access panels which adjoin exposed interior concrete and masonry surfaces.	Match adjacent
c. Joints of interior masonry walls and partitions which adjoin columns, pilasters, concrete walls, and exterior walls unless otherwise detailed.	Match adjacent

LOCATION	COLOR
d. Joints between edge members for acoustical tile and adjoining vertical surfaces.	Match adjacent
e. Interior locations, not otherwise indicated or specified, where small voids exist between materials specified to be painted.	Match adjacent
f. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplaner tile surfaces meet.	As selected
g. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.	As selected
h. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.	As selected

2.1.2 Exterior Sealant

For joints in vertical surfaces, provide ASTM C 920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C 920, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows:

LOCATION	COLOR
a. Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	As selected
b. Joints between new and existing exterior masonry walls.	Match adjacent
c. Masonry joints where shelf angles occur.	Match adjacent
d. Expansion and control joints.	Match adjacent
e. Interior face of expansion joints in exterior concrete or masonry walls where metal expansion joint covers are not required.	As selected
f. Voids where items pass through exterior walls.	Match adjacent
g. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.	Match adjacent
h. Metal-to-metal joints where sealant is indicated or specified.	As selected

LOCATION	COLOR
i. Joints between ends of gravel stops, fascias, copings, and adjacent walls.	As selected

2.1.3 Floor Joint Sealant

ASTM C 920, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows:

LOCATION	COLOR
a. Seats of metal thresholds for exterior doors.	As selected
b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.	As selected

2.1.4 Acoustical Sealant

Rubber or polymer-based acoustical sealant conforming to ASTM C 919 must have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant must have a consistency of 250 to 310 when tested in accordance with ASTM D 217, and must remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C 734, and must be non-staining.

2.2 PRIMERS

Provide a nonstaining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

2.3 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.4 BACKSTOPS

Provide glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Provide 25 to 33 percent oversized backing for closed cell and 40 to 50 percent oversized backing for open cell material, unless otherwise indicated. Make backstop material compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

2.5 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Clean surfaces from dirt frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair

adhesion. Remove oil and grease with solvent. Surfaces must be wiped dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, contact sealant manufacturer for specific recommendations.

3.1.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue-free solvent.

3.1.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. For removing protective coatings and final cleaning, use nonstaining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.1.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove laitance, efflorescence and loose mortar from the joint cavity.

3.2 SEALANT PREPARATION

Do not add liquids, solvents, or powders to the sealant. Mix multicomponent elastomeric sealants in accordance with manufacturer's instructions.

3.3 APPLICATION

3.3.1 Joint Width-To-Depth Ratios

a. Acceptable Ratios:

<u>JOINT WIDTH</u>	<u>JOINT DEPTH</u>	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch	1/2 of width	Equal to width
For wood, concrete, masonry, stone:		
1/4 inch (minimum)	1/4 inch	1/4 inch
Over 1/4 inch to 1/2 inch	1/4 inch	Equal to width
Over 1/2 inch to 2 inch	1/2 inch	5/8 inch
Over 2 inch.	(As recommended by sealant manufacturer)	

- b. Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding is not required on metal surfaces.

3.3.2 Masking Tape

Place masking tape on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Remove masking tape within 10 minutes after joint has been filled and tooled.

3.3.3 Backstops

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified. Install backstops in the following locations:

- a. Where indicated.
- b. Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint Width-to-Depth Ratios".

3.3.4 Primer

Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

3.3.5 Bond Breaker

Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

3.3.6 Sealants

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and can not be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Make sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply sealant, and tool smooth as specified. Apply sealer over the sealant when and as specified by the sealant manufacturer.

3.4 PROTECTION AND CLEANING

3.4.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

3.4.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

- a. Masonry and Other Porous Surfaces: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding.
- b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent-moistened cloth.

-- End of Section --

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SECTION 08 11 13

STEEL DOORS AND FRAMES

02/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M (2019) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A924/A924M (2020) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

ASTM C578 (2018) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

ASTM C591 (2018) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

ASTM C612 (2010) Mineral Fiber Block and Board Thermal Insulation

ASTM D2863 (2013) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.115 (2006) Hardware Preparation in Steel Doors and Steel Frames

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM HMMA HMM (1999; R2000) Hollow Metal Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 252 (2017) Standard Methods of Fire Tests of Door Assemblies

NFPA 80 (2016; TIA 16-1) Standard for Fire Doors and Other Opening Protectives

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR 111	(2009) Recommended Selection and Usage Guide for Standard Steel Doors, Frames and Accessories
SDI/DOOR 113	(2001; R2006) Standard Practice for Determining the Steady State Thermal Transmittance of Steel Door and Frame Assemblies
SDI/DOOR A250.11	(2001) Recommended Erection Instructions for Steel Frames
SDI/DOOR A250.4	(2011) Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcing
SDI/DOOR A250.6	(2003; R2009) Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
SDI/DOOR A250.8	(2003; R2008) Recommended Specifications for Standard Steel Doors and Frames

UNDERWRITERS LABORATORIES (UL)

UL 10C	(2009) Standard for Positive Pressure Fire Tests of Door Assemblies
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1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00
SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors

Frames

Weatherstripping

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of doors

Schedule of frames

Submit door and frame locations.

SD-03 Product Data

Doors

Frames

Weatherstripping

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to SDI/DOOR A250.8 requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 1/4 inch airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

PART 2 PRODUCTS

2.1 STANDARD STEEL DOORS

SDI/DOOR A250.8, except as specified otherwise. Prepare doors to receive door hardware as specified in Section 08 71 00. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 1-3/4 inch thick, unless otherwise indicated.

2.1.1 Classification - Level, Performance, Model

2.1.1.1 Maximum Duty Doors

SDI/DOOR A250.8, Level 4, physical performance Level A, Model 1 with core construction as required by the manufacturer for indicated exterior doors, of size(s) and design(s) indicated.

2.2 CUSTOM HOLLOW METAL DOORS

Provide custom hollow metal doors where nonstandard steel doors are indicated. At the Contractor's option, custom hollow metal doors may be provided in lieu of standard steel doors. Door size(s), design(s), materials, construction, gages, and finish shall be as specified for standard steel doors and shall comply with the requirement of NAAMM HMMA HMM. Fill all spaces in doors with insulation. Close top and bottom edges with steel channels not lighter than 16 gage. Close tops of exterior doors flush with an additional channel and seal to prevent water intrusion. Prepare doors to receive hardware specified in Section 08 71 00 DOOR HARDWARE. Undercut doors where indicated. Doors shall be 1-3/4 inch thick, unless otherwise indicated.

2.3 INSULATED STEEL DOOR SYSTEMS

Insulated steel doors shall have a core of polyurethane foam and an R factor of 10.0 or more (based on a k value of 0.16); face sheets, edges, and frames of galvanized steel not lighter than 23 gage, 16 gage, and 16 gage respectively; magnetic weatherstripping; nonremovable-pin hinges; thermal-break aluminum threshold; and vinyl door bottom. Doors and frames shall receive phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Doors shall have been tested in accordance with SDI/DOOR A250.4 and shall have met the requirements for Level C. Prepare

doors to receive specified hardware. Doors shall be 1-3/4 inch thick. Provide insulated steel doors and frames where shown.

2.4 ACCESSORIES

2.4.1 Louvers

2.4.1.1 Interior Louvers

SDI/DOOR 111, Louvers shall be stationary sightproof and lightproof type where scheduled. Detachable moldings on room or non security side of door; on security side of door, moldings to be integral part of louver. Form louver frames of 20 gage steel and louver blades of a minimum 24 gage. Louvers for lightproof doors shall have minimum of 20 percent net-free opening. Sightproof louvers to be inverted "V" blade design with minimum 55 percent net-free opening.

2.5 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI/DOOR 113 and shall conform to:

- a. Rigid Cellular Polyisocyanurate Foam: ASTM C591, Type I or II, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D2863; or
- b. Rigid Polystyrene Foam Board: ASTM C578, Type I or II; or
- c. Mineral board: ASTM C612, Type I.

2.6 STANDARD STEEL FRAMES

SDI/DOOR A250.8, Level 4, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners. Provide steel frames for doors, unless otherwise indicated.

2.6.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

Weld frames in accordance with the recommended practice of the Structural Welding Code Sections 1 through 6, AWS D1.1/D1.1M and in accordance with the practice specified by the producer of the metal being welded.

2.6.2 Stops and Beads

Form stops and beads from 20 gage steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 12 to 16 inch on center. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

2.6.3 Cased Openings

Fabricate frames for cased openings of same material, gage, and assembly as specified for metal door frames, except omit door stops and preparation for hardware.

2.6.4 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 18 gage.

2.6.4.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 7.5 feet in height, provide one additional anchor for each jamb for each additional 2.5 feet or fraction thereof.

- a. Masonry: Provide anchors of corrugated or perforated steel straps or 3/16 inch diameter steel wire, adjustable or T-shaped;
- b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding;
- c. Completed openings: Secure frames to previously placed concrete or masonry with expansion bolts in accordance with SDI/DOOR 111;

2.6.4.2 Floor Anchors

Provide floor anchors drilled for 3/8 inch anchor bolts at bottom of each jamb member.

2.7 FIRE DOORS AND FRAMES

NFPA 80 and this specification. The requirements of NFPA 80 shall take precedence over details indicated or specified.

2.7.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10C. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

2.7.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and construction to a door which has been tested and meets the requirements for the class indicated.

2.7.3 Astragal on Fire Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements.

2.8 WEATHERSTRIPPING

As specified in Section 08 71 00 DOOR HARDWARE.

2.9 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in SDI/DOOR A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI/DOOR A250.8 and SDI/DOOR A250.6. For additional requirements refer to ANSI/BHMA A156.115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI/DOOR A250.8, as applicable. Punch door frames with the exception of frames that will have weatherstripping gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

2.10 FINISHES

2.10.1 Factory-Primed Finish

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI/DOOR A250.8.

2.10.2 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A924/A924M and ASTM A653/A653M. The coating weight shall meet or exceed the minimum requirements for coatings having 0.4 ounces per square foot, total both sides, i.e., A40. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in SDI/DOOR A250.8.

2.11 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable.

2.11.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Frames

Set frames in accordance with SDI/DOOR A250.11. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with

expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing.

3.1.2 Doors

Hang doors in accordance with clearances specified in SDI/DOOR A250.8. After erection and glazing, clean and adjust hardware.

3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

-- End of Section --

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SECTION 08 14 00

WOOD DOORS
08/16

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
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WINDOW AND DOOR MANUFACTURERS ASSOCIATION (WDMA)

ANSI/WDMA I.S.1A	(2013) Interior Architectural Wood Flush Doors
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ANSI/WDMA I.S.6A	(2013) Interior Architectural Stile and Rail Doors
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WOODWORK INSTITUTE (WI)

NAAWS 3.1	(2017; 2018 Errata Edition) North American Architectural Woodwork Standards
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1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Doors

Submit drawings or catalog data showing each type of door unit ; include descriptive data of head and jamb weatherstripping with installation instructions. Indicate within drawings and data the door types and construction, sizes, thickness, door louvers, and glazing.

SD-03 Product Data

Doors

Accessories

Sample Warranty

Sound Transmission Class Rating

SD-04 Samples

Doors

Prior to the delivery of wood doors, submit a sample section of each type of door which shows the stile, rail, veneer, finish, and core construction.

Door Finish Colors

SD-06 Test Reports

Cycle-Slam

Hinge Loading Resistance

Submit cycle-slam test report for doors tested in accordance with ANSI/WDMA I.S.1A, and hinge loading resistance test report for doors tested in accordance with ANSI/WDMA I.S.6A.

SD-07 Certificates

Certificates of Grade

SD-11 Closeout Submittals

Warranty

1.3 CERTIFICATIONS

1.3.1 Certified Wood Grades

Provide certificates of grade from the grading agency on wood doors.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver doors to the site in an undamaged condition and protect against damage and dampness. Stack doors flat under cover. Support on blocking, a minimum of 4 inch thick, located at each end and at the midpoint of the door. Store doors in a well-ventilated building so that they will not be exposed to excessive moisture, heat, dryness, direct sunlight, or extreme changes of temperature and humidity. Do not store in a building under construction until concrete, masonry work, and plaster are dry. Replace defective or damaged doors with new ones.

1.5 WARRANTY

Warrant doors free of defects as set forth in the door manufacturer's standard door warranty.

PART 2 PRODUCTS

2.1 DOORS

Provide doors of the types, sizes, and designs specified free of urea-formaldehyde resins.

2.1.1 Flush Doors

Conform to ANSI/WDMA I.S.1A for flush doors. Provide hollow core doors with lock blocks and 1 inch minimum thickness hinge stile. Hardwood stile edge bands of doors receives a natural finish, compatible with face veneer. Provide mill option for stile edge of doors scheduled to be painted. No visible finger joints will be accepted in stile edge bands. When used, locate finger-joints under hardware.

2.1.1.1 Interior Flush Doors

Provide particleboard core, Type II flush doors conforming to ANSI/WDMA I.S.1A with faces of premium grade natural birch. Hardwood veneers must be rotary cut. Products must contain no added urea-formaldehyde resins.

2.1.2 Acoustical Doors

ANSI/WDMA I.S.1A, solid core, constructed to provide Sound Transmission Class rating of 35 when tested in accordance with ASTM E90.

2.2 ACCESSORIES

2.2.1 Door Louvers

Fabricate from wood and of sizes indicated. Provide louvers with a minimum of 35 percent free air. Equip louvers with sightproof inverted vee slat type. Mount louvers in the door with flush wood moldings.

2.2.2 Door Light Openings

Provide glazed openings with the manufacturer's standard wood moldings. Provide moldings for doors to receive natural finish of the same wood species and color as the wood face veneers. Lip type moldings for flush doors.

2.2.3 Additional Hardware Reinforcement

Provide the minimum lock blocks to secure the specified hardware. The measurement of top, bottom, and intermediate rail blocks are a minimum 125 mm 5 inch by full core width. Comply with the manufacturer's labeling requirements for reinforcement blocking, but not mineral material similar to the core.

2.3 FABRICATION

2.3.1 Marking

Stamp each door with a brand, stamp, or other identifying mark indicating quality and construction of the door.

2.3.2 Quality and Construction

Identify the standard on which the construction of the door was based and identify doors having a Type I glue bond.

2.3.3 Preservative Treatment

Treat doors scheduled for restrooms, janitor closets and other possible

wet locations including exterior doors with a water-repellent preservative treatment and so marketed at the manufacturer's plant.

2.3.4 Adhesives and Bonds

ANSI/WDMA I.S.1A. Use Type I bond for exterior doors and Type II bond for interior doors. Provide a nonstaining adhesive on doors with a natural finish.

2.3.5 Prefitting

Provide factory prefinished factory prefitted doors for the specified hardware, door frame and door-swing indicated. Machine and size doors at the factory by the door manufacturer in accordance with the standards under which the doors are produced and manufactured. The work includes sizing, beveling edges, mortising, and drilling for hardware and providing necessary beaded openings for glass and louvers. Provide the door manufacturer with the necessary hardware samples, and frame and hardware schedules to coordinate the work.

2.3.6 Finishes

2.3.6.1 Factory Finish

Provide doors finished at the factory by the door manufacturer as follows:

WDMA System TR-8 (UV cured acrylated polyester/urethane) or TR-2 (catalyzed lacquer) or TR-4 (conversion varnish) factory finish systems that utilize water-based stains and finishes with ultraviolet UV protection. The coating is NAAWS 3.1 premium, medium rubbed sheen, closed grain effect. Use stain when required to produce the finish specified for color. Seal edges, cutouts, trim, and wood accessories, and apply two coats of finish compatible with the door face finish. Touch-up finishes that are scratched or marred, or where exposed fastener holes are filled, in accordance with the door manufacturer's instructions. Match color and sheen of factory finish using materials compatible for field application. Submit Door Finish Colors for approval.

2.4 SOURCE QUALITY CONTROL

Meet or exceed the following minimum performance criteria of stiles of "B" and "C" label fire doors utilizing standard mortise leaf hinges:

- a. Cycle-slam: Heavy Duty Doors: 500,000 cycles with no loose hinge screws or other visible signs of failure when tested in accordance with the requirements of ANSI/WDMA I.S.1A.
- b. Hinge loading resistance: Averages of ten test samples not less than Heavy Duty doors: 475 pounds force when tested for direct screw withdrawal in accordance with ANSI/WDMA I.S.6A using a No. 12, 1-1/4 inch long, steel, fully threaded wood screw. Drill 5/32 inch pilot hole, use 1-1/2 inch opening around screw for bearing surface, and engage screw full, except for last 1/8 inch. Do not use a steel plate to reinforce screw area.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence

of biological growth.

Before installation, seal top and bottom edges of doors with the approved water-resistant sealer. Seal cuts made on the job immediately after cutting using approved water-resistant sealer. Fit, trim, and hang doors with a 1/16 inch minimum, 1/8 inch maximum clearance at sides and top, and a 3/16 inch minimum, 1/4 inch maximum clearance over thresholds. Provide 3/8 inch minimum, 7/16 inch maximum clearance at bottom where no threshold occurs. Bevel edges of doors at the rate of 1/8 inch in 2 inch. Door warp must not exceed 1/4 inch when measured in accordance with ANSI/WDMA I.S.1A.

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SECTION 08 31 00

ACCESS DOORS AND PANELS

05/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2020) Structural Welding Code - Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M (2016) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A653/A653M (2019) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A666 (2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

ASTM E119 (2018) Standard Test Methods for Fire Tests of Building Construction and Materials

MASTER PAINTERS INSTITUTE (MPI)

MPI 79 (Oct 2009) Alkyd Anti-Corrosive Metal Primer

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 252 (2017) Standard Methods of Fire Tests of Door Assemblies

NFPA 288 (2017) Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal Fire Resistance-Rated Assemblies

UNDERWRITERS LABORATORIES (UL)

UL 10B (2008; Reprint Feb 2015) Fire Tests of
Door Assemblies

UL 263 (2011; Reprint Jun 2015) Fire Tests of
Building Construction and Materials

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL
PROCEDURES:

SD-02 Shop Drawings

Access Doors And Panels

SD-03 Product Data

Access Doors And Panels

Hardware Including Locks and Keys

Accessories

SD-04 Samples

Finishes

SD-06 Test Reports

Fire-rating(s) of Assemblies

1.3 MISCELLANEOUS REQUIREMENTS

For access doors and panels provide the following:

1.3.1 Shop Drawings

For field assembled access doors and panels, provide plans, elevations, sections, and details for each type of access door and panel assembly. Indicate frame, surface and edge construction, materials, and accessories. Indicate types of finished surfaces and details for panel edge conditions. Provide a door schedule with a unique number for each access door and panel, specific location in the project, location of hinges and hardware for each door. Indicate fire-rating(s) of assemblies.

1.3.2 Product Data

For shop assembled access doors and panels, provide literature indicating sizes, types, frame and edge construction, finishes, hardware, accessories such as gaskets, seals and weatherstripping, and location of each door and panel in the project. Indicate fire-ratings of assemblies. Provide details of adjoining work for each condition indicated.

1.3.3 Finish Samples

Submit two color charts from manufacturer's standard color and finish options for each type of frame and panel assembly finish indicated.

1.3.4 Test Reports

Provide test reports for fire-rated assemblies when tested in accordance with NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically and NFPA 288 for fire-rated access door assemblies installed horizontally.

1.4 PERFORMANCE REQUIREMENTS

1.4.1 Structural Requirements

Provide floor access assemblies to support live loads indicated for floors. Deflection must not exceed 1/180 of span.

1.4.2 Fire-Rating Requirements

Provide access panels with a minimum fire-rating of as indicated on the Drawings.

1.4.3 Access Panels for Wet Areas

Provide panel assemblies that will be located in wet areas with corrosion resistant finishes and hardware and water resistant gasketing.

1.5 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Steel Plates, Shapes, and Bars

Provide in accordance with ASTM A36/A36M.

2.1.2 Sheet Steel

Provide cold rolled steel sheet substrate in accordance with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

2.1.3 Stainless Steel

Provide in accordance with ASTM A666, type 302 or 304.

2.1.4 Metallic Coated Steel Sheet

Provide in accordance with ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.1.5 Hardware

Provide automatic closing devices. Provide latch releases operable from insides of doors. Provide anchors in accordance with applicable fire test parameters.

2.1.6 Hinges

Provide concealed spring hinges, 175 degrees of opening, with removable hinge pins. Provide hinges of same steel as door and frame or in accordance with manufacturer's written recommendations. If providing non-continuous hinges, provide in numbers required to maintain alignment of door panel with frame. Provide coatings as necessary to permanently protect dissimilar metals from contact with one another; see Part 3 herein for more information.

2.1.7 Locks

Unless otherwise indicated, provide flush screwdriver operated cam lock. Provide plastic sleeve or stainless steel bushings to protect holes in surface finishes for screwdriver to access lock.

2.1.8 Accessories

Provide anchors in size, number and location on four sides to secure access door to substrate. Provide anchors in types as recommended by manufacturer's written installation instructions for each substrate indicated. Provide shims, bushings, clips, gaskets, and other devices as necessary for a complete installation.

2.2 FABRICATION

2.2.1 Thickness, Size, Edges

Fabricate frames for access doors of steel not lighter than 16 gage with welded joints and anchorage for securing to adjacent construction. Provide doors a minimum of 24 by 24 inches and of not lighter than 16 gage steel, with stiffened edges and welded attachments. Provide with eased (lightly rounded) edges, without burrs, snags or sharpness and exposed welds ground smooth.

2.2.2 Welding

Provide in accordance with AWS D1.1/D1.1M.

2.3 ACCESS ASSEMBLY TYPES

Unless indicated otherwise, provide flush-face steel access doors and panels with steel frames and flanges.

2.3.1 Fire-rated Doors(As Necessary)

2.3.1.1 Door Construction

Provide ceiling access door construction in accordance with ASTM E119 or UL 263. Provide wall access doors in accordance with NFPA 252 or UL 10B.

2.3.1.2 Labels

Provide class B opening according to UL 10B or test by another nationally recognized laboratory, approved by the Contracting Officer. Provide fire-rating as indicated herein, with a maximum temperature rise of 216 degrees F.

2.3.1.3 Door Panel and Frame

Steel sheet, with mineral fiber insulation core, insulated sandwich type construction.

2.4 FINISHES

Provide steel frames and panel surfaces with a baked enamel. Provide manufacturer's standard two coat finish system consisting of one coat primer and one thermoset topcoat. Provide dry film thickness in 2 mils minimum. Provide exposed fastenings that approximately match the color and finish of the each material to which fastenings are applied.

PART 3 EXECUTION

3.1 PREPARATION

Field verify all measurements prior to fabrication. Verify access door locations and sizes provide required maintenance access to installed building services components. Protect existing construction and completed work from damage during installation.

3.2 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, in accordance with manufacturer's written instructions. Include materials and parts as necessary for a complete installation of each item. Conceal fastenings where practicable. Poor matching of holes to fasteners is cause for rejection of the work.

3.3 ACCESS LOCATIONS

Install removable access panels directly below each valve, flow indicator, damper, air splitter or other utility requiring access that is located above ceilings, other than at acoustical panel ceilings, and that would otherwise not be accessible. Install access doors and panels permitting access to service valves, traps, dampers, cleanouts, and other mechanical, electrical and conveyor control items concealed in walls and partitions.

3.4 ACCESS LOCATIONS IN WET AREAS

When possible, avoid locating access panels in wet areas. When such locations cannot be avoided, provide moisture resistant assemblies as indicated in Part I herein.

3.5 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, protect surfaces with a coating in accordance with MPI 79 to prevent galvanic or corrosive action.

3.6 ADJUSTMENT

Adjust hardware so that door panel opens freely. Adjust door when closed center door panel in frame.

3.7 ENVIRONMENTAL CONDITIONS

Do not paint surfaces when damp or exposed to weather, when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by

20-0075 Repair BEQ FC530

the Contracting Officer.

-- End of Section --

SECTION 08 33 23

OVERHEAD COILING DOORS

07/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-10 (2010) Minimum Design Loads for Buildings and Other Structures

ASME INTERNATIONAL (ASME)

ASME B29.400 (2001; R 2008) Combination, "H" Type Mill Chains, and Sprockets

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M (2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A27/A27M (2010) Standard Specification for Steel Castings, Carbon, for General Application

ASTM A307 (2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

ASTM A36/A36M (2019) Standard Specification for Carbon Structural Steel

ASTM A48/A48M (2003; R 2016) Standard Specification for Gray Iron Castings

ASTM A53/A53M (2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A653/A653M (2019) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A666 (2015) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

ASTM A780/A780M (2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A924/A924M	(2020) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B221	(2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2012a) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM D 2000	(2008) Standard Classification System for Rubber Products in Automotive Applications
ASTM E 330	(2002; R 2010) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
ASTM F 568M	(2007) Standard Specification for Carbon and Alloy Steel Externally Threaded Metric Fasteners

1.2 DESCRIPTION

Overhead coiling doors to be counterbalanced doors by methods of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed or self-lubricating bearings for rotating members. Doors to be coiling type, with interlocking slats, complete with anchoring and door hardware, guides, hood, and operating mechanisms, and designed for use on openings as indicated.

1.3 PERFORMANCE REQUIREMENTS

1.3.1 Wind Loading

Design and fabricate door assembly to withstand the wind loading pressure of at least 47.5 pounds per square foot with a maximum deflection of 1/120 of the opening width. Provide test data showing compliance with ASTM E 330. Sound engineering principles may be used to interpolate or extrapolate test results to door sizes not specifically tested. Complete assembly must meet or exceed the requirements of ASCE 7-10.

1.3.2 Operational Cycle Life

All portions of the door, hardware and operating mechanism that are subject to movement, wear, or stress fatigue must be designed to operate through a minimum number of 10 cycles per day. One complete cycle of door operation is defined as when the door is in the closed position, moves to the fully open position, and returns to the closed position.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Provide fabrication drawings that show complete assembly with hardware and framing details for the following items:

Overhead Coiling Doors

Counterbalancing Mechanism

Manual Door Operators

Bottom Bar

Guides

Mounting Brackets

Overhead Drum

Painting

Submit Installation Drawings in accordance with paragraph entitled, "Overhead Coiling Door Assemblies," of this section.

SD-03 Product Data

Submit manufacturer's catalog data for the following items listing all accessories including supports, locks and latches, and weather stripping.

Overhead Coiling Doors

Hardware

Counterbalancing Mechanism

Manual Door Operators

SD-05 Design Data

Submit equipment and performance data for the following items in accordance with the paragraph entitled, "Performance Requirements," of this section.

Overhead Coiling Doors

Hardware

Counterbalancing Mechanism

Manual Door Operators

SD-10 Operation and Maintenance Data

Submit Operation and Maintenance Manuals for Overhead Coiling Door Assemblies , including the following items:

Materials

Devices

Procedures

Manufacture's Brochures

Parts Lists

Cleaning

1.5 OVERHEAD COILING DOOR DETAIL SHOP DRAWINGS

Provide installation drawings for overhead coiling door assemblies which show elevations of each door type, shape and thickness of materials, finishes, details of joints and connections, and details of guides and fittings, rough opening dimensions, location and description of hardware, anchorage locations, and counterbalancing mechanism and door operator details. Show locations of replaceable fusible links wiring diagrams for power, signal and controls. Include a schedule showing the location of each door with the drawings.

Contractor must submit 6 copies of the Operation and Maintenance Manuals 30 calendar days prior to testing the Overhead Coiling Door Assemblies. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

Provide operation and maintenance manuals which are consistent with manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Provide test data that is legible and of good quality.

1.6 WARRANTY, OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance Manuals for Overhead Coiling Door Assemblies, including the following items:

Materials

Devices

Manual Door Operators

Counterbalancing Mechanism

Painting

Procedures

Manufacture's Brochures

Parts Lists

Contractor must furnish a written guarantee that the helical spring and counterbalance mechanism are free from defects in material and workmanship and that they will remain so for not less than two years after completion and acceptance of the project.

Contractor must warrant that upon notification by the Government, he will immediately make good any defects in material, workmanship, and door operation within the same time period covered by the guarantee, at no cost to the Government.

1.7 DELIVERY AND STORAGE

Delivered doors to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Store doors in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

PART 2 PRODUCTS

2.1 OVERHEAD COILING DOORS

2.1.1 Curtain Materials and Construction

Provide curtain slats which are fabricated from steel sheets conforming to ASTM A653/A653M, Grade A, with the additional requirement of a minimum yield point of 33,000 psi. Provide sheets which are galvanized in accordance with ASTM A653/A653M and ASTM A924/A924M.

Fabricate doors from interlocking cold-rolled slats, with section profiles as specified, designed to withstand the specified wind loading. Provide slats which are continuous without splices for the width of the door.

2.1.2 Curtain Bottom Bar

Curtain bottom bars must be pairs of angles from the manufacturer's standard steel, stainless and aluminum extrusions not less than 2.0 by 2.0 inches by 0.188 inch. Steel extrusions must conform to ASTM A36/A36M. Stainless steel extrusions conforming to ASTM A666, Type 304. Aluminum extrusions conforming to ASTM B221 or (ASTM B221M). Galvanize angles and fasteners in accordance with ASTM A653/A653M and ASTM A924/A924M. Coat welds and abrasions with paint conforming to ASTM A780/A780M.

2.1.3 Locks

Provide end and/or wind locks of cast steel conforming to ASTM A27/A27M, Grade B; galvanized in accordance with ASTM A653/A653M, ASTM A153/A153M and ASTM A924/A924M and secured at every other curtain slat.

2.1.4 Weather Stripping

Weather-stripping at the door-head and jamb must be 1/8-inch thick sheet of natural or neoprene rubber with air baffles, secured to the insides of hoods with galvanized-steel fasteners through continuous galvanized-steel pressure bars at least 5/8-inch wide and 1/8-inch thick.

Threshold weather-stripping must be 1/8-inch thick sheet natural or neoprene rubber secured to the bottom bars.

Provide weather-stripping of natural or neoprene rubber conforming to ASTM D 2000.

2.1.5 Locking Devices

Slide Bolt to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

2.1.6 Safety Interlock

Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.1.7 Overhead Drum

Fabricate drums from nominal 0.028-inch thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A653/A653M.

2.2 HARDWARE

All hardware must conform to ASTM A153/A153M, ASTM A307, ASTM F 568M, and ASTM A27/A27M.

2.2.1 Guides

Fabricate curtain jamb guides from the manufacturer's standard angles or channels of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for track adjustment.

2.2.2 Equipment Supports

Fabricate door-operating equipment supports from the manufacturer's standard steel shapes and plates conforming to ASTM A36/A36M, galvanized in accordance with ASTM A653/A653M and ASTM A924/A924M. Size the shapes and plates in accordance with the industry standards for the size, weight, and type of door installation..

2.3 COUNTERBALANCING MECHANISM

Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed or self-lubricating bearings for rotating members.

2.3.1 Brackets

Provide the manufacturer's standard mounting brackets of either cast iron or cold-rolled steel with one located at each end of the counterbalance barrel conforming to ASTM A48/A48M.

2.3.2 Counterbalance Barrels

Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, conforming to ASTM A53/A53M, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 inch per foot of span under full load.

2.3.3 Torsion Rod for Counter Balance

Fabricate rod from the manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

2.4 MANUAL DOOR OPERATORS

2.4.1 Manual Chain-Hoist Door Operators

Provide door operators which consist of an endless steel hand chain, chain-pocket wheel, guard, and a geared reduction unit of at least a 3 to 1 ratio with a maximum 25 lbf required pull for operation must not exceed 35 pounds.

Provide chain hoists to have a self-locking mechanism allowing the curtain to be stopped at any point in its upward or downward travel and to remain in that position until moved to the fully open or closed position. Provide hand chains of cadmium-plated alloy steel conforming to ASME B29.400. Yield point of the chain must be at least three times the required hand-chain pull.

Provide chain sprocket wheels of cast iron conforming to ASTM A48/A48M.

2.5 SURFACE FINISHING

Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Noticeable variations in the same metal component are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.1 GENERAL

Install overhead coiling door assembly, anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories in accordance with approved detail drawings and manufacturer's written instructions. Upon completion of installation, doors must be free from all distortion.

Install overhead coiling doors, motors, hoods, and operators at the mounting locations as indicated for each door in the contract documents and as required by the manufacturer.

Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility and as required by the manufacturer.

3.2 FIELD PAINTED FINISH

Steel doors and frames which are to be field painted must accordance with Section 09 90 00 PAINTS AND COATINGS and manufacturer's written instructions. Protect weather stripping from paint. Finishes must be free of scratches or other blemishes.

3.3 ACCEPTANCE PROVISIONS

After installation, adjust hardware and moving parts. Lubricate bearings

and sliding parts as recommended by manufacturer to provide smooth operating functions for ease movement, free of warping, twisting, or distortion of the door assembly.

Adjust seals to provide weather-tight fit around entire perimeter.

Engage a factory-authorized service representative to perform startup service and checks according to manufacturer's written instructions.

Test the door opening and closing operation when activated by controls or alarm-connected fire-release system. Adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Reset door-closing mechanism after successful test.

Test and make final adjustment of new doors at no additional cost to the Government.

3.3.1 Maintenance and Adjustment

Not more than 90 calendar days after completion and acceptance of the project, the Contractor must examine, lubricate, test, and re-adjust doors as required for proper operation.

3.3.2 CLEANING

Clean doors in accordance with manufacturer's approved instructions.

-- End of Section --

SECTION 08 51 13

ALUMINUM WINDOWS
05/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System
for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 611 (2014) Voluntary Specification for
Anodized Architectural Aluminum

AAMA/WDMA/CSA 101/I.S.2/A440 (2011) Standard/Specification for Windows,
Doors, and Skylights

1.2 CERTIFICATION

Each prime window unit must bear the AAMA Label warranting that the product complies with AAMA/WDMA/CSA 101/I.S.2/A440. Certified test reports attesting that the prime window units meet the requirements of AAMA/WDMA/CSA 101/I.S.2/A440, including test size, will be acceptable in lieu of product labeling.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows

Fabrication Drawings

SD-03 Product Data

Windows

Hardware

Fasteners

Accessories

SD-04 Samples

Finish Sample

SD-10 Operation and Maintenance Data

Windows

1.4 QUALITY ASSURANCE

1.4.1 Shop Drawing Requirements

Provide drawings that indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, details of operating hardware, material and method of attaching subframes, installation details, and other related items.

1.4.2 Sample Requirements

1.4.2.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish color coating is to be provided.

1.5 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Repair damaged windows to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

1.6 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method. Do not apply coatings or lacquers to surfaces to which caulking and glazing compounds must adhere.

1.7 FIELD MEASUREMENTS

Take field measurements prior to preparation of the drawings and fabrication.

1.8 DRAWINGS

Submit the Fabrication Drawings for aluminum window units showing complete window assembly including hardware, weatherstripping, and subframe assembly details.

1.9 QUALIFICATION

Window manufacturer must specialize in designing and manufacturing the type of aluminum windows specified in this section, and have a minimum of 5 years of documented successful experience. Manufacturer must have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.10 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 WINDOWS

2.1.1 Fixed Windows (F)

Type F-R15.

2.1.2 Interior Sliding Window

As per drawings, 1/4" tempered clear glass

2.1.3 Glass and Glazing

Design windows for interior glazing using snap-on, screwless, extruded or roll-formed aluminum, or AISI series-300 corrosion-resistant steel beads. Fixed glazing stops and stop beads must be 3/4 inch high by 1/16 inch thick. Width of the stop bead will be as required for the glass thickness.

Materials are specified in Section 08 81 00 GLAZING.

2.1.4 Caulking and Sealing

Are specified in Section 07 92 00 JOINT SEALANTS.

2.2 FABRICATION

Fabrication of window units must comply with AAMA/WDMA/CSA 101/I.S.2/A440.

2.2.1 Fasteners

Fabricated from 100 percent re-melted steel. Use fasteners as standard with the window manufacturer for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 1/16 inch thick.

2.2.2 Combination Windows

Windows used in combination must be the same class and grade and will be factory assembled. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

2.2.3 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation.

2.2.3.1 Hardware

AAMA/WDMA/CSA 101/I.S.2/A440. The item, type, and functional characteristics must be the manufacturer's standard for the particular

window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used. Equip all operating ventilators with a lock or latching device which can be secured from the inside.

2.2.3.2 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners must be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 6 inches from each end and at midpoint.

2.2.3.3 Window Anchors

Anchoring devices for installing windows must be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA/WDMA/CSA 101/I.S.2/A440.

2.2.4 Finishes

Exposed aluminum surfaces must be factory finished with an anodic coating. All windows for each building will have the same finish.

2.2.4.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish must be:

- a. Architectural Class II (0.4 mil to 0.7 mil), designation AA-M10-C22-anodized.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Protect ventilators and operating parts against accumulation of dirt and building materials by keeping ventilators tightly closed and locked to frame. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install and caulk windows in a manner that will prevent entrance of water and wind. Fasten insect screens securely in place.

3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, protect the aluminum surface from dissimilar materials as recommended in the Appendix to AAMA/WDMA/CSA 101/I.S.2/A440. Do not coat surfaces in contact with sealants after installation with any type of protective material.

3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls must have head and jamb members designed to recess into masonry wall not less than 7/16 inch.

3.1.4 Adjustments After Installation

After installation of windows and completion of glazing and field painting, adjust all ventilators and hardware to operate smoothly and to provide weathertight sealing when ventilators are closed and locked. Lubricate hardware and operating parts as necessary. Verify that products are properly installed, connected, and adjusted.

3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

3.3 WASTE MANAGEMENT

Separate corrugated cardboard and protective materials in accordance with the Waste Management Plan and place in designated areas for reuse or recycling. Place materials defined as hazardous or toxic waste in designated containers. Close and seal tightly all partly used sealant containers and store protected in well ventilated fire-safe area at moderate temperature. Place used sealant tubes and containers in areas designated for hazardous materials.

-- End of Section --

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SECTION 08 71 00

DOOR HARDWARE
02/16

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM E283	(2004; R 2012) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
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BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.1	(2016) Butts and Hinges
ANSI/BHMA A156.13	(2017) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.16	(2013) Auxiliary Hardware
ANSI/BHMA A156.18	(2016) Materials and Finishes
ANSI/BHMA A156.21	(2014) Thresholds
ANSI/BHMA A156.22	(2017) Door Gasketing and Edge Seal Systems
ANSI/BHMA A156.3	(2014) Exit Devices
ANSI/BHMA A156.30	(2014) High Security Cylinders
ANSI/BHMA A156.4	(2013) Door Controls - Closers
ANSI/BHMA A156.6	(2015) Architectural Door Trim
ANSI/BHMA A156.7	(2016) Template Hinge Dimensions

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2021) Life Safety Code
NFPA 252	(2017) Standard Methods of Fire Tests of Door Assemblies
NFPA 72	(2019; TIA 19-1; ERTA 2019) National Fire Alarm and Signaling Code
NFPA 80	(2016; TIA 16-1) Standard for Fire Doors and Other Opening Protectives

STEEL DOOR INSTITUTE (SDI/DOOR)

SDI/DOOR A250.8 (2003; R2008) Recommended Specifications
for Standard Steel Doors and Frames

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191 Americans with Disabilities Act (ADA)
Accessibility Guidelines for Buildings and
Facilities; Architectural Barriers Act
(ABA) Accessibility Guidelines

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (updated continuously online) Building
Materials Directory

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL
PROCEDURES:

SD-02 Shop Drawings

Manufacturer's Detail Drawings

Verification of Existing Conditions

Hardware Schedule

SD-03 Product Data

Hardware Items

SD-08 Manufacturer's Instructions

Installation

SD-10 Operation and Maintenance Data

Hardware Schedule Items, Data Package 1;

1.3 SHOP DRAWINGS

Submit manufacturer's detail drawings indicating all hardware assembly
components and interface with adjacent construction. Indicate power
components and wiring coordination for electrified hardware. Base shop
drawings on verified field measurements and include verification of
existing conditions.

1.4 PRODUCT DATA

Indicate fire-ratings at applicable components. Provide documentation of
ABA/ADA accessibility compliance of applicable components, as required by
36 CFR 1191 Appendix D - Technical.

1.5 HARDWARE SCHEDULE

Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr Name and Catalog No.	Key Control Symbols	UL Mark (If fire-rated and listed)	BHMA Finish Designation

In addition, submit hardware schedule data package 1 in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.6 KEY BITTING CHART REQUIREMENTS

1.6.1 Requirements

Key bitting and key cutting is performed by DLA. Cylinders are GFGI.

1.7 QUALITY ASSURANCE

1.7.1 Hardware Manufacturers and Modifications

Provide, as far as feasible, locks, hinges, and closers of one lock, hinge, or closer manufacturer's make. Modify hardware as necessary to provide features indicated or specified.

1.7.2 Key Shop Drawings Coordination Meeting

Prior to the submission of the key shop drawing, the Contracting Officer, Contractor, Door Hardware Subcontractor, using Activity and Base Locksmith must meet to discuss and coordinate key requirements for the facility.

1.8 DELIVERY, STORAGE, AND HANDLING

Deliver hardware in original individual containers, complete with necessary appurtenances including fasteners and instructions. Mark each individual container with item number as shown on hardware schedule.

PART 2 PRODUCTS

2.1 TEMPLATE HARDWARE

Hardware applied to metal or to prefinished doors must be manufactured using a template. Provide templates to door and frame manufacturers in accordance with ANSI/BHMA A156.7 for template hinges. Coordinate hardware items to prevent interference with other hardware.

2.2 HARDWARE FOR FIRE DOORS AND EXIT DOORS

Provide all hardware necessary to meet the requirements of NFPA 72 for door alarms, NFPA 80 for fire doors, NFPA 101 for exit doors, NFPA 252 for fire tests of door assemblies, ABA/ADA accessibility requirements, and all other requirements indicated, even if such hardware is not specifically mentioned in paragraph HARDWARE SCHEDULE. Provide Underwriters Laboratories, Inc. labels for such hardware in accordance with UL Bld Mat Dir or equivalent labels in accordance with another testing laboratory approved in writing by the Contracting Officer.

2.3 HARDWARE ITEMS

Clearly and permanently mark with the manufacturer's name or trademark, hinges, pivots, locks, latches, exit devices, bolts and closers where the identifying mark is visible after the item is installed. For closers with covers, the name or trademark may be beneath the cover.

2.3.1 Hinges

Provide in accordance with ANSI/BHMA A156.1. Provide hinges that are 4-1/2 by 4-1/2 inch unless otherwise indicated. Construct loose pin hinges for interior doors and reverse-bevel exterior doors so that pins are non-removable when door is closed. Other anti-friction bearing hinges may be provided in lieu of ball bearing hinges.

2.3.2 Locks and Latches

2.3.2.1 Mortise Locks and Latches

Provide in accordance with ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 2. Provide mortise locks with escutcheons not less than 7 by 2-1/4 inch with a bushing at least 1/4 inch long. Cut escutcheons to fit cylinders and provide trim items with straight, beveled, or smoothly rounded sides, corners, and edges. Provide knobs and roses of mortise locks with screwless shanks and no exposed screws.

2.3.3 Exit Devices

Provide in accordance with ANSI/BHMA A156.3, Grade 1. Provide adjustable strikes for rim type and vertical rod devices. Provide open back strikes for pairs of doors with mortise and vertical rod devices.

2.3.4 Cylinders and Cores

Provide cylinders and cores that are compatible with Best Locks M-Series (7) pin for new locks, including locks provided under other sections of this specification. Provide cylinders from the products of one manufacturer, and provide cores from the products of one manufacturer.

2.3.4.1 High Security Cylinders

Provide in accordance with ANSI/BHMA A156.30, security level A for all high security cylinder components.

2.3.5 Lock Trim

Provide cast, forged, or heavy wrought construction and commercial plain design for lock trim.

2.3.5.1 Lever Handles

Provide lever handles. Provide in accordance with ANSI/BHMA A156.3 for mortise locks of lever handles for exit devices. Provide lever handle locks with a breakaway feature (such as a weakened spindle or a shear key) to prevent irreparable damage to the lock when force in excess of that specified in ANSI/BHMA A156.13 is applied to the lever handle. Provide lever handles return to within 1/2 inch of the door face.

2.3.5.2 Texture

Provide knurled or abrasive coated knobs or lever handles for doors which are accessible to blind persons and which lead to dangerous areas.

2.3.6 Door Bolts

Provide in accordance with ANSI/BHMA A156.16. Provide dustproof strikes for bottom bolts, except at doors having metal thresholds. Provide automatic latching flush bolts in accordance with ANSI/BHMA A156.3, Type 25.

2.3.7 Closers

Provide in accordance with ANSI/BHMA A156.4, Series C02000, Grade 1, with PT 4C. Provide with brackets, arms, mounting devices, fasteners, full size covers and other features necessary for the particular application. Size closers in accordance with manufacturer's printed recommendations, or provide multi-size closers, Sizes 1 through 6, and list sizes in the Hardware Schedule. Provide manufacturer's 10 year warranty.

2.3.7.1 Identification Marking

Engrave each closer with manufacturer's name or trademark, date of manufacture, and manufacturer's size designation in locations that will be visible after installation.

2.3.8 Door Protection Plates

Provide in accordance with ANSI/BHMA A156.6.

2.3.9 Door Stops and Silencers

Provide in accordance with ANSI/BHMA A156.16. Silencers Type L03011. Provide three silencers for each single door, two for each pair.

2.3.10 Thresholds

Provide in accordance with ANSI/BHMA A156.21. Use J35100, with vinyl or silicone rubber insert in face of stop, for exterior doors opening out, unless specified otherwise.

2.3.11 Weatherstripping Gasketing

Provide in accordance with ANSI/BHMA A156.22. Provide the type and function designation where specified in paragraph HARDWARE SCHEDULE. Provide a set to include head and jamb seals, sweep strips, and, for pairs of doors, astragals. Air leakage of weatherstripped doors not to exceed 0.5 cubic feet per minute of air per square foot of door area when tested in accordance with ASTM E283. Provide weatherstripping with one of the following:

2.3.11.1 Extruded Aluminum Retainers

Extruded aluminum retainers not less than 0.050 inch wall thickness with vinyl, neoprene, silicone rubber, or polyurethane inserts. Provide clear (natural) anodized aluminum.

2.3.11.2 Interlocking Type

Zinc or bronze not less than 0.018 inch thick.

2.3.12 Lightproofing Gasketing

Provide in accordance with ANSI/BHMA A156.22. Provide adjustable doorstops at heads, jambs and automatic door bottoms in accordance with the hardware set, of extruded aluminum, clear (natural) anodized, surface applied, with vinyl fin seals between plunger and housing. Provide doorstops with solid neoprene tube, silicone rubber, or closed cell sponge gasket. Provide door bottoms with adjustable operating rod and silicone rubber or closed cell sponge neoprene gasket. Provide doorstops that are mitered at corners. Provide type and function designation where specified in paragraph HARDWARE SETS.

2.3.13 Rain Drips

Provide in accordance with ANSI/BHMA A156.22. Provide extruded aluminum rain drips, not less than 0.08 inch thick, factory painted finish. Provide the manufacturer's full range of color choices to the Contracting Officer for color selection. Provide rain drips with a 4 inch overlap on each side of each exterior door that is not protected by an awning, roof, eave or other horizontal projection. Set drips in sealant and fasten with stainless steel screws.

2.3.13.1 Overhead Rain Drips

Approximately 1-1/2 inch high by 2-1/2 inch projection. Align bottom with door frame rabbet.

2.3.14 Auxiliary Hardware (Other than locks)

Provide in accordance with ANSI/BHMA A156.16, Grade 1.

2.3.15 Special Tools

Provide special tools, such as spanner and socket wrenches and dogging keys, as required to service and adjust hardware items.

2.4 FASTENERS

Provide fasteners of type, quality, size, and quantity appropriate to the specific application. Fastener finish to match hardware. Provide stainless steel or nonferrous metal fasteners in locations exposed to weather. Verify metals in contact with one another are compatible and will avoid galvanic corrosion when exposed to weather.

2.5 FINISHES

Provide in accordance with ANSI/BHMA A156.18. Provide hardware in BHMA 630 finish (satin stainless steel), unless specified otherwise. Provide items not manufactured in stainless steel in BHMA 626 finish (satin chromium plated) over brass or bronze, except BHMA 652 finish (satin chromium plated) for steel hinges. Provide hinges for exterior doors in stainless steel with BHMA 630 finish or chromium plated brass or bronze with BHMA 626 finish. Furnish exit devices in BHMA 626 finish in lieu of BHMA 630 finish except where BHMA 630 is specified under paragraph HARDWARE SETS. Match exposed parts of concealed closers to lock and door

trim. Match hardware finish for aluminum doors to the doors.

PART 3 EXECUTION

3.1 INSTALLATION

Provide hardware in accordance with manufacturers' printed installation instructions. Fasten hardware to wood surfaces with full-threaded wood screws or sheet metal screws. Provide machine screws set in expansion shields for fastening hardware to solid concrete and masonry surfaces. Provide toggle bolts where required for fastening to hollow core construction. Provide through bolts where necessary for satisfactory installation.

3.1.1 Weatherstripping Installation

Provide full contact, weathertight seals that allow operation of doors without binding the weatherstripping.

3.1.1.1 Stop Applied Weatherstripping

Fasten in place with color matched sheet metal screws not more than 9 inch on center after doors and frames have been finish painted.

3.1.1.2 Interlocking Type Weatherstripping

Provide interlocking, self adjusting type on heads and jambs and flexible hook type at sills. Nail weatherstripping to door 1 inch on center and to heads and jambs at 4 inch on center.

3.1.2 Lightproofing Installation

Provide as specified for stop applied weatherstripping.

3.1.3 Threshold Installation

Extend thresholds the full width of the opening and notch end for jamb stops. Set thresholds in a full bed of sealant and anchor to floor with cadmium-plated, countersunk, steel screws in expansion sleeves.

3.2 HARDWARE LOCATIONS

Provide in accordance with SDI/DOOR A250.8, unless indicated or specified otherwise.

3.3 FIELD QUALITY CONTROL

After installation, protect hardware from paint, stains, blemishes, and other damage until acceptance of work. Submit notice of testing 15 days before scheduled, so that testing can be witnessed by the Contracting Officer. Adjust hinges, locks, latches, bolts, holders, closers, and other items to operate properly. Demonstrate that permanent keys operate respective locks, and give keys to the Contracting Officer. Correct, repair, and finish, errors in cutting and fitting and damage to adjoining work.

20-0075 Repair BEQ FC530

3.4 HARDWARE SETS

HW-1

Typical Sleeping Room Entry

3 ea.	Hinges	A8112	652
1	Card Key System		
1	Door Viewer		
1 ea.	Closer	C02021	689
1 ea.	Wall/Floor stop	L22102	630
1 ea.	Kickplate	J102 2" LDW x 10"	630
1 ea.	Weatherstripping	R3Y165	AL
1	Door Rain Drip		
1 ea.	Threshold	J32130	AL

HW-2

Typical Sleeping Closet Doors

3 ea.	Hinges	A8112	652
1 ea.	Sliding Closet Hasp		1884
1 ea.	Strike Plate		
3 ea.	Silencers	L03011	Grey

HW-3

Typical Sleeping Head Doors

3 ea.	Hinges	A8112	652
1 ea.	Closer	C02021	689
1 ea.	Privacy Lockset	F84 Grade 1	626
3 ea.	Silencers	L03011	Grey
1 ea.	Wall/Floor stop	L22102	630

HW-4

Exterior Mechanical Double Door

6 ea.	Hinges	A8112	652
1 ea.	Lockset	F84 Grade 1	626
2 ea.	Closer	C02021 w/stop arm	689
2 ea.	Weatherstripping	R3Y165	AL
1	Door Rain Drip		
1 ea.	Threshold	J32130	AL

HW-5

Exterior Chase/Exterior Mechanical Door

3 ea.	Hinges	A8112	652
1 ea.	Lockset	F84 Grade 1	626
1 ea.	Wall stop	L22102	630
1 ea.	Weatherstripping	R3Y165	AL
1	Door Rain Drip		
1 ea.	Threshold	J32130	AL

HW-6

Typical Exterior Office Entry, Exterior Corridor Entry

3 ea.	Hinges	A8112	652
1 ea.	Lockset	F84 Grade 1	626
1 ea.	Closer	C02021	689
1 ea.	Wall/Floor stop	L22102	630
1 ea.	Kickplate	J102 2" LDW x 10"	630
1 ea.	Weatherstripping	R3Y165	AL
1	Door Rain Drip		
1 ea.	Threshold	J32130	AL

HW-7

Interior Chase Door

3 ea.	Hinges	A8112	652
1 ea.	Lockset	F84 Grade 1	626
1 ea.	Wall stop	L22102	630
1 ea.	Threshold	J32130	AL

HW-8

Typical Interior Office/Corridor Head Door

3 ea.	Hinges	A8112	652
1 ea.	Closer	C02021	689
1 ea.	Privacy Lockset	F84 Grade 1	626
3 ea.	Silencers	L03011	Grey
1 ea.	Wall/Floor stop	L22102	630

HW-9

Interior Storage Door

3 ea.	Hinges	A8112	652
1 ea.	Lockset	F84 Grade 1	626
1 ea.	Wall/Floor stop	L22102	630
3 ea.	Silencers	L03011	Grey

HW-10

Interior Office Door

3 ea.	Hinges	A8112	652
1 ea.	Lockset	F84 Grade 1	626
1 ea.	Wall/Floor stop	L22102	630
3 ea.	Silencers	L03011	Grey

HW-11

Corridor Exterior Door

3 ea.	Hinges	A5111 NRP	630
1 ea.	Rim Exit Device	Type 1 Function 08 Grade 1	630
1 ea.	Closer	C02021 w/stop arm	689
1 ea.	Wall stop	L22102	630
1 ea.	Kickplate	J102 2" LDW x 10"	630
1 ea.	Threshold	J32130	AL
1 ea.	Weatherstripping	R3Y165	AL

20-0075 Repair BEQ FC530

HW-12

Laundry, Lounge Entry

3 ea.	Hinges	A8112	652
1 ea.	Passage set	F84 Grade 1	626
1 ea.	Closer	C02021 w/stop arm	689
3 ea.	Silencers	L03011	Grey
1 ea.	Wall stop	L22102	630
1 ea.	Kickplate	J102 2" LDW x 10"	630

HW-13

Electrical, Telecom

3 ea.	Hinges	A8112	652
1 ea.	Lockset	F84 Grade 1	626
1 ea.	Kickplate	J102 2" LDW x 10"	630
1 ea.	Closer	C02021 w/stop arm	689
3 ea.	Silencers	L03011	Grey

HW-14

Laundry Chase Access Door

3 ea.	Hinges	A8112	652
1 ea.	Lockset	F84 Grade 1	626
1 ea.	Closer	C02021 w/stop arm	689
1 ea.	Wall stop	L22102	630
1 ea.	Weatherstripping	R3Y165	AL

HW-15

Corridor Passage Door

3 ea.	Hinges	A8112 NRP	652
1 ea.	Push Plate	J301	630
1 ea.	Pull Plate	J405	630
1 ea.	Closer	C02021 w/stop arm	689
1 ea.	Kickplate	J102 2" LDW x 10"	630
1 ea.	Wall stop	L22102	630
1 ea.	Kickplate	J102 2" LDW x 10"	630
1 ea.	Weatherstripping	R3Y165	AL
1 ea.	Threshold	J32130	AL

HW-16

Attic Draft Door

3 ea.	Spring Hinges	K81071F	
1 ea.	Passage set	F84 Grade 1	626
1 set	Draft Control Gasketing		156.22
1 ea.	Door Sweep	R3Y435	AL

20-0075 Repair BEQ FC530

-- End of Section --

SECTION 08 81 00

GLAZING

05/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 800 (2016) Voluntary Specifications and Test Methods for Sealants

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (2015) Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

ASTM INTERNATIONAL (ASTM)

ASTM C509 (2006; R 2015) Elastomeric Cellular Preformed Gasket and Sealing Material

ASTM C920 (2018) Standard Specification for Elastomeric Joint Sealants

ASTM C1021 (2008; R 2014) Standard Practice for Laboratories Engaged in Testing of Building Sealants

ASTM C1036 (2016) Standard Specification for Flat Glass

ASTM C1048 (2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

ASTM C1087 (2016) Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems

ASTM C1184 (2014) Standard Specification for Structural Silicone Sealants

ASTM C1281 (2016) Standard Specification for Preformed Tape Sealants for Glazing Applications

ASTM C1376 (2015) Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass

ASTM D395	(2016; E 2017) Standard Test Methods for Rubber Property - Compression Set
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E413	(2016) Classification for Rating Sound Insulation
ASTM E1300	(2016) Standard Practice for Determining Load Resistance of Glass in Buildings
ASTM E2190	(2010) Standard Specification for Insulating Glass Unit Performance and Evaluation

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2008) Glazing Manual
GANA Sealant Manual	(2008) Sealant Manual
GANA Standards Manual	(2008) Engineering Standards Manual

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)

IGMA TB-1200	(1983; R 2016) Guidelines for Insulating Glass Dimensional Tolerances
IGMA TB-3001	(2001) Guidelines for Sloped Glazing
IGMA TM-3000	(1990; R 2016) North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2014) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2014) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

16 CFR 1201	Safety Standard for Architectural Glazing Materials
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1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Insulating Glass

Glazing Accessories

Sealants

Joint Backer

SD-07 Certificates

Insulating Glass

SD-08 Manufacturer's Instructions

Setting and Sealing Materials

Glass Setting

SD-11 Closeout Submittals

Warranty for Insulated Glass Units

1.3 SYSTEM DESCRIPTION

Fabricate and install watertight and airtight glazing systems to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, or defects in the work. Glazed panels must comply with the safety standards, in accordance with ANSI Z97.1, and comply with indicated wind/snow loading in accordance with ASTM E1300.

1.3.1 Glazing for Passive Solar and Dynamic Control Fenestration

Identify glazing for Passive Solar and Dynamic Control Fenestration noted as part of a passive solar heating system and/or chromogenic fenestration and evaluate separately from other fenestration. Glazing for use in Passive Solar systems are exempt from SHGC requirements. Area-weighted averaging of chromogenic fenestration with other non-chromogenic fenestration is not permitted. For chromogenic fenestration systems, the lower-rated labeled SHGC must be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above 40 degrees F and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp

or rainy weather.

1.6 WARRANTY

1.6.1 Warranty for Insulated Glass Units

Warranty insulating glass units against development of material obstruction to vision (such as dust, fogging, or film formation on the inner glass surfaces) caused by failure of the hermetic seal, other than through glass breakage, for a 10-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this warranty within 45 working days after receipt of notice from the Government.

PART 2 PRODUCTS

2.1 PRODUCT SUSTAINABILITY CRITERIA

2.2 GLASS

ASTM C1036, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201.

2.2.1 Heat-Absorbing Glass

Type I, Class 2 (tinted), Quality q4 (A), .25 inch thick, green in color, 0.25 percent shading coefficient, conforming to ASTM C1036.

2.2.2 Reflective Coating Vision Glass

ASTM C1376

2.2.3 Tempered Glass

ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 2 (tinted heat absorbing), Quality q3, 0.25 inch thick, 0.25 percent shading coefficient conforming to ASTM C1048 and GANA Standards Manual. Color must be bronze. Provide FT and wherever safety glazing material is indicated or specified.

2.3 INSULATING GLASS UNITS

Two panes of glass separated by a dehydrated airspace, filled with argon gas and hermetically sealed, conforming to ASTM E2190. Submit performance and compliance documentation for each type of insulating glass.

Insulated glass units must have a Solar Heat Gain Coefficient (SHGC) maximum of 0.25 determined according to NFRC 200 and a U-factor maximum of 0.46 Btu per square foot by hr by degree F in accordance with NFRC 100.

Glazed panels must be rated for not less than 30 Sound Transmission Class (STC) when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

Dimensional tolerances must be as specified in IGMA TB-1200. Spacer must be black, roll-formed, thermally broken aluminum, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal must be compressed polyisobutylene and

the secondary seal must be a specially formulated silicone.

2.4 SETTING AND SEALING MATERIALS

Provide as specified in the GANA Glazing Manual, IGMA TM-3000, IGMA TB-3001, and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted must be gray or neutral color. Sealant testing must be performed by a testing agency qualified according to ASTM C1021.

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified.

2.4.1 Sealants

Provide elastomeric sealants.

2.4.1.1 Elastomeric Sealant

ASTM C920, Type S, Grade NS, Class 12.5, Use G. Use for channel or stop glazing metal sash. Sealants must be chemically compatible with setting blocks, edge blocks, and sealing tapes, with sealants used in manufacture of insulating glass units.

2.4.1.2 Structural Sealant

ASTM C1184, Type S.

2.4.2 Joint Backer

Joint backer must have a diameter size at least 25 percent larger than joint width; type and material as recommended in writing by glass and sealant manufacturer.

2.4.3 Glazing Tapes

2.4.3.1 Back-Bedding Mastic Glazing Tapes

Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

- a. AAMA 804.3 tape, where indicated.
- b. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
- c. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.4.3.2 Expanded Cellular Glazing Tapes

Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

- a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the

primary sealant.

- b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.4.4 Setting Blocks and Edge Blocks

Closed-cell neoprene setting blocks must be dense extruded type conforming to ASTM C509 and ASTM D395, Method B, Shore A durometer between 70 and 90. Edge blocking must be Shore A durometer of 50 (plus or minus 5). Provide silicone setting blocks when blocks are in contact with silicone sealant. Profiles, lengths and locations must be as required and recommended in writing by glass manufacturer. Block color must be black.

2.4.5 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers. Use ASTM C1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to surface.

PART 3 EXECUTION

Any materials that show visual evidence of biological growth due to the presence of moisture must not be installed on the building project.

3.1 PREPARATION

Preparation, unless otherwise specified or approved, must conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.2 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, must conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place. Verify products are properly installed, connected, and adjusted.

3.2.1 Sheet Glass

Cut and set with the visible lines or waves horizontal.

3.2.2 Insulating Glass Units

Do not grind, nip, or cut edges or corners of units after the units have left the factory. Springing, forcing, or twisting of units during setting will not be permitted. Handle units so as not to strike frames or other objects. Installation must conform to applicable recommendations of IGMA TB-3001 and IGMA TM-3000.

3.2.3 Installation of Laminated Glass

Sashes which are to receive laminated glass must be weeped to the outside to allow water drainage into the channel.

3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass must be clean at the time the work is accepted.

3.4 PROTECTION

Protect glass work immediately after installation. Identify glazed openings with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Protect reflective glass with a protective material to eliminate any contamination of the reflective coating. Place protective material far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Upon removal, separate protective materials for reuse or recycling. Remove and replace glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities with new units.

-- End of Section --

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SECTION 08 91 00

METAL WALL LOUVERS

05/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-L (2015) Laboratory Methods of Testing
Louvers for Rating

AMCA 511 (2010) Certified Ratings Program for Air
Control Devices

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System
for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 2603 (2017a) Voluntary Specification,
Performance Requirements and Test
Procedures for Pigmented Organic Coatings
on Aluminum Extrusions and Panels

AAMA 611 (2014) Voluntary Specification for
Anodized Architectural Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM A653/A653M (2019) Standard Specification for Steel
Sheet, Zinc-Coated (Galvanized) or
Zinc-Iron Alloy-Coated (Galvannealed) by
the Hot-Dip Process

ASTM B209 (2014) Standard Specification for Aluminum
and Aluminum-Alloy Sheet and Plate

ASTM B221 (2014) Standard Specification for Aluminum
and Aluminum-Alloy Extruded Bars, Rods,
Wire, Profiles, and Tubes

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL
PROCEDURES:

SD-02 Shop Drawings

Wall louvers

SD-03 Product Data

Metal Wall Louvers

1.3 DELIVERY, STORAGE, AND PROTECTION

Deliver materials to the site in an undamaged condition. Carefully store materials off the ground to provide proper ventilation, drainage, and protection against dampness. Louvers shall be free from nicks, scratches, and blemishes. Replace defective or damaged materials with new.

1.4 DETAIL DRAWINGS

Show all information necessary for fabrication and installation of wall louvers. Indicate materials, sizes, thicknesses, fastenings, and profiles.

1.5 COLOR SAMPLES

Colors of finishes for wall louvers shall closely approximate colors indicated. Where color is not indicated, submit the manufacturer's standard colors, (hard copies, to the Contracting Officer for selection.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Galvanized Steel Sheet

ASTM A653/A653M, coating designation G90.

2.1.2 Aluminum Sheet

ASTM B209, alloy 3003 or 5005 with temper as required for forming.

2.1.3 Extruded Aluminum

ASTM B221, alloy 6063-T5 or -T52.

2.2 METAL WALL LOUVERS

Wind driven rain resistant type, with bird screens and made to withstand a wind load of not less than 30 pounds per square foot. Wall louvers must bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500-L and AMCA 511. The rating must show a water penetration of 0.20 or less ounce per square foot of free area at a free velocity of 800 feet per minute.

2.2.1 Extruded Aluminum Louvers

Fabricated of extruded 6063-T5 or -T52 aluminum with a wall thickness of not less than 0.081 inch.

2.2.2 Formed Metal Louvers

Formed of zinc-coated steel sheet not thinner than 16 U.S. gage, or aluminum sheet not less than 0.08 inch thick.

2.2.3 Mullions and Mullion Covers

Same material and finish as louvers. Provide mullions for all louvers more than 5 feet in width at not more than 5 feet on centers. Provide mullions covers on both faces of joints between louvers.

2.2.4 Screens and Frames

For aluminum louvers, provide 1/2 inch square mesh, 14 or 16 gage aluminum or 1/4 inch square mesh, 16 gage aluminum bird screening. Mount screens in removable, rewirable frames of same material and finish as the louvers.

2.3 FASTENERS AND ACCESSORIES

Provide stainless steel screws and fasteners for aluminum louvers and zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories as required for complete and proper installation.

2.4 FINISHES

2.4.1 Aluminum

Exposed aluminum surfaces shall be factory finished with an anodic coating or organic coating. Color shall be selected by Architect. Louvers shall have the same finish.

2.4.1.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish shall be:

- a. Architectural Class I (0.7 mil or thicker), designation AA-M10-C22-A44, electrolytically deposited color anodized.

2.4.1.2 Organic Coating

Clean and prime exposed aluminum surfaces. Provide a baked enamel finish conforming to AAMA 2603, with total dry film thickness not less than 0.8 mil with total dry film thickness of not less than 1.2 mil.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Wall Louvers

Install using stops or moldings, flanges, strap anchors, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations.

3.1.2 Screens and Frames

Attach frames to louvers with screws or bolts.

3.2 PROTECTION FROM CONTACT OF DISSIMILAR MATERIALS

3.2.1 Copper or Copper-Bearing Alloys

Paint copper or copper-bearing alloys in contact with dissimilar metal

with heavy-bodied bituminous paint or separate with inert membrane.

3.2.2 Aluminum

Where aluminum contacts metal other than zinc, paint the dissimilar metal with a primer and two coats of aluminum paint.

3.2.3 Metal

Paint metal in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

-- End of Section --

SECTION 09 22 00

SUPPORTS FOR PLASTER AND GYPSUM BOARD

02/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A463/A463M	(2010) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A653/A653M	(2019) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM C 645	(2009a) Nonstructural Steel Framing Members
ASTM C 754	(2009a) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
ASTM C 841	(2003; R 2008e1) Installation of Interior Lathing and Furring
ASTM C 847	(2010a) Standard Specification for Metal Lath

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM ML/SFA 920	(1991) Metal Lathing and Furring
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UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance	(2014) Fire Resistance Directory
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1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Metal support systems

Submit for the erection of metal framing. Indicate materials, sizes, thicknesses, and fastenings.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the job site and store in ventilated dry locations. Storage area shall permit easy access for inspection and handling. If materials are stored outdoors, stack materials off the ground, supported on a level platform, and fully protected from the weather. Handle materials carefully to prevent damage. Remove damaged items and provide new items.

PART 2 PRODUCTS

2.1 MATERIALS

Provide steel materials for metal support systems with galvanized coating ASTM A653/A653M, G-60; aluminum coating ASTM A463/A463M, T1-25; or a 55-percent aluminum-zinc coating.

2.1.1 Materials for Attachment of Lath

2.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C 841, and ASTM C 847.

2.1.1.2 Non-loadbearing Wall Framing

NAAMM ML/SFA 920.

2.1.2 Materials for Attachment of Gypsum Wallboard

2.1.2.1 Suspended and Furred Ceiling Systems

ASTM C 645.

2.1.2.2 Nonload-Bearing Wall Framing and Furring

ASTM C 645, but not thinner than 0.0179 inch thickness, with 0.0329 inch minimum thickness supporting wall hung items such as cabinetwork, equipment and fixtures.

2.1.2.3 Furring Structural Steel Columns

ASTM C 645. Steel (furring) clips and support angles listed in UL Fire Resistance may be provided in lieu of steel studs for erection of gypsum wallboard around structural steel columns.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Systems for Attachment of Lath

3.1.1.1 Suspended and Furred Ceiling Systems and Wall Furring

ASTM C 841, except as indicated otherwise.

3.1.1.2 Non-loadbearing Wall Framing

NAAMM ML/SFA 920, except provide framing members 16 inches o.c. unless indicated otherwise.

3.1.2 Systems for Attachment of Gypsum Wallboard

3.1.2.1 Suspended and Furred Ceiling Systems

ASTM C 754, except provide framing members 16 inches o.c. unless indicated otherwise.

3.1.2.2 Non-loadbearing Wall Framing and Furring

ASTM C 754, except as indicated otherwise.

3.2 ERECTION TOLERANCES

Provide framing members which will be covered by finish materials such as wallboard, plaster, or ceramic tile set in a mortar setting bed, within the following limits:

- a. Layout of walls and partitions: 1/4 inch from intended position;
- b. Plates and runners: 1/4 inch in 8 feet from a straight line;
- c. Studs: 1/4 inch in 8 feet out of plumb, not cumulative; and
- d. Face of framing members: 1/4 inch in 8 feet from a true plane.

Provide framing members which will be covered by ceramic tile set in dry-set mortar, latex-portland cement mortar, or organic adhesive within the following limits:

- a. Layout of walls and partitions: 1/4 inch from intended position;
- b. Plates and runners: 1/8 inch in 8 feet from a straight line;
- c. Studs: 1/8 inch in 8 feet out of plumb, not cumulative; and
- d. Face of framing members: 1/8 inch in 8 feet from a true plane.

-- End of Section --

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SECTION 09 29 00

GYPSUM BOARD

08/16

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.11 (1992; Reaffirmed 2005) Specifications for Interior Installation of Cementitious Backer Units

ASTM INTERNATIONAL (ASTM)

ASTM C475/C475M (2017) Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board

ASTM C840 (2019b) Standard Specification for Application and Finishing of Gypsum Board

ASTM C954 (2018) Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

ASTM C1002 (2018) Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

ASTM C1047 (2019) Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base

ASTM C1396/C1396M (2017) Standard Specification for Gypsum Board

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide
<http://www.approvalguide.com/>

GYPSUM ASSOCIATION (GA)

GA 214 (2010) Recommended Levels of Gypsum Board Finish

GA 216 (2010) Application and Finishing of Gypsum

Panel Products

UNDERWRITERS LABORATORIES (UL)

UL Fire Resistance

(2014) Fire Resistance Directory

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Water-Resistant Gypsum Backing Board

Accessories

Submit for each type of gypsum board and for cementitious backer units.

Gypsum Board

SD-06 Test Reports

SD-07 Certificates

Asbestos Free Materials

Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos.

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery

Deliver materials in the original packages, containers, or bundles with each bearing the brand name, applicable standard designation, and name of manufacturer, or supplier.

1.3.2 Storage

Keep materials dry by storing inside a sheltered building. Where necessary to store gypsum board and cementitious backer units outside, store off the ground, properly supported on a level platform, and protected from direct exposure to rain, snow, sunlight, and other extreme weather conditions. Provide adequate ventilation to prevent condensation. Store per manufacturer's recommendations for allowable temperature and humidity range. Do not store panels near materials that may offgas or emit harmful fumes, such as kerosene heaters, fresh paint, or adhesives. Do not use materials that have visible moisture or biological growth.

1.3.3 Handling

Neatly stack gypsum board and cementitious backer units flat to prevent sagging or damage to the edges, ends, and surfaces.

1.4 QUALIFICATIONS

Furnish type of gypsum board work specialized by the installer with a minimum of 3 years of documented successful experience.

1.5 SCHEDULING

Commence application only after the area scheduled for gypsum board work is completely weathertight. The heating, ventilating, and air-conditioning systems must be complete and in operation prior to application of the gypsum board. If the mechanical system cannot be activated before gypsum board is begun, the gypsum board work may proceed in accordance with an approved plan to maintain the environmental conditions specified below. Apply gypsum board prior to the installation of finish flooring and acoustic ceiling.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not expose the gypsum board to excessive sunlight prior to gypsum board application. Maintain a continuous uniform temperature of not less than 50 degrees F and not more than 80 degrees F for at least one week prior to the application of gypsum board work, while the gypsum board application is being done, and for at least one week after the gypsum board is set. Shield air supply and distribution devices to prevent any uneven flow of air across the plastered surfaces. Provide ventilation to exhaust moist air to the outside during gypsum board application, set, and until gypsum board jointing is dry. In glazed areas, keep windows open top and bottom or side to side 3 to 4 inches. Reduce openings in cold weather to prevent freezing of joint compound when applied. For enclosed areas lacking natural ventilation, provide temporary mechanical means for ventilation. In unglazed areas subjected to hot, dry winds or temperature differentials from day to night of 20 degrees F or more, screen openings with cheesecloth or similar materials. Avoid rapid drying. During periods of low indoor humidity, provide minimum air circulation following gypsum boarding and until gypsum board jointing complete and is dry.

1.7 FIRE RESISTIVE CONSTRUCTION

Comply with specified fire-rated assemblies for design numbers indicated per UL Fire Resistance or FM APP GUIDE.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to specifications, standards and requirements specified. Provide gypsum board types, gypsum backing board types, cementitious backing units, and joint treating materials manufactured from asbestos free materials only.

2.1.1 Gypsum Board

ASTM C1396/C1396M.

2.1.1.1 Regular

48 inch wide, 5/8 inch thick, tapered edges.

2.1.1.2 Type X (Special Fire-Resistant)

48 inch wide, 5/8 inch thick, tapered edges.

2.1.2 Regular Water-Resistant Gypsum Backing Board

ASTM C1396/C1396M

2.1.2.1 Regular

48 inch wide, 5/8 inch thick, tapered edges.

2.1.2.2 Type X (Special Fire-Resistant)

48 inch wide, 5/8 inch thick, tapered edges.

2.1.3 Joint Treatment Materials

ASTM C475/C475M. Product must be low emitting VOC types with VOC limits not exceeding 50 g/L. Use all purpose joint and texturing compound containing inert fillers and natural binders, including lime compound. Pre-mixed compounds must be free of antifreeze, vinyl adhesives, preservatives, biocides and other slow releasing compounds.

2.1.3.1 Embedding Compound

Specifically formulated and manufactured for use in embedding tape at gypsum board joints and compatible with tape, substrate and fasteners.

2.1.3.2 Finishing or Topping Compound

Specifically formulated and manufactured for use as a finishing compound.

2.1.3.3 All-Purpose Compound

Specifically formulated and manufactured to serve as both a taping and a finishing compound and compatible with tape, substrate and fasteners.

2.1.3.4 Setting or Hardening Type Compound

Specifically formulated and manufactured for use with fiber glass mesh tape.

2.1.3.5 Joint Tape

Use cross-laminated, tapered edge, reinforced paper, or fiber glass mesh tape recommended by the manufacturer.

2.1.4 Fasteners

2.1.4.1 Screws

ASTM C1002, Type "G", Type "S" or Type "W" steel drill screws for fastening gypsum board to gypsum board, wood framing members and steel framing members less than 0.033 inch thick. ASTM C954 steel drill screws for fastening gypsum board to steel framing members 0.033 to 0.112 inch thick. Provide cementitious backer unit screws with a polymer coating.

2.1.5 Accessories

ASTM C1047. Fabricate from corrosion protected steel or plastic designed for intended use. Accessories manufactured with paper flanges are not acceptable. Flanges must be free of dirt, grease, and other materials that may adversely affect bond of joint treatment. Provide prefinished or job decorated materials.

2.1.6 Water

Provide clean, fresh, and potable water.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Framing and Furring

Verify that framing and furring are securely attached and of sizes and spacing to provide a suitable substrate to receive gypsum board and cementitious backer units. Verify that all blocking, headers and supports are in place to support plumbing fixtures and to receive soap dishes, grab bars, towel racks, and similar items. Do not proceed with work until framing and furring are acceptable for application of gypsum board and cementitious backer units.

3.1.2 Building Construction Materials

Do not install building construction materials that show visual evidence of biological growth.

3.2 APPLICATION OF GYPSUM BOARD

Apply gypsum board to framing and furring members in accordance with ASTM C840 or GA 216 and the requirements specified. Apply gypsum board with separate panels in moderate contact; do not force in place. Stagger end joints of adjoining panels. Neatly fit abutting end and edge joints. Use gypsum board of maximum practical length; select panel sizes to minimize waste. Cut out gypsum board to make neat, close, and tight joints around openings. In vertical application of gypsum board, provide panels in lengths required to reach full height of vertical surfaces in one continuous piece. Lay out panels to minimize waste; reuse cutoffs whenever feasible. Surfaces of gypsum board and substrate members may not be bonded together with an adhesive, except where prohibited by fire rating(s). Treat edges of cutouts for plumbing pipes, screwheads, and joints with water-resistant compound as recommended by the gypsum board manufacturer.

3.2.1 Application of Gypsum Board to Steel Framing and Furring

Apply in accordance with ASTM C840, System VIII or GA 216.

3.2.2 Arches and Bending Radii

Apply gypsum board in accordance with ASTM C840, System IX or GA 216.

3.2.3 Exterior Application

Apply exterior gypsum board (such as at soffits) in accordance with

ASTM C840, System XI or GA 216.

3.2.4 Control Joints

Install expansion and contraction joints in ceilings and walls in accordance with ASTM C840, System XIII or GA 216.

3.3 APPLICATION OF CEMENTITIOUS BACKER UNITS

3.3.1 Application

In wet areas (tubs, shower enclosures, saunas, steam rooms, gang shower rooms), apply cementitious backer units in accordance with ANSI A108.11. Place a 15 lb asphalt impregnated, continuous felt paper membrane behind cementitious backer units, between backer units and studs or base layer of gypsum board. Place membrane with a minimum 6 inch overlap of sheets laid shingle style.

3.3.2 Joint Treatment

ANSI A108.11.

3.4 FINISHING OF GYPSUM BOARD

Tape and finish gypsum board in accordance with ASTM C840, GA 214 and GA 216. Finish plenum areas above ceilings to Level 1 in accordance with GA 214. Finish water resistant gypsum backing board, ASTM C1396/C1396M, to receive ceramic tile to Level 2 in accordance with GA 214. Finish walls and ceilings to receive a heavy-grade wall covering or heavy textured finish before painting to Level 3 in accordance with GA 214. Finish walls and ceilings without critical lighting to receive flat paints, light textures, or wall coverings to Level 4 in accordance with GA 214. Unless otherwise specified, finish all gypsum board walls, partitions and ceilings to Level 5 in accordance with GA 214. Provide joint, fastener depression, and corner treatment. Tool joints as smoothly as possible to minimize sanding and dust. Do not use self-adhering fiber glass mesh tape with conventional drying type joint compounds; use setting or hardening type compounds only. Provide treatment for water-resistant gypsum board as recommended by the gypsum board manufacturer. Protect workers, building occupants, and HVAC systems from gypsum dust.

3.4.1 Uniform Surface

Wherever gypsum board is to receive eggshell, semigloss or gloss paint finish, or where severe, up or down lighting conditions occur, finish gypsum wall surface in accordance to GA 214 Level 5. In accordance with GA 214 Level 5, apply a thin skim coat of joint compound to the entire gypsum board surface, after the two-coat joint and fastener treatment is complete and dry.

3.5 SEALING

Seal openings around pipes, fixtures, and other items projecting through gypsum board and cementitious backer units as specified in Section 07 92 00 JOINT SEALANTS. Apply material with exposed surface flush with gypsum board or cementitious backer units.

3.6 FIRE-RESISTANT ASSEMBLIES

Wherever fire-rated construction is indicated, provide materials and application methods, including types and spacing of fasteners, wall and ceiling framing in accordance with the specifications contained in UL Fire Resistance for the Design Number(s) indicated. Joints of fire-rated gypsum board enclosures must be closed and sealed in accordance with UL test requirements or GA requirements. Seal penetrations through rated partitions and ceilings tight in accordance with tested systems.

3.7 PATCHING

Patch surface defects in gypsum board to a smooth, uniform appearance, ready to receive finishes.

-- End of Section --

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SECTION 09 30 10

CERAMIC, QUARRY, AND GLASS TILING
08/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A137.1 (2012) American National Standards
Specifications for Ceramic Tile

ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C144	(2018) Standard Specification for Aggregate for Masonry Mortar
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM C206	(2014) Standard Specification for Finishing Hydrated Lime
ASTM C207	(2018) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C241/C241M	(2015) Standard Specification for Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C373	(2018) Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products
ASTM C648	(2004; R 2009) Breaking Strength of Ceramic Tile
ASTM C847	(2014a) Standard Specification for Metal Lath

ASTM C1026	(2013; R 2018) Standard Test Method for Measuring the Resistance of Ceramic and Glass Tile to Freeze-Thaw Cycling
ASTM C1027	(2009; R 2017) Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)	
CDPH SECTION 01350	(2010; Version 1.1) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers
GREEN SEAL (GS)	
GS-36	(2013) Adhesives for Commercial Use
MARBLE INSTITUTE OF AMERICA (MIA)	
MIA Design Manual	(2016) Dimension Stone Design Manual
SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)	
SCAQMD Rule 1168	(2017) Adhesive and Sealant Applications
TILE COUNCIL OF NORTH AMERICA (TCNA)	
TCNA Hdbk	(2017) Handbook for Ceramic, Glass, and Stone Tile Installation

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Porcelain Tile

Setting-Bed

Mortar, Grout, and Adhesive

Reinforcing Wire Fabric

SD-04 Samples

Tile

Accessories

Transition Strips

Grout

SD-07 Certificates

SD-08 Manufacturer's Instructions

Maintenance Instructions

SD-10 Operation and Maintenance Data

Installation

1.3 QUALITY ASSURANCE

Provide installers having a minimum of two years experience with a company specializing in performing the type of work described. Each type and color of tile to be provided from a single source. Each type and color of mortar, adhesive, and grout to be provided from the same source.

1.4 DELIVERY, STORAGE, AND HANDLING

Ship tiles in sealed packages and clearly marked with the grade, type of tile, producer identification, and country of origin. Deliver materials to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Protect materials from weather, and store them under cover in accordance with manufacturer's printed instructions.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not perform ceramic tile work unless the substrate and ambient temperature is at least 50 degrees F and rising. Maintain temperature above 50 degrees F while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used, ventilate the area to the outside to avoid carbon dioxide damage to new tilework.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period.

1.7 EXTRA MATERIALS

Supply an extra 2 percent of each type tile used in clean and marked cartons.

PART 2 PRODUCTS

2.1 TILE

Provide tiles that comply with ANSI A137.1 and are standard grade tiles. Provide a minimum breaking strength of 125 lbs. for wall tile and 250 lbs. for floor tile in accordance with ASTM C648. Provide exterior building tile for cold climate projects that is approved by the manufacturer for exterior use when tested in accordance with ASTM C1026. Provide floor tiles with a wet dynamic coefficient of friction (DCOF) value of 0.42 or greater when tested in accordance with ANSI A137.1 requirements. Provide glazed floor tile with a Class IV-Commercial classification as rated by

the manufacturer when tested in accordance with ASTM C1027 for visible abrasion resistance as related to foot traffic. For materials like tile, accessories, and transition strips submit samples of sufficient size to show color range, pattern, type and joints. Submit manufacturer's catalog data.

2.1.1 Porcelain Tile

Provide glazed porcelain tile, cove base and trim pieces with color extending uniformly through the body of the tile. Provide tile with a V2 aesthetic classification. Blend tiles in factory and in a packages to have same color range and continuous blend for installation. Provide nominal tile size(s) of 12x12 floor tile & 6x6 wall tile. Provide a 0.50 percent maximum water absorption in accordance with ASTM C373.

2.2 SETTING-BED

Submit manufacturer's catalog data. Compose the setting-bed of the following materials:

2.2.1 Aggregate for Concrete Fill

Conform to ASTM C33/C33M for aggregate fill. Do not exceed one-half the thickness of concrete fill for maximum size of coarse aggregate.

2.2.2 Portland Cement

Conform to ASTM C150/C150M for cement, Type I, white for wall mortar and gray for other uses.

2.2.3 Sand

Conform to ASTM C144 for sand.

2.2.4 Hydrated Lime

Conform to ASTM C206 for hydrated lime, Type S or ASTM C207, Type S.

2.2.5 Metal Lath

Conform to ASTM C847 for flat expanded type metal lath, and weighing a minimum 2.5 pound/square yard.

2.2.6 Reinforcing Wire Fabric

Conform to ASTM A1064/A1064M for wire fabric. Provide 2 by 2 inch mesh, 16/16 wire or 1-1/2 by 2 inch mesh, 16/13 wire.

2.3 WATER

Provide potable water.

2.4 MORTAR, GROUT, AND ADHESIVE

Provide non-aerosol adhesive products used on the interior of the building (defined as inside of the weatherproofing system) meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) and VOC content requirements of SCAQMD Rule 1168. Provide aerosol adhesives used on the interior of

the building meeting either emissions requirements of CDPH SECTION 01350 (limit requirements for either office or classroom spaces regardless of space type) or VOC content requirements of GS-36.

2.4.1 Dry-Set Portland Cement Mortar

TCNA Hdbk.

2.4.2 Latex-Portland Cement Mortar

TCNA Hdbk.

2.4.3 Ceramic Tile Grout

TCNA Hdbk; petroleum-free and plastic-free sand portland cement grout .

2.4.4 Epoxy Resin Grout

TCNA Hdbk. 100% solids epoxy grout.

2.4.5 Sealants

Comply with applicable regulations regarding toxic and hazardous materials and as specified. Grout sealant must not change the color or alter the appearance of the grout. Refer to Section 07 92 00 JOINT SEALANTS.

2.5 SUBSTRATES

2.5.1 Cementitious Backer Board

Provide cementitious backer units, for use as tile substrate over wood sub-floors, in accordance with TCNA Hdbk. Furnish 1/2 inch thick cementitious backer units.

2.6 TRANSITION STRIPS

Provide marble transitions appropriate for conditions. Categorize marble Group A as classified by MIA Design Manual. Provide a fine sand-rubbed finish marble, white in color. Provide minimum 12.0 marble abrasion when tested in accordance with ASTM C241/C241M.

2.7 MEMBRANE MATERIALS

Conform to ASTM D226/D226M, Type 1 for 15 pound waterproofing membrane, asphalt-saturated building felt. Conform to 4 mil for polyethylene film.

PART 3 EXECUTION

3.1 PREPARATORY WORK AND WORKMANSHIP

Inspect surface to receive tile in conformance to the requirements of TCNA Hdbk for surface conditions for the type setting bed specified and for workmanship. Provide variations of tiled surfaces that fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.
Organic Adhesives	1/8 inch in 8 ft.	1/16 inch in 3 ft.
Latex Portland Cement Mortar	1/8 inch in 8 ft.	1/8 inch in 10 ft.
Epoxy	1/8 inch in 8 ft.	1/8 inch in 10 ft.

3.2 GENERAL INSTALLATION REQUIREMENTS

Do not start tile work until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Close space, in which tile is being set, to traffic and other work. Keep closed until tile is firmly set. Do not start floor tile installation in spaces requiring wall tile until after wall tile has been installed. Apply tile in colors and patterns indicated in the area shown on the drawings. Install tile with the respective surfaces in true even planes to the elevations and grades shown. Provide special shapes as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Solidly back tile bases and coves with mortar. Do not walk or work on newly tiled floors without using kneeling boards or equivalent protection of the tiled surface. Keep traffic off horizontal portland cement mortar installations for at least 72 hours. Keep all traffic off epoxy installed floors for at least 40 hours after grouting, and heavy traffic off for at least 7 days, unless otherwise specifically authorized by manufacturer. Include drawings of pattern at inside corners, outside corners, termination points and location of all equipment items such as thermostats, switch plates, mirrors and toilet accessories mounted on surface. Submit manufacturer's preprinted installation instructions.

Do not install building construction materials that show visual evidence of biological growth.

3.3 INSTALLATION OF WALL TILE

Install wall tile in accordance with the TCNA Hdbk, method W223 and with grout joints as recommended by the manufacturer for the type of tile.

3.3.1 Workable or Cured Mortar Bed

Install tile over workable mortar bed or a cured mortar bed at the option of the Contractor. Install a 4 mil polyethylene membrane, metal lath, and scratch coat. Conform to TCNA Hdbk for workable mortar bed, materials, and installation of tile. Conform to TCNA Hdbk for cured mortar bed and materials.

3.3.2 Dry-Set Mortar and Latex-Portland Cement Mortar

Use Dry-set to install tile in accordance with TCNA Hdbk. Use Latex Portland Cement when installing porcelain ceramic tile.

3.3.3 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with TCNA Hdbk. Provide and apply manufacturer's standard product for sealing grout joints in accordance with manufacturer's recommendations.

3.4 INSTALLATION OF FLOOR TILE

Install floor tile in accordance with TCNA Hdbk method F122 and with grout joints as recommended by the manufacturer for the type of tile. Install shower receptors in accordance with TCNA Hdbk method B414.

3.4.1 Workable or Cured Mortar Bed

Install floor tile over a workable mortar bed or a cured mortar bed at the option of the Contractor. Conform to TCNA Hdbk for workable mortar bed materials and installation. Conform to TCNA Hdbk for cured mortar bed materials and installation. Provide minimum 1/4 inch to maximum 3/8 inch joints in uniformed width.

3.4.2 Dry-Set and Latex-Portland Cement

Use dry-set mortar to install tile directly over properly cured, plane, clean concrete slabs in accordance with TCNA Hdbk. Use Latex Portland cement when installing porcelain ceramic tile.

3.4.3 Resinous Grout

When resinous grout is indicated, grout quarry tile with either furan or epoxy resin grout. Rake and clean joints to the full depth of the tile and neutralize when recommended by the resin manufacturer. Install epoxy resin grout in conformance with TCNA Hdbk. Install resin grout in accordance with manufacturer's printed installation instructions. Provide a coating of wax applied from the manufacturer on all tile installed and furan resin. Follow manufacturer's printed installation instructions of installed resin grout for proportioning, mixing, installing, and curing. Maintain the recommended temperature in the area and on the surface to be grouted. Protect finished grout of grout stain.

3.4.4 Ceramic Tile Grout

Prepare and install ceramic tile grout in accordance with TCNA Hdbk. Provide and apply manufacturer's standard product for sealing grout joints in accordance with manufacturer's recommendations.

3.4.5 Waterproofing

Shower pans are specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE.

3.4.6 Concrete Fill

Provide a 3500 psi concrete fill mix to dry as consistency as practicable. Compose concrete fill by volume of 1 part Portland cement to 3 parts fine aggregate to 4 parts coarse aggregate, and mix with water to as dry a consistency as practicable. Spread, tamp, and screed concrete fill to a true plane, and pitch to drains or levels as shown. Thoroughly damp concrete fill before applying setting-bed material. Reinforce concrete fill with one layer of reinforcement, with the uncut edges lapped the width of one mesh and the cut ends and edges lapped a minimum 2 inch.

Tie laps together with 18 gauge wire every 10 inch along the finished edges and every 6 inch along the cut ends and edges. Provide reinforcement with support and secure in the centers of concrete fills. Provide a continuous mesh; except where expansion joints occur, cut mesh and discontinue across such joints. Provide reinforced concrete fill under the setting-bed where the distance between the under-floor surface and the finished tiles floor surface is a minimum of 2 inches, and of the same thickness that the mortar setting-bed over the concrete fill with the thickness required in the specified TCNA Hdbk method.

3.5 INSTALLATION OF TRANSITION STRIPS

Install transition strips where indicated, in a manner similar to that of the ceramic tile floor and as recommended by the manufacturer. Provide thresholds full width of the opening. Install head joints at ends not exceeding 1/4 inch in width and grouted full.

3.6 EXPANSION JOINTS

Form and seal joints as specified in Section 07 92 00 JOINT SEALANTS.

3.6.1 Walls

Provide expansion joints at control joints in backing material. Wherever backing material changes, install an expansion joint to separate the different materials.

3.6.2 Floors

Provide expansion joints over construction joints, control joints, and expansion joints in concrete slabs. Provide expansion joints where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 24 to 36 feet each way in large interior floor areas and 12 to 16 feet each way in large exterior areas or areas exposed to direct sunlight or moisture. Extend expansion joints through setting-beds and fill.

3.7 CLEANING AND PROTECTING

Upon completion, thoroughly clean tile surfaces in accordance with manufacturer's approved cleaning instructions. Do not use acid for cleaning glazed tile. Clean floor tile with resinous grout or with factory mixed grout in accordance with printed instructions of the grout manufacturer. After the grout has set, provide a protective coat of a noncorrosive soap or other approved method of protection for tile wall surfaces. Cover tiled floor areas with building paper before foot traffic is permitted over the finished tile floors. Provide board walkways on tiled floors that are to be continuously used as passageways by workmen. Replace damaged or defective tiles. Submit copy of manufacturer's printed maintenance instructions.

-- End of Section --

SECTION 09 51 00

ACOUSTICAL CEILINGS

08/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2016) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A489	(2018; E 2018) Standard Specification for Carbon Steel Eyebolts
ASTM A641/A641M	(2009a; R 2014) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2019) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B633	(2015) Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C635/C635M	(2017) Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C636/C636M	(2013) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM C834	(2017) Standard Specification for Latex Sealants
ASTM E1264	(2014) Acoustical Ceiling Products
ASTM E1414/E1414M	(2011a; E 2014) Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
ASTM E1477	(1998a; R 2017; E 2018) Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of

Integrating-Sphere Reflectometers

ASTM E580/E580M (2017) Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions

ASTM E795 (2016) Standard Practices for Mounting Test Specimens During Sound Absorption Tests

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-310-04 (2013; with Change 1) Seismic Design of Buildings

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings

SD-04 Samples

Acoustical Units

SD-06 Test Reports

Ceiling Attenuation Class and Test

1.3 DELIVERY, STORAGE. AND HANDLING

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.4 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of acoustical units.

1.5 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

1.6 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that

extend beyond a one year period. Include an agreement to repair or replace acoustical panels that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide sound controlling units mechanically mounted on a ceiling suspension system for acoustical treatment. The unit size, texture, finish, and color must be as specified. The Contractor has the option to substitute inch-pound (I-P) Recessed Light Fixtures (RLF) for metric RLF. If the Contractor opts to furnish I-P RLF, other ceiling elements like acoustical ceiling tiles, air diffusers, air registers and grills, must also be I-P products. Coordinate the whole ceiling system with other details, like the location of access panels and ceiling penetrations, etc., shown on the drawings. The Contractor is responsible for all associated labor and materials and for the final assembly and performance of the specified work and products if I-P products are used. The location and extent of acoustical treatment must be as shown on the approved detail drawings. Submit drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan.

2.1.1 Ceiling Attenuation Class and Test

Provide a ceiling system with an attenuation class (CAC) of 40 when determined in accordance with ASTM E1414/E1414M. Provide fixture attenuators over light fixtures and other ceiling penetrations, and provide acoustical blanket insulation adjacent to partitions, as required to achieve the specified CAC. Provide test ceiling continuous at the partition and assembled in the suspension system in the same manner that the ceiling will be installed on the project.

2.1.2 Ceiling Sound Absorption

Determine the Noise Reduction Coefficient (NRC) in accordance with ASTM C423 Test Method.

2.1.3 Light Reflectance

Determine light reflectance factor in accordance with ASTM E1477 Test Method.

2.2 ACOUSTICAL UNITS

Submit two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color. Conform acoustical units to ASTM E1264, Class A, and the following requirements:

2.2.1 Humidity Resistant Composition Units (TYPICAL SPACES)

2.2.1.1 Type

Non-asbestos mineral or glass fibers bonded with ceramic, moisture resistant thermo-setting resin, or other moisture resistant material and having a factory applied white paint finish. Provide panels that do not sag or warp under conditions of heat, high humidity or chemical fumes.

2.2.1.2 Flame Spread

Class: A, 25 or less

2.2.1.3 Pattern, E form 2

2.2.1.4 Minimum NRC

Minimum 0.55 when tested on Mounting Type E-400 of ASTM E795.

2.2.1.5 Minimum Light Reflectance Coefficient

LR-1, 0.75 or greater

2.2.1.6 Nominal Size

24 X 24 inch

2.2.1.7 Edge Detail, Tegular

2.3 SUSPENSION SYSTEM

TYPICAL SPACES

Provide standard suspension system conforming to ASTM C635/C635M for intermediate-duty systems. Provide surfaces exposed to view of aluminum or steel with a factory-applied whitebaked-enamel finish. Provide wall molding having a flange of not less than 15/16 inch. Provide standard corners. Suspended ceiling framing system must have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. Provide a suspension system with a maximum deflection of 1/360 of the span length. Conform seismic details to the guidance in UFC 3-310-04 and ASTM E580/E580M.

2.4 HANGERS

Provide hangers and attachment capable of supporting a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

2.4.1 Wires

Conform wires to ASTM A641/A641M, Class 1, .011 inch in diameter.

2.4.2 Straps

Provide straps of 1 by 3/16 inch galvanized steel conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008M with an electrodeposited zinc coating conforming to ASTM B633, Type RS.

2.4.3 Rods

Provide 3/16 inch diameter threaded steel rods, zinc or cadmium coated.

2.4.4 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with ASTM A489. Eyebolt size must be a minimum 1/4 inch.

2.5 ADHESIVE

Use adhesive as recommended by tile manufacturer.

2.6 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

2.7 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components selected from manufacturer's list of colors.

2.8 ACOUSTICAL SEALANT

Conform acoustical sealant to ASTM C834, nonstaining.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Rid areas, where acoustical units will be cemented, of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Complete and dry interior finish work such as plastering, concrete, and terrazzo work before installation. Complete and approve mechanical, electrical, and other work above the ceiling line prior to the start of acoustical ceiling installation. Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object with the hanger wires, install a subsuspension system so that all hanger wires will be plumb.

3.1.1 Suspension System

Install suspension system in accordance with ASTM C636/C636M and as specified herein. Do not suspend hanger wires or other loads from underside of steel decking.

3.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than 6 inch from each corner of each fixture.

3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, offset the resulting horizontal force by bracing, countersplaying, or other acceptable means.

3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners where wall moldings intersect or install corner caps. Secure wall molding not more than 3 inch from ends of each length and not more than 16 inch on centers between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

3.1.4 Caulking

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

3.1.5 Adhesive Application

Wipe back of tile to remove accumulated dust. Daub acoustical units on back side with four equal daubs of adhesive. Apply daubs near corners of tiles. Ensure that contact area of each daub is at least 2 inch diameter in final position. Press units into place, aligning joints and abutting units tight and uniform without differences in joint widths.

3.2 CEILING ACCESS PANELS

Locate ceiling access panels directly under the items which require access.

3.3 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

3.4 RECLAMATION PROCEDURES

Neatly stack ceiling tile, designated for recycling by the Contracting Officer, on 4 by 4 foot pallets not higher than 4 foot. Panels must be completely dry. Shrink wrap and symmetrically stack pallets on top of each other without falling over.

-- End of Section --

SECTION 09 67 23.13

STANDARD RESINOUS FLOORING

11/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A990/A990M	(2018) Standard Specification for Castings, Iron-Nickel-Chromium and Nickel Alloys, Specially Controlled for Pressure Retaining Parts for Corrosive Service
ASTM C881/C881M	(2020a) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM D1475	(2013) Standard Test Method for Density of Liquid Coatings, Inks, and Related Products
ASTM D1544	(2004; R 2010) Standard Test Method for Color of Transparent Liquids (Gardner Color Scale)
ASTM D1652	(2011; E 2012) Standard Test Method for Epoxy Content of Epoxy Resins
ASTM D2240	(2015; E 2017) Standard Test Method for Rubber Property - Durometer Hardness
ASTM D2471	(1999) Standard Test Method for Gel Time and Peak Exothermic Temperature of Reacting Thermosetting Resins
ASTM D4259	(1988; R 2012) Standard Practice for Abrading Concrete
ASTM D445	(2017a) Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)
ASTM D523	(2014; R 2018) Standard Test Method for Specular Gloss
ASTM D570	(1998; E 2010; R 2010) Standard Test Method for Water Absorption of Plastics
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics

ASTM D696

(2016) Standard Test Method for
Coefficient of Linear Thermal Expansion of
Plastics Between -30 degrees C and 30
degrees C With a Vitreous Silica
Dilatometer

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Product Data

Within 30 days of contract award, submit manufacturer's catalog data for the following items:

- a. Epoxy-Resin Binder/Matrix
- b. Cured Epoxy Binder
- c. Aggregate
- d. Surface Sealing Coat

1.2.2 Design Mix Data

Within 30 days of contract award, submit design mix data for the following items, including a complete list of ingredients and admixtures:

- a. Epoxy-Resin Binder/Matrix
- b. Cured Epoxy Binder
- c. Surface Sealing Coat

Ensure applicable test reports verify the mix has been successfully tested and meets design requirements.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Manufacturer's Catalog Data

SD-04 Samples

Hardboard Mounted Epoxy Flooring

Floor Topping

SD-05 Design Data

Design Mix Data

SD-07 Certificates

Listing of Product Installations

Referenced Standards Certificates

SD-11 Closeout Submittals

Warranty

1.4 DELIVERY, STORAGE, AND HANDLING

Protect materials from weather, soil, and damage during delivery, storage, and construction. Deliver materials in original packages, containers, or bundles bearing brand name and name of material.

Maintain materials used in the installation of floor topping at a temperature between 65 and 85 degrees F.

1.5 QUALITY CONTROL

Prior to commencement of work, submit referenced standards certificates for the following, showing conformance with the referenced standards contained in this section:

- a. Epoxy-Resin Binder/Matrix
- b. Cured Epoxy Binder
- c. Aggregate
- d. Surface Sealing Coat

1.5.1 Qualifications

Submit a listing of product installations for heavy duty epoxy flooring including identification of at least 5 units, similar to those proposed for use, that have been in successful service for a minimum period of 5 years. Identify purchaser, address of installation, service organization, and date of installation.

Ensure floor system applicators are experienced in the application of troweled aggregate thin-set floor topping.

1.5.2 Sampling

Submit hardboard mounted epoxy flooring samples not less than 12-inch square for each required color.

1.6 WARRANTY

Submit a 2 year written warranty for all materials and installation work.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Submit installation drawings for heavy duty epoxy flooring systems clearly designating the areas of application and the installation plan. Include in the installation plan, methods to control sand and dust if sand

blasting is required.

2.2 MATERIALS

2.2.1 Mixes

2.2.1.1 Epoxy-Resin Binder/Matrix

Provide a clear two-component compatible system epoxy resin binder consisting of: (1) a liquid blend of a biphenyl-based epoxy resin and an aliphatic polyglyceride ether, and (2) a liquid blend of two modified amine curing agents, which individually cures the epoxy resin at room temperature to a glossy smooth film. Ensure the two components and the cured epoxy binder have the following physical properties:

<u>PROPERTY</u>	<u>TEST METHOD</u>	<u>REQUIREMENT</u>
COMPONENT A (EPOXY RESIN)		
Viscosity (kinematic), at 77 degrees F, centipoises	ASTM D445	3000 to 5000
Weight per epoxide, grams	ASTM D1652	205 to 225
Color (Gardner Color Scale), maximum	ASTM D1544	5
Weight per gallon, pounds	ASTM D1475	9.46 - 9.56
COMPONENT B (CURING AGENT)		
Viscosity (kinematic), at 77 degrees F, centistokes	ASTM D445	75 to 125
Weight per gallon, pounds	ASTM D1475	7.50 to 7.60
Color (Gardner Color Scale), maximum	ASTM D1544	8

2.2.1.2 Cured Epoxy Binder

Provide a cured epoxy binder with the following properties.

<u>PROPERTY</u>	<u>TEST METHOD</u>	<u>REQUIREMENT</u>
Tensile strength, psi* at test temperature: 77 degrees F	ASTM D638	4500 to 6500
Tensile elongation, percent* at test temperature: 77 degrees F	ASTM D638	20 to 40

PROPERTY	TEST METHOD	REQUIREMENT
Water absorption, percent 24 hours at 77 degrees F, maximum	ASTM D570	0.40
Hardness, Shore D	ASTM D2240	74 to 82
Linear shrinkage, inch/inch maximum	ASTM C881/C881M	0.006
Shrinkage, glass bow, inch divergence, maximum	ASTM A990/A990M	0.016
Coefficient of linear thermal expansion, inch/inch/degree C, maximum	ASTM D696 0 degrees C to 40 degrees C	200 X 10 ⁻⁶
Gel time/peak exotherm at 77 degrees F, 100 gm mass in 4-ounce metal container	ASTM D2471	20 to 40 minutes at 300 degrees F, maximum
*1/8 inch thick castings		
**1/8 by 1 by 3 inch castings, aged in forced draft oven		

2.2.1.3 Aggregate

Provide aggregate recommended by the resinous flooring manufacturer and approved by the Contracting Officer. Deliver aggregate to the site in three separate package gradations for blending. Gradations are:

SIEVE SIZE	PERCENT	
	MAXIMUM	MINIMUM
GRADUATION NO. 1		
Retained on No. 6	0.0	-
Passing No. 6, retained on No. 8	5.0	0.0
Passing No. 8, retained on No. 12	100.0	74.0
Passing No. 20	1.0	-
GRADATION NO. 2		
Retained on No. 16	0.0	-
Passing No. 16, retained on No. 18	5.0	0.0

SIEVE SIZE	PERCENT	
	MAXIMUM	MINIMUM
Passing No. 18, retained on No. 40	100.0	85.0
Passing No. 40, retained on No. 60	9.0	0.0
Passing No. 60	1.0	-
GRADATION NO. 3		
Retained on No. 20	0.0	-
Passing No. 20, retained on No. 35	5.0	0.0
Passing No. 35, retained on No. 60	100.0	80.0
Passing No. 60, retained on No. 100	13.0	0.0
Passing No. 100	2.0	-

2.2.1.4 Surface Sealing Coat

Provide nonumbering aliphatic or aromatic moisture-curing polyurethane surface sealer into which has been incorporated a flatting agent. Add flatting agent not more than 24 hours prior to actual application of the coating. Ensure cured coating with flatting agent yields 60-degree specular gloss of 10 to 20 when tested in accordance with ASTM D523.

PART 3 EXECUTION

3.1 PREPARATION

Prior to applying resinous flooring material, inspect substrate and immediately report any unsatisfactory conditions that exist and repair.

3.1.1 Safety Precautions

Prior to application in confined spaces of toppings and coatings containing flammable or toxic properties, institute safety precautions recommended by the manufacturer of the product.

Erect "NO SMOKING" signs, and prohibit smoking or use of spark- or flame-producing devices within 50 feet of any mixing or placing operation involving flammable materials.

Provide personnel required to handle, mix, or apply toppings containing toxic or flammable properties with such items of personal protective equipment and apparel for eye, skin, and respiratory protection as are recommended by the manufacturer of the product. Ensure all personnel are trained in the appropriate use and wearing of personal protection equipment.

3.1.2 Protection of Adjacent Surfaces

In addition to the protection of adjacent surfaces during installation, provide areas used to store and mix materials with a protective covering under the materials. After application of the sealer coats, protect finished flooring during the remainder of the construction period. In areas of expected minimum or moderate traffic, cover floors with 70-pound kraft paper, with strips taped together and edges secured to prevent roll-up. Place vegetable fiberboard, plywood, or other suitable material that does not mar the flooring over the paper to protect areas used as passages by workmen and areas subject to floor damage because of subsequent building operations. Upon completion of construction, remove the protection, clean flooring and, where necessary, repair, reseal, or both, at no additional cost to the Government.

3.1.3 Concrete Subfloor

3.1.3.1 New Concrete Floors

Do not commence installation of floor topping until concrete has cured a minimum of 28 calendar days. Verify concrete floor is straight, properly sloped, and has wooden float type finish. Ensure concrete is moist cured with burlap or polyethylene. Prior to applying the prime coat, clean concrete surface by an approved method.

3.1.3.2 Existing Concrete Floors

Clean existing concrete floors, with hard troweled or contaminated areas in conformance with ASTM D4259, and ensure concrete is free of all paint, sealers, curing agents, oil, grease, moisture, dirt or any other contaminants. Remove any loose or corroded segments of existing concrete and patch with a grouting compound as recommended by the resinous flooring manufacturer. Fill all cracks with an elastomeric jointing compound compatible with the resinous flooring system used.

3.1.4 Mixing Of Materials

Select job mix proportions on the trial batch proportions used to prepare the floor topping samples as submitted and approved.

Use mechanical equipment for mixing of materials in accordance with the manufacturer's instructions.

Use rotating paddle-type masonry mortar mixers for preblending the three sizes and color pigment, if any, of the walnut shell aggregate and addition of the mixed epoxy resin binder. Ensure mixing times are as recommended by the materials supplier(s), provided mixing times result in homogeneous mixtures. Limit quantity of material mixed at one time to that which can be applied and finished within the working life of the mixtures. Verify temperature of materials at the time of mixing are between 65 and 85 degrees F.

3.2 APPLICATION

3.2.1 Areas of Application

Anchor plates set with the top surface at or above the finished epoxy floor level do not require coverage with this flooring material. Extend flooring under equipment, except when the equipment base is indicated to

be flush against the structural floor. Cover and/or mask surfaces not to receive the epoxy floor topping, such as equipment or cabinets installed prior to surface-preparation efforts and adjacent to the flooring installation.

3.2.2 Application of Prime Coat and Troweling

Combine the epoxy binder components A and B in the proportions specified by the manufacturer to form a clear compatible system immediately on mixing. Cure combined components to a clear film possessing a glossy, non-greasy surface at relative humidities less than 80 percent, having the following properties after curing 24 hours at 77 degrees F, followed by 24 hours at 125 degrees F:

Ensure prepared subfloor surface is dry and at a temperature of not less than 60 degrees F when application of the floor topping is initiated. Immediately prior to application of the prime/scratch coat on the prepared surface, remove dust or other loose particles by blowing with compressed air or vacuum cleaned. Use only an air compressor equipped with an efficient oil-water trap to prevent oil contamination or wetting of surface.

Apply a thin roller coat of the epoxy binder specified to the prepared subfloor as a prime coat. As an aid to placing, compacting, and finishing the floor topping, form a scratch coat by sprinkling a minimum quantity of the walnut shell aggregate on the prime coat surface immediately following the prime coat application. Prior to application of the prime/scratch coat, fill cracks in the concrete, and make provisions to keep control or expansion joints open.

Place the floor topping prior to final gelling of the prime/scratch coat. Immediately after the materials are mixed as specified, dump the mixture in the placement area and spread to prolong troweling life. Screed or rough trowel placed materials to the specified thickness and then compact by the use of a smooth roller prior to finish troweling to a nominal thickness of 3/16-inch plus or minus 1/16-inch. Ensure all finished surfaces are free of ridges, hollows (bird-baths), trowel marks, and smoothness varies no more than 1/8-inch when tested with an 8-foot straightedge. Make provisions to maintain the work areas in a relatively dust-free environment during curing of the topping.

3.2.3 Sealer Coat

After the floor topping has set firmly (approximately 6 to 16 hours depending on subfloor temperature) in a relatively dust-free environment, apply two thin coats of the sealer coat, by means of brush, roller, squeegee, or notched trowel to provide a pore-free, easy-to-clean surface. At the time of sealer application, ensure the surface is dust-free. Depending on relative humidity, allow the applied sealer to cure to a tack-free condition in 2 to 4 hours. Do not apply second coat until after the initial coat has cured to a tack-free, hard film. Maintain topping areas in a relatively dust-free environment during curing of the sealer coats.

3.3 FIELD QUALITY CONTROL

3.3.1 Repairing

Remove and replace damaged or unacceptable portions of completed work with

new work to match adjacent surfaces at no additional cost to the Government.

3.4 ADJUSTING AND CLEANING

Clean surfaces of the new work, and adjacent surfaces soiled as a result of the work. Remove all equipment, surplus materials, and rubbish associated with the work from the site.

-- End of Section --

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SECTION 09 90 00

PAINTS AND COATINGS

05/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 0100 (2001; Supplements 2002-2008)
Documentation of the Threshold Limit
Values and Biological Exposure Indices

ASTM INTERNATIONAL (ASTM)

ASTM D235 (2002; R 2012) Mineral Spirits (Petroleum
Spirits) (Hydrocarbon Dry Cleaning Solvent)

ASTM D4214 (2007; R 2015) Standard Test Method for
Evaluating the Degree of Chalking of
Exterior Paint Films

ASTM D4263 (1983; R 2012) Indicating Moisture in
Concrete by the Plastic Sheet Method

ASTM D523 (2014; R 2018) Standard Test Method for
Specular Gloss

ASTM D6386 (2010) Standard Practice for Preparation
of Zinc (Hot-Dip Galvanized) Coated Iron
and Steel Product and Hardware Surfaces
for Painting

ASTM F1869 (2011) Measuring Moisture Vapor Emission
Rate of Concrete Subfloor Using Anhydrous
Calcium Chloride

MASTER PAINTERS INSTITUTE (MPI)

MPI 141 (Oct 2009) Interior High Performance Latex
MPI Gloss Level 5

MPI 154 (Oct 2009) Interior W.B. Light Industrial
Coating, Gloss, MPI Gloss Level 6

MPI 23 (Oct 2009) Surface Tolerant Metal Primer

MPI 4 (Oct 2009) Interior/Exterior Latex Block
Filler

MPI 50 (Oct 2009) Interior Latex Primer Sealer

MPI 54	(Oct 2009) Interior Latex, Semi-Gloss, MPI Gloss Level 5
MPI 77	(Oct 2009) Epoxy Gloss
MPI 79	(Oct 2009) Alkyd Anti-Corrosive Metal Primer
MPI 9	(Oct 2009) Exterior Alkyd, Gloss, MPI Gloss Level 6

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SP-01	(2000) Environmentally Preferable Product Specification for Architectural and Anti-Corrosive Paints
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THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC 7/NACE No.4	(2007; E 2004) Brush-Off Blast Cleaning
SSPC PA 1	(2016) Shop, Field, and Maintenance Coating of Metals
SSPC PA Guide 3	(1982; E 1995) A Guide to Safety in Paint Application
SSPC SP 1	(1982; E 2004) Solvent Cleaning
SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning
SSPC SP 12/NACE No.5	(2002) Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating
SSPC SP 2	(1982; E 2000; E 2004) Hand Tool Cleaning
SSPC SP 3	(2018) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
SSPC VIS 1	(2002; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC VIS 3	(2004) Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning
SSPC VIS 4/NACE VIS 7	(1998; E 2000; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-313	(Rev D; Notice 1) Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000

Air Contaminants

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00
SUBMITTAL PROCEDURES:

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

In keeping with the intent of Executive Order 13101, "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition", products certified by SCS as meeting SCS SP-01 shall be given preferential consideration over registered products. Products that are registered shall be given preferential consideration over products not carrying any EPP designation.

SD-03 Product Data

Materials

Coating

Manufacturer's Technical Data Sheets

SD-04 Samples

Color

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated.

SD-07 Certificates

Applicator's qualifications

SD-08 Manufacturer's Instructions

Application instructions

Mixing

Detailed mixing instructions, minimum and maximum application temperature and humidity, potlife, and curing and drying times between coats.

Manufacturer's Material Safety Data Sheets

Submit manufacturer's Material Safety Data Sheets for coatings, solvents, and other potentially hazardous materials, as defined in FED-STD-313.

SD-10 Operation and Maintenance Data

Coatings:

Preprinted cleaning and maintenance instructions for all coating systems shall be provided.

SD-11 Closeout Submittals

Materials

1.3 APPLICATOR'S QUALIFICATIONS

1.3.1 Contractor Qualification

Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and coating application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on military installations on a minimum of three similar projects within the past three years. List information by individual and include the following:

- a. Name of individual and proposed position for this work.
- b. Information about each previous assignment including:

Position or responsibility

Employer (if other than the Contractor)

Name of facility owner

Mailing address, telephone number, and telex number (if non-US) of facility owner

Name of individual in facility owner's organization who can be contacted as a reference

Location, size and description of structure

Dates work was carried out

Description of work carried out on structure

1.4 REGULATORY REQUIREMENTS

1.4.1 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.4.2 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.4.3 Asbestos Content

Materials shall not contain asbestos.

1.4.4 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.4.5 Silica

Abrasive blast media shall not contain free crystalline silica.

1.4.6 Human Carcinogens

Materials shall not contain ACGIH 0100 confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.5 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F.

1.6 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.6.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA Guide 3.

1.6.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
- b. 29 CFR 1910.1000.
- c. ACGIH 0100, threshold limit values.

1.7 ENVIRONMENTAL CONDITIONS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation.

1.7.1 Coatings

Do not apply coating when air or substrate conditions are:

- a. Less than 5 degrees F above dew point;
- b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

1.8 COLOR SELECTION

Colors of finish coats shall be as indicated or specified. Where not indicated or specified, colors shall be selected by the Contracting Officer. Manufacturers' names and color identification are used for the purpose of color identification only. Named products are acceptable for use only if they conform to specified requirements. Products of other manufacturers are acceptable if the colors approximate colors indicated and the product conforms to specified requirements.

Tint each coat progressively darker to enable confirmation of the number of coats.

Color, texture, and pattern of wall coating systems shall be as selected.

1.9 LOCATION AND SURFACE TYPE TO BE PAINTED

1.9.1 Painting Included

Where a space or surface is indicated to be painted, include the following unless indicated otherwise.

- a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.
- b. New factory finished surfaces that require identification or color coding and factory finished surfaces that are damaged during performance of the work.
- c. Existing coated surfaces that are damaged during performance of the work.

1.9.1.1 Exterior Painting

Includes new surfaces of the building and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

1.9.1.2 Interior Painting

Includes new surfaces existing coated surfaces of the building and appurtenances as indicated and existing coated surfaces made bare by cleaning operations. Where a space or surface is indicated to be painted, include the following items, unless indicated otherwise.

- a. Exposed columns, girders, beams, joists, and metal deck; and
- b. Other contiguous surfaces.

1.9.2 Painting Excluded

Do not paint the following unless indicated otherwise.

- a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.
- b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.
- c. Steel to be embedded in concrete.
- d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.
- e. Hardware, fittings, and other factory finished items.

1.9.3 Mechanical and Electrical Painting

Includes field coating of interior and exterior new surfaces.

- a. Where a space or surface is indicated to be painted, include the following items unless indicated otherwise.
 - (1) Exposed piping, conduit, and ductwork;
 - (2) Supports, hangers, air grilles, and registers;
 - (3) Miscellaneous metalwork and insulation coverings.

1.9.4 Definitions and Abbreviations

1.9.4.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

1.9.4.2 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (metals, plastics, wood, paper, leather, cloth, etc.). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendaring, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

1.9.4.3 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.9.4.4 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five (5) levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

1.9.4.5 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

1.9.4.6 EXT

MPI short term designation for an exterior coating system.

1.9.4.7 INT

MPI short term designation for an interior coating system.

1.9.4.8 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

1.9.4.9 mil / mils

The English measurement for 0.001 in or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

1.9.4.10 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

1.9.4.11 MPI Gloss Levels

MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

Gloss Level	Description	Units at 60 degrees	Units at 85 degrees
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with ASTM D523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

1.9.4.12 MPI System Number

The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.

1.9.4.13 Paint

See Coating definition.

1.9.4.14 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.9.4.15 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents. Comply with applicable regulations regarding toxic and hazardous materials.

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, disintegrated coatings, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and

compatible with the coating specified for the adjacent areas.

3.2.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

- a. Test existing finishes for lead before sanding, scraping, or removing. If lead is present, refer to paragraph Toxic Materials.
- b. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, ASTM D235. Allow surface to dry. Wiping shall immediately precede the application of the first coat of any coating, unless specified otherwise.
- c. Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.
- d. The requirements specified are minimum. Comply also with the application instructions of the paint manufacturer.
- e. Previously painted surfaces shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter.
- f. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed.
- g. Chalk shall be removed so that when tested in accordance with ASTM D4214, the chalk resistance rating is no less than 8.
- h. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas.
- i. Edges of chipped paint shall be feather edged and sanded smooth.
- j. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting.
- k. New, proposed coatings shall be compatible with existing coatings.

3.3 PREPARATION OF METAL SURFACES

3.3.1 Existing and New Ferrous Surfaces

- a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2, SSPC SP 3,, or SSPC SP 10/NACE No. 2. Brush-off blast remaining surface in accordance with SSPC 7/NACE No.4; Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.
- b. Surfaces With More Than 20 Percent Rust, Mill Scale, and Other Foreign

Substances: Clean entire surface in accordance with SSPC SP 6/NACE No.3/SSPC SP 12/NACE No.5 WJ-3.

3.3.2 Final Ferrous Surface Condition:

For tool cleaned surfaces, the requirements are stated in SSPC SP 2 and SSPC SP 3. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 3.

For abrasive blast cleaned surfaces, the requirements are stated in SSPC 7/NACE No.4, SSPC SP 6/NACE No.3, and SSPC SP 10/NACE No. 2. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 1.

For waterjet cleaned surfaces, the requirements are stated in SSPC SP 12/NACE No.5. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 4/NACE VIS 7.

3.3.3 Galvanized Surfaces

- a. New or Existing Galvanized Surfaces With Only Dirt and Zinc Oxidation Products: Clean with solvent, steam, or non-alkaline detergent solution in accordance with SSPC SP 1. If the galvanized metal has been passivated or stabilized, the coating shall be completely removed by brush-off abrasive blast. New galvanized steel to be coated shall not be "passivated" or "stabilized" If the absence of hexavalent stain inhibitors is not documented, test as described in ASTM D6386, Appendix X2, and remove by one of the methods described therein.

3.3.4 Non-Ferrous Metallic Surfaces

Aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces.

Surface Cleaning: Solvent clean in accordance with SSPC SP 1 and wash with mild non-alkaline detergent to remove dirt and water soluble contaminants.

3.4 PREPARATION OF CONCRETE AND CEMENTITIOUS SURFACE

3.4.1 Concrete and Masonry

- a. Curing: Concrete, stucco and masonry surfaces shall be allowed to cure at least 30 days before painting, except concrete slab on grade, which shall be allowed to cure 90 days before painting.
- b. Surface Cleaning: Remove the following deleterious substances.
 - (1) Dirt, Chalking, Grease, and Oil: Wash new and existing uncoated surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, and 4 quarts of warm water. Then rinse thoroughly with fresh water. Wash existing coated surfaces with a suitable detergent and rinse thoroughly. For large areas, water blasting may be used.
 - (2) Fungus and Mold: Wash , existing coated, surfaces with a solution composed of 1/2 cup trisodium phosphate, 1/4 cup household detergent, 1 quart 5 percent sodium hypochlorite solution and 3 quarts of warm water. Rinse thoroughly with fresh

water.

(3) Paint and Loose Particles: Remove by wire brushing.

(4) Efflorescence: Remove by scraping or wire brushing followed by washing with a 5 to 10 percent by weight aqueous solution of hydrochloric (muriatic) acid. Do not allow acid to remain on the surface for more than five minutes before rinsing with fresh water. Do not acid clean more than 4 square feet of surface, per workman, at one time.

c. Cosmetic Repair of Minor Defects: Repair or fill mortar joints and minor defects, including but not limited to spalls, in accordance with manufacturer's recommendations and prior to coating application.

d. Allowable Moisture Content: Latex coatings may be applied to damp surfaces, but not to surfaces with droplets of water. Do not apply epoxies to damp vertical surfaces as determined by ASTM D4263 or horizontal surfaces that exceed 3 lbs of moisture per 1000 square feet in 24 hours as determined by ASTM F1869. In all cases follow manufacturers recommendations. Allow surfaces to cure a minimum of 30 days before painting.

3.5 APPLICATION

3.5.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats.

a. Drying Time: Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat

adhesion problems. Provide each coat in specified condition to receive next coat.

- b. Primers, and Intermediate Coats: Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.
- c. Finished Surfaces: Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.
- d. Thermosetting Paints: Topcoats over thermosetting paints (epoxies and urethanes) should be applied within the overcoating window recommended by the manufacturer.
- e. Floors: For nonslip surfacing on level floors, as the intermediate coat is applied, cover wet surface completely with almandite garnet, Grit No. 36, with maximum passing U.S. Standard Sieve No. 40 less than 0.5 percent. When the coating is dry, use a soft bristle broom to sweep up excess grit, which may be reused, and vacuum up remaining residue before application of the topcoat.

3.5.2 Mixing and Thinning of Paints

Reduce paints to proper consistency by adding fresh paint, except when thinning is mandatory to suit surface, temperature, weather conditions, application methods, or for the type of paint being used. Obtain written permission from the Contracting Officer to use thinners. The written permission shall include quantities and types of thinners to use.

When thinning is allowed, paints shall be thinned immediately prior to application with not more than quantity recommended by paint manufacturer of suitable thinner per . The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

3.5.3 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

3.5.4 Coating Systems

- a. Systems by Substrates: Apply coatings that conform to the respective specifications listed in the following Tables:

Table

Division 5. Exterior Metal, Ferrous and Non-Ferrous Paint Table

Division 4. Interior Concrete Masonry Units Paint Table

Table

Division 5. Interior Metal, Ferrous and Non-Ferrous Paint Table

Division 9: Interior Plaster, Gypsum Board, Textured Surfaces
Paint Table

- b. Minimum Dry Film Thickness (DFT): Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.
- c. Coatings for Surfaces Not Specified Otherwise: Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.
- d. Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces: Coat surfaces with the following:
 - (1) One coat of primer.
 - (2) One coat of undercoat or intermediate coat.
 - (3) One topcoat to match adjacent surfaces.
- e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.6 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

- a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.
- b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.
- c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.

3.7 COATING SYSTEMS FOR CONCRETE AND CEMENTITIOUS SUBSTRATES

Apply coatings of Tables in Division 3, 4 and 9 for Exterior and Interior.

3.8 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.9 PAINT TABLES

3.9.1 EXTERIOR PAINT TABLES

DIVISION 5: EXTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE
STEEL / FERROUS SURFACES

A. New Steel that has been hand or power tool cleaned to SSPC SP 2 or SSPC SP 3

1. New; MPI EXT 5.1Q-G6 (Gloss) / Existing; MPI REX 5.1D-G6
Primer: Intermediate: Topcoat:
MPI 23 MPI 9 MPI 9
System DFT: 5.25 mils

3.9.2 INTERIOR PAINT TABLES

DIVISION 4: INTERIOR CONCRETE MASONRY UNITS PAINT TABLE

A. New and uncoated Existing Concrete masonry:

1. MPI INT 4.2D-G5 (Semigloss)
Filler Primer: Intermediate: Topcoat:
MPI 4 N/A MPI 141 MPI 141
System DFT: 11 mils

Fill all holes in masonry surface

B. Existing, previously painted Concrete masonry:

1. MPI RIN 4.2K-G5 (Semigloss)
Spot Primer: Intermediate: Topcoat:
MPI 50 MPI 141 MPI 141
System DFT: 4.5 mils

C. New and uncoated Existing Concrete masonry units in toilets, laundry areas, shower areas, and other high humidity areas unless otherwise specified:

1. MPI INT 4.2K-G6(Gloss)
Filler: Primer: Intermediate: Topcoat:
MPI 4 N/A MPI 154 MPI 154
System DFT: 11 mils

Fill all holes in masonry surface

D. Existing, previously painted, concrete masonry units in toilets, laundry areas, shower areas, and other high humidity areas unless otherwise specified:

1. MPI RIN 4.2G-G6(Gloss)
Spot Primer: Intermediate: Topcoat:
MPI 154 MPI 154 MPI 154
System DFT: 4.5 mils

DIVISION 5: INTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE

INTERIOR STEEL / FERROUS SURFACES

A. Metal, Mechanical, Electrical, Surfaces adjacent to painted surfaces (Match surrounding finish), exposed copper piping, and miscellaneous metal items not otherwise specified except floors, hot metal surfaces, and new prefinished equipment:

1. MPI INT 5.1R-G5 (Semigloss)
Primer: Intermediate: Topcoat:
MPI 79 MPI 141 MPI 141
System DFT: 5 mils

DIVISION 9: INTERIOR PLASTER, GYPSUM BOARD, TEXTURED SURFACES PAINT TABLE

A. New Wallboard:

1. New; MPI INT 9.2A-G5 (Semigloss) / Existing; RIN 9.2A-G5 (Semigloss)
Primer: Intermediate: Topcoat:
MPI 50 MPI 54 MPI 54
System DFT: 4 mils

B. New Wallboard in toilets:

1. Epoxy
New; MPI INT 9.2E-G6 (Gloss) / Existing; MPI RIN 9.2D-G6 (Gloss)
Primer: Intermediate: Topcoat:
MPI 50 MPI 77 MPI 77
System DFT: 4 mils

-- End of Section --

SECTION 10 14 00.20

INTERIOR SIGNAGE

8/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

36 CFR 1191

Americans with Disabilities Act (ADA)
Accessibility Guidelines for Buildings and
Facilities; Architectural Barriers Act
(ABA) Accessibility Guidelines

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-03 Product Data

Installation

Warranty

SD-04 Samples

Interior Signage;

Approved Manufacturer's Instructions

Protection and Cleaning

1.3 QUALITY ASSURANCE

1.3.1 Samples

Submit interior signage samples of each of the following sign types showing typical quality, workmanship and color: Directional sign, Standard Room sign, Changeable message strip sign, and as shown on construction documents. The samples may be installed in the work, provided each sample is identified and location recorded.

1.3.2 Detail Drawings

Submit detail drawings showing elevations of each type of sign, dimensions, details and methods of mounting or anchoring, mounting height,

shape and thickness of materials, and details of construction. Include a schedule showing the location, each sign type, and message.

1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be packaged to prevent damage and deterioration during shipment, handling, storage and installation. Product shall be delivered to the jobsite in manufacturer's original packaging and stored in a clean, dry area in accordance with manufacturer's instructions.

1.5 WARRANTY

Warrant the interior signage for a period of 2 years against defective workmanship and material. Warranties shall be signed by the authorized representative of the manufacturer. Submit warranty accompanied by the document authenticating the signer as an authorized representative of the guarantor. Guarantee that the signage products and the installation are free from any defects in material and workmanship from the date of delivery.

1.6 ROOM NUMBERING SCHEME

Actual room numbering scheme may vary from those shown in the drawings. After award the Government will provide the Contractor with the scheme for room numbering for the signage.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Signs, plaques, directories, and dimensional letters shall be the standard product of a manufacturer regularly engaged in the manufacture of such products that essentially duplicate signs that have been in satisfactory use at least 2 years prior to bid opening. Obtain signage from a single manufacturer with edges and corners of finished letterforms and graphics true and clean.

2.2 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM - STANDARD 1 STD-1

2.2.1 Materials

- a. Commercial grade sign materials such as Acrylic, or ABS.
- b. UV resistant: All must be UV resistant.
- c. VOC: Low index for all components.
- d. Back plate: 0.125" (1/8") min.
- e. Spacer: Min .031 thick, Industry standard w/adhesive.
- f. Front Plate: 0.031" (1/32") min. w/adhesive for routed graphics.
- g. Window: Industry standard transparent plastic.
- h. Window Inserts: Paper Inserts to be provided by End User.
- i. Sliding Inserts: (Sliders) Industry standard. Back plate with front plate w/adhesive for routed text/graphics. Sliding slider moves horizontally with finger.

2.2.2 Graphic Process

- a. ADA, Applied Tactile Graphics and Text: Computer Aided Router cut domed/beveled characters 1/32" thick, bonded to substrate with industrial grade adhesive or bonding process.

- b. ADA Raster Braille: Copy Raster method with 0.060" diameter clear acrylic beads set into pre-drilled holes, resulting in .032" Braille text.
- c. Direct Print Copy: Cured inks digitally applied directly to the substrate surface or sub-surface.
- d. Laser Print Copy: Insert provided by end user.

2.2.3 Typography

- a. Case: Upper/Lower Case unless specified or requiring ADA regulations.
- b. Letterform: Helvetica Regular.
- c. Marine Corps Emblem: Eagle Globe and Anchor. Refer to drawings for applicability.
- d. Letter spacing and in-between line spacing: Industry Standard.
- e. Arrows, symbols and logo art: Industry standard for style, sizes, and spacing unless shown otherwise.
- f. Braille: Grade 2. Dimension measurements shall comply with the ADAAG 703.3.1

2.2.4 Colors

- a. Letters and Numbers: White.
- b. Braille: ADA compliant: Clear.
- c. Arrows, symbols and logo art (Except MC Emblem): White.
- d. Background: Black.
- e. Marine Corps Emblem: Full colors as shown in other documents or as directed by the Construction Manager and approved shop drawings submittal.

2.2.5 Miscellaneous

- a. Fastening: Double sided tape for initial installation. Industrial grade adhesive for permanent installation. Industrial Grade Adhesive: Provide low VOC products. Comply with ASTM C-557.
- b. Corners: Squared.
- c. Conditioned Spaces: Provide interior or exterior grade.
- d. Non-Conditioned Spaces: Provide exterior grade only.
- e. Stair signage: Shall be considered non-conditioned spaces. Provide signs on stairs serving three or more stories with special signage within the enclosure at each floor landing conforming to NFPA 101. Indicate the floor level, the terminus of the top and bottom of the stair enclosure, and the identification of the stair enclosure. State the floor level of, and the direction to, exit discharge. Locate the signage inside the enclosure in a position that is visible when the door is in the open or closed position and install in conformance with 36 CFR 1191. The floor level designation shall also be tactile in accordance with ICC A117.1 COMM.
- f. Signage in conditioned spaces but open to the exterior (for example: garages, storage spaces, warehouses, repair shops, etc.): Provide exterior grade only.
- g. Holes for bolts and screws shall be drilled or punched. Drilling and punching shall produce clean, true lines and surfaces. Exposed surfaces

of work shall have a smooth finish and exposed riveting shall be flush. Fastenings shall be concealed where practicable.

h. Where dissimilar metals are in contact, the surfaces will be protected to prevent galvanic or corrosive action.

2.3 ROOM IDENTIFICATION/DIRECTIONAL SIGNAGE SYSTEM - STANDARD 1 STD-2

2.3.1 Materials

a. Metal frame: Extruded Aluminum 6063-TS aluminum. Brush aluminum with clear anodized finish.

b. All other components same as STD1.

2.3.2 Graphic Process

a. Same as STD1.

2.3.3 Typography

a. Same as STD1.

2.3.4 Colors

a. Same as STD1.

2.3.5 Miscellaneous

a. Same as STD1 except fastening.

b. Fastening: Screws and anchors fastening for permanent installation only. Screws to be treated or of same metal as not to cause corrosion. Provide a minimum of four (4) screws per sign. Provide a minimum of six (6) screw per signs 12" or larger. Screw size and shield type as recommended by manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

Signs shall be installed plumb and true and in accordance with approved manufacturer's instructions at locations shown on the detail drawings. Submit 3 copies of operating instructions outlining the step-by-step procedures required for system operation. The instructions shall include simplified diagrams for the system as installed, the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Each set shall be permanently bound and shall have a hard cover. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS", name and location of the facility, name of the Contractor, and contract number. Mounting height and mounting location shall conform to 36 CFR 1191. Required blocking shall be installed. Signs on doors or other surfaces shall not be installed until finishes on such surfaces have been installed. Signs installed on glass surfaces shall be installed with matching blank back-up plates in accordance with manufacturer's instructions.

3.1.1 Anchorage

Anchorage shall be in accordance with approved manufacturer's instructions. Anchorage not otherwise specified or shown shall include slotted inserts, expansion shields, and powder-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine carriage bolts for steel; lag bolts and screws for wood. Exposed anchor and fastener materials shall be compatible with metal to which applied and shall have matching color and finish.

- a. Signs mounted to painted gypsum board surfaces shall be removable for painting maintenance.
- b. Mount signs mounted to lay-in ceiling grids with clip connections to ceiling tees.

3.1.2 Protection and Cleaning

Protect the work against damage during construction. Hardware and electrical equipment shall be adjusted for proper operation. Glass, frames, and other sign surfaces shall be cleaned at completion of sign installation in accordance with the manufacturer's approved instructions. Submit three copies of maintenance instructions listing routine procedures, repairs, and guides.

-- End of Section --

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SECTION 10 28 13

TOILET ACCESSORIES

08/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1036 (2016) Standard Specification for Flat Glass

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Finishes

Accessory Items

SD-04 Samples

Finishes

Accessory Items

SD-07 Certificates

Accessory Items

SD-10 Operation and Maintenance Data

Electric Hand Dryer

1.3 DELIVERY, STORAGE, AND HANDLING

Wrap toilet accessories for shipment and storage, then deliver to the jobsite in manufacturer's original packaging, and store in a clean, dry area protected from construction damage and vandalism.

1.4 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

Provide toilet accessories where indicated in accordance with paragraph SCHEDULE. Provide each accessory item complete with the necessary mounting plates of sturdy construction with corrosion resistant surface.

2.1.1 Anchors and Fasteners

Provide anchors and fasteners capable of developing a restraining force commensurate with the strength of the accessory to be mounted and suited for use with the supporting construction.

2.1.2 Finishes

Except where noted otherwise, provide the following finishes on metal:

Metal	Finish
Stainless steel	No. 4 satin finish
Carbon steel, copper alloy, and brass	Chromium plated, bright

2.2 ACCESSORY ITEMS

Conform to the requirements for accessory items specified below. Submit fasteners proposed for use for each type of wall construction, mounting, operation, and cleaning instructions and one sample of each other accessory proposed for use. Incorporate approved samples into the finished work, provided they are identified and their locations noted. Submit certificate for each type of accessory specified, attesting that the items meet the specified requirements.

2.2.1 Grab Bar (GB)

Provide an 18 gauge, 1-1/4 inch grab bar OD Type 304 stainless steel. Provide form and length for grab bar as indicated. Provide concealed mounting flange. Provide grab with satin finish. Furnish installed bars capable of withstanding a 500 pound vertical load without coming loose from the fastenings and without obvious permanent deformation. Allow 1-1/2 inch space between wall and grab bar.

2.2.2 Mirrors, Glass (MG)

Provide Type I transparent flat type, Class 1-clear glass for mirrors. Glazing Quality ql 1/4 inch thick conforming to ASTM C1036. Coat glass on one surface with silver coating, copper protective coating, and mirror backing paint. Provide highly adhesive pure silver coating of a thickness which provides reflectivity of 83 percent or more of incident light when viewed through 1/4 inch thick glass, free of pinholes or other defects. Provide copper protective coating with pure bright reflective copper, homogeneous without sludge, pinholes or other defects, of proper thickness to prevent "adhesion pull" by mirror backing paint. Provide mirror backing paint with two coats of special scratch and abrasion-resistant paint and baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

Provide stainless steel frame around mirror.

2.2.3 Combination Paper Towel Dispenser/Waste Receptacle (PTDWR)

Provide semi-recessed dispenser/receptacle with a capacity of 400 sheets of C-fold, single-fold, or quarter-fold towel. Design waste receptacle to be locked in unit and removable for service. Provide tumbler key locking mechanism. Provide waste receptacle capacity of 12 gallons. Fabricate a minimum 0.03 inch stainless steel welded construction unit with all exposed surfaces having a satin finish. Provide waste receptacle that accepts reusable liner standard for unit manufacturer.

2.2.4 Shower Curtain (SC)

Provide shower curtain, size to suit conditions. Provide anti-bacterial nylon/vinyl fabric curtain.

2.2.5 Shower Curtain Rods (SCR)

Provide Type 304 stainless steel shower curtain rods 1-1/4 inch OD by 0.049 inch minimum straight to meet installation conditions.

2.2.6 Soap Dispenser (SD)

Provide soap dispenser surface mounted, liquid type consisting of a vertical Type 304 stainless steel tank with holding capacity of 40 fluid ounces with a corrosion-resistant all-purpose valve that dispenses liquid soaps, lotions, detergents and antiseptic soaps.

2.2.7 Shelf, Metal, Light Duty (SMLD)

Support light duty metal shelf between brackets or on brackets. Purpose of brackets is to prevent lateral movement of the shelf. Furnish 18 inch long shelf. Provide stainless steel shelf and brackets.

2.2.8 Towel Bar (TB)

Provide stainless steel towel bar with a minimum thickness of 0.015 inch. Provide minimum 3/4 inch diameter bar, or 5/8 inch square. Provide satin finish.

2.2.9 Toilet Tissue Dispenser (TTD)

Furnish Type II - surface mounted toilet tissue holder with two rolls of standard tissue mounted horizontally. Provide stainless steel, satin finish cabinet.

2.2.10 Electric Hand Dryer (EHD)

Provide wall mount and electric hand dryer designed to operate at 110/125 volts, 60 cycle, single phase alternating current with a heating element core rating of a maximum 2100 watts. Provide dryer housing of single piece construction and of white porcelain enamel. Submit 4 complete copies of maintenance instructions listing routine maintenance procedures and possible breakdowns. Include repair instructions for simplified wiring and control diagrams and other information necessary for unit maintenance.

2.2.11 Folding Shower Seat (FSS)

Folding shower seat must have a frame constructed of type-304 satin finish stainless steel, 16-gauge, 1-1/4 inch square tubing, and 18-gauge, 1 inch diameter seamless tubing. Seat must be constructed of one-piece, 1/2 inch thick water-resistant, ivory colored solid phenolic with black edge. Clearance between back of shower seat and wall must be 1-1/2 inches to comply with ADA Accessibility Guidelines (ADAAG). Seat supports must not come into contact with the floor. Seat must be able to lock in upright position when not in use. Seat must be attached to wall by two 3 inch diameter mounting flanges constructed of type-304, 3/16 inch thick stainless steel with satin finish. Manufacturer's service and parts manual must be provided to building owner/manager upon completion of project.

2.2.12 Mop and Broom Holder (MH)

Stainless steel with grip jaw cam mechanism securing 5 mop or broom handles. Also includes hooks and storage shelf.

PART 3 EXECUTION

3.1 INSTALLATION

Do not install items that show visual evidence of biological growth. Provide the same finish for the surfaces of fastening devices exposed after installation as the attached accessory. Provide oval exposed screw heads. Install accessories at the location and height indicated. Protect exposed surfaces of accessories with strippable plastic or by other means until the installation is accepted. After acceptance of accessories, remove and dispose of strippable plastic protection. Coordinate accessory manufacturer's mounting details with other trades as their work progresses. Use sealants for brackets, plates, anchoring devices and similar items in showers (a silicone or polysulfide sealant) as they are set to provide a watertight installation. After installation, thoroughly clean exposed surfaces and restore damaged work to its original condition or replace with new work.

3.1.1 Recessed Accessories

Fasten accessories with wood screws to studs, blocking or rough frame in wood construction. Set anchors in mortar in masonry construction. Fasten to metal studs or framing with sheet metal screws in metal construction.

3.1.2 Surface Mounted Accessories

Mount on concealed backplates, unless specified otherwise. Conceal fasteners on accessories without backplates. Install accessories with sheet metal screws or wood screws in lead-lined braided jute, PTFE or neoprene sleeves, or lead expansion shields, or with toggle bolts or other approved fasteners as required by the construction. Install backplates in the same manner, or provide with lugs or anchors set in mortar, as required by the construction. Fasten accessories mounted on gypsum board and plaster walls without solid backing into the metal or wood studs or to solid wood blocking secured between wood studs, or to metal backplates secured to metal studs.

3.2 CLEANING

Clean material in accordance with manufacturer's recommendations. Do not use alkaline or abrasive agents. Take precautions to avoid scratching or marring exposed surfaces.

3.3 SCHEDULE

See drawings for Accessory Schedule.

-- End of Section --

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SECTION 11 24 24

ROOFTOP FALL PROTECTION ANCHORAGE SYSTEM

10/20

PART 1 GENERAL

1.1 SUMMARY

a. Section Includes:

(1) Fall protection systems and related appurtenances to protect the workers walking on the rooftop.

(2) Furnish and install all cables, intermediate brackets, end terminations, support posts, attachment brackets and user equipment as required to provide a complete fall protection system that provides coverage for the rooftop as shown on the plans.

(3) Prepare training program in the use, care and maintenance of the horizontal lifeline fall protection system.

b. Related Sections:

(1) Division 01 Specification Sections apply to the work of this Section

1.2 SYSTEM DESCRIPTION/REQUIREMENTS

a. Design a fall protection system to allow safe work on the rooftop as per Occupational Health and Safety regulations. The fall protection system shall allow the user to walk uninterrupted the entire length of the system without having to unhook from the system to pass through intermediate support points and provide secure anchorage to arrest a fall by the user. All essential components shall be included as part of the above referenced system, though not specifically stated in the following Specifications, so as to provide a complete and fully operational system.

b. System components to meet the requirements of this specifications section 2.0.

c. Design the horizontal lifeline systems to accommodate 3 users at one time.

d. All components of the horizontal lifeline system shall be designed to maintain a factor of safety of at least 2, relative to the dynamic forces generated by the falling workers.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Experience Information

SD-02 Shop Drawings

Fall Protection System

Shop Drawings: For fabrication and erection. Include plans, member profiles, sizes, elevations and details for anchorages and

connections. Show complete layout of the system in plan and elevation.

SD-03 Product Data

Product Data

System Components

Fasteners

SD-10 Operation and Maintenance Data

Operations and Maintenance Manuals

SD-11 Closeout Submittals

Installation Certificate

1.4 QUALITY ASSURANCE

a. All equipment called for under this Section shall be supplied by a single source. The equipment supplier shall, in addition to the installer, assume the responsibility for proper and complete installation.

b. Design of the horizontal lifeline system shall be performed by an Engineer with experience in designing not less than 5 installations of similar size and scope. Engineer shall maintain and Errors and Omissions insurance policy with limits of not less than \$1 million per occurrence, \$2 million aggregate.

c. Submit Experience Information: Including type of fall protection system, location and date of installation and Owner's name and address.

d. No equipment shall be supplied by any manufacturer not regularly engaged in the manufacturing and production of fall protection systems. The manufacturer must have installed and had in satisfactory use for a period of not less than two (2) years a minimum of ten (10) installations of the size and type comparable to the unit specified. Manufacturer shall maintain Commercial General and Excess Liability insurance policy for Products and Completed Operations with limits of not less than \$2 million per occurrence, \$10 million aggregate.

e. Submit product data prior to installation.

1.5 DELIVERY, STORAGE, AND HANDLING

a. Deliver materials in manufacturer's original, unopened protective packaging.

b. Store materials in original protective packaging. Prevent soiling, physical damage or wetting.

1.6 PROJECT CONDITIONS

Field Measurements: Perform prior to preparation of Shop Drawings and fabrication drawings to ensure required fit and dimensions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

Fall Protection System Basis of design: Xenon Fall Arrest System as manufactured by Honeywell Safety Products USA, Inc.

All products shall be engineered and installed by an approved authorized manufacturer's representative.

Other acceptable manufacturers, subject to providing systems in conformance with these specifications, include but are not limited to:

Guardian Fall Protection Flexible Lifeline System Diversified Fall Protection Peak Fall Protection

2.2 MATERIALS

a. All materials shall be new, and the complete fall protection system, except for accessory equipment, shall be essentially the product of one manufacturer regularly engaged in the production of such equipment.

b. Stainless Steel Plates and Bars: ASTM A666, Type 304 or 316.

c. Structural Steel: ASTM A36 and ASTM A500.

d. Fasteners

(1) The Fall Protection System shall be attached to the supporting structure with appropriate fasteners. The fasteners shall be designed to support a load on the fall protection system of 2 times the maximum design load without failure.

(2) Where through-bolting is not possible, practical or desirable, the listed fastening systems are acceptable:

- (a) Hilti Fastening Systems
- (b) Lindapter Connection Systems
- (c) Approved Others

2.3 FABRICATION

General

a. System components shall be of the same material unless otherwise indicated.

b. Exposed work shall be true to line and level with accurate angles, surfaces and with straight square edges.

c. Coordinate anchorage system with supporting structure. Fabricate and locate anchoring devices as recommended by manufacturer to provide adequate support for intended use.

2.4 FALL ARREST SYSTEM COMPONENTS

a. System to consist of:

(1) The Fall Arrest System shall consist of a stainless steel

safety cable attached to the structure with anchors at ends and intermediates points as required to meet the performance requirements. The cable shall be continuous or shall have swaged splices, which allow the user to pass without unhooking from the system.

(2) The cable shall have stainless steel swaged end, swaged to the cable, at each end of the cable.

(3) A Multifunction Absorber will be provided at one or both ends, if required by system analysis. Provide steel end brackets or Dee Anchors to attach the cable to the structure.

(4) Support cable (not to exceed 35 foot maximum intervals) with stainless steel Universal Intermediate Brackets designed to allow the user to pass without unhooking from the cable.

(5) Provide 3 Automatic Pass-Through Shuttle(s). The Shuttle shall be able to be hooked and unhooked at any point on the cable and be able to pass the Universal Intermediate Brackets and splices without having to be detached. The Shuttle shall have a double locking mechanism that is designed for opening with one hand.

b. Lanyards: Provide 3 tear out shock absorbing lanyard(s) or self-retracting lanyard(s), having a maximum arresting force of 900 lbs., with double locking snap assemblies at each end meeting OSHA regulations and ANSI A10.32 and as recommended by the fall protection system supplier.

c. Support Harness(es): Provide 3 nylon or polyester full body harness(es) with back "D" ring meeting OSHA regulations and ANSI A10.32 and as recommended by the fall protection system supplier.

PART 3 EXECUTION

3.1 INSTALLATION

a. Install in accordance with approved shop drawings and manufacturer's instructions.

b. Examine the existing support structure and the existing conditions under which work is to be installed. Proceed with installation only after any unsatisfactory conditions have been corrected.

c. Fall protection system shall be installed under the direction of manufacturer's authorized trained personnel.

d. Install anchorages and fasteners in accordance with manufacturer's recommendations to obtain the allowable working loads published in the product literature and in accordance with this specification. Do not load or stress fall protection system until all materials and fasteners are properly installed and ready for service.

3.2 TRAINING

a. Train owner's designated rigging employees in the proper use of the fall protection system.

- b. Train owner's designated rigging employees in the proper techniques of rescue and retrieval of fallen personnel.
- c. Submit Operations and Maintenance Manual: Include 3 copies of Operations and Maintenance manuals, indicating parts list and maintenance requirements for all equipment, indicating proper procedures and equipment for safe operations of the system.

3.3 FIELD QUALITY CONTROL

- a. After the safety system is installed and properly tensioned, the safety system manufacturer's approved authorized representative shall inspect and operate the system and shall make all final adjustments for proper operation.
- b. After the system has been placed into operation, the manufacturer's authorized representative shall issue a certificate attesting to the system's design and installation.
- c. Submit Installation Certificate: Indicating completion and certification of the installed system.

3.4 CLEANING

- a. Remove all loose materials, crating and packing material from premises.

-- End of Section --

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SECTION 12 24 13

ROLLER WINDOW SHADES

08/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/WCMA A100.1 (2018) American National Standard for
Safety of Window Covering Products

ASTM INTERNATIONAL (ASTM)

ASTM G21 (2015) Standard Practice for Determining
Resistance of Synthetic Polymeric
Materials to Fungi

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 701 (2019) Standard Methods of Fire Tests for
Flame Propagation of Textiles and Films

UNDERWRITERS LABORATORIES (UL)

UL 325 (2017; Reprint Feb 2020) UL Standard for
Safety Door, Drapery, Gate, Louver, and
Window Operators and Systems

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL
PROCEDURES

SD-02 Shop Drawings

Detailed Drawings

Location Schedule

SD-03 Product Data

Window Shades

SD-04 Samples

Window Shades

SD-06 Test Reports

Flammability Requirements

SD-07 Certificates

Qualifications

SD-10 Operation and Maintenance Data

Window Shades, Data Package 1

SD-11 Closeout Submittals

Submit Data Package 1 for roller window shades in accordance with Section 01 78 23 OPERATIONS AND MAINTENANCE DATA.

1.3 QUALITY ASSURANCE

1.3.1 Qualifications

1.3.1.1 Installer's Qualifications

Installer trained and certified by the manufacturer with a minimum of ten years of experience in installing products comparable to those specified in this section.

1.3.2 Flammability Requirements

Passes in accordance with NFPA 701 small and large-scale vertical burn. Materials tested are identical to products proposed for use.

1.3.3 Electrical Requirements

NFPA Article 100 listed and labeled in accordance with UL 325 or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components is not acceptable in lieu of system testing.

1.3.4 Anti-Microbial Requirements

'No Growth' per ASTM G21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver components to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated and free from dust, water, or other contaminants and has easy access for inspection and handling. Store materials flat in a clean dry area with temperature maintained above 50 degrees F. Do not open containers until needed for installation unless verification inspection is required. Handle and store shades in accordance with manufacturer's recommendations.

1.5 WARRANTY

Provide manufacturer's warranty to repair or replace defective materials

and workmanship for a period of 10 years from date of final acceptance of the work.

PART 2 PRODUCTS

2.1 WINDOW SHADES

Submit drawings showing plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to work. Submit a location schedule showing location, size and quantity of shades. Include the use of same room designations as indicated on the drawings.

Provide product data composed of catalog cuts, brochures, and operating and maintenance instructions on each product to be used. Include styles, profiles and features.

Furnish samples of each type and color of roller shade fabric and roller shade channel. Provide shade material minimum 6 by 6 inches in size. Mark face of material to indicate interior faces.

Mock up: Install shade in area designated by Contracting Officer. Do not proceed with remaining work until the Contracting Officer approves workmanship and operation. Rework mock up as required to produce acceptable work. The approved shade can be used in the installation.

Submit fire resistance data, flame spread and smoke contribution data.

Provide roller tube that operates smoothly and of sufficient diameter and thickness to prevent excessive deflection. Provide brackets that are appropriate for outside mount. Provide shade cloth meeting the performance described in NFPA 701, small scale test. Treat steel features for corrosion resistance.

2.1.1 Manufacturer's Qualifications

Obtain motor-controlled roller shades through one source from a single manufacturer with a minimum of twenty years of experience and minimum of three projects of similar scope and size in manufacturing products comparable to those specified in this section. Furnish manual and motorized shades produced by the same manufacturer to provide matching appearance.

2.1.2 Manually Operated Shades with Dual Rollers

2.1.2.1 Chain-and-Clutch Operating Mechanisms

Provide continuous-loop bead chain and clutch that stops shade movement when bead chain is released; shade to be permanently adjusted and lubricated.

2.1.2.2 Bead Chains

Provide bead chain from #10 stainless steel rated to 90 lb. minimum breaking strength with pull chain tensioning device complying with ANSI/WCMA A100.1. Provide positive mechanical engagement of drive mechanism to shade roller tube. Center bead chain placement for right or left- hand operation.

- a. Loop Length: Full length of roller shade.
- b. Limit Stops: Allows shade to stop when chain is released. Provide limit stops to prevent shade from being raised or lowered too far.
- c. Chain-Retainer Type: Chain tensioner, jamb mounted.

2.1.2.3 Rollers

Provide corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shade bands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shade bands for service.

- a. Dual Shade-Roller Mounting Configuration: Side by Side.
- b. Inside Roller: Drive-End Location: Right side of interior face of shade. Direction of Shade cloth Roll: Reverse, from front (interior face) of roller.
- c. Outside Roller: Drive-End Location: Right side of interior face of shade. Direction of Shade cloth Roll: Regular, from back (exterior face) of roller .
- d. Shade cloth-to-Roller Attachment: Removable spline fitting into integral channel in tube. Adhesive attachment is not acceptable.

2.1.2.4 Mounting Hardware

Provide corrosion resistant brackets or endcaps compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated. Provide hardware that allows for field adjustment or removal of shade roller tube and other operable hardware component without removal of brackets and end or center supports.

2.1.2.5 Inside Shade Cloth

- a. Shade Material: Light-blocking fabric.
- b. Shade Cloth Bottom (Hem) Bar: Steel or extruded aluminum. Provide shade bar exposed with endcaps and integral light seal at bottom where it meets the sill.

2.1.2.6 Outside Shade Cloth

- a. Shade Material: Light-filtering fabric: Openness 3 percent.
- b. Shade Cloth Bottom (Hem) Bar: Steel or extruded aluminum. Provide shade bar enclosed in sealed pocket of shade cloth material

2.1.2.7 Installation Accessories

- a. Front Fascia: L-shaped aluminum extrusion to conceal shade roller and hardware that snaps onto end caps without requiring exposed fasteners of any kind. Fascia can be mounted continuously across two or more shade bands. Provide manufacturers standard height fascia as required to conceal roller and shade band assembly when shade is fully open.

- b. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure. Provide manufacturers standard height fascia as required to conceal roller and shade band assembly when shade is fully open.
- c. Endcaps: Extruded aluminum with universal design suitable for mounting to window mullions. Provide size compatible with roller size. Provide end cap covers matching fascia/headbox finish.

2.1.2.8 Room Darkening Shades

Provide room darkening (black-out) window shades designed to eliminate all visible light gaps when shades are fully closed, and conform with the following:

- a. Provide roller tube made of aluminum. Provide shop fabricated light traps, consisting of a head box to house the shade roller, and U-shaped channels to serve as guides for the shade along the sides and to receive the bottom edge of the shade along the sill.
- b. Provide light trap made of sheet steel having a minimum thickness of 22 gauge or anodized, extruded, aluminum. Provide legs of the channels not less than 1-3/4 inches long and separated by the minimum distance that permits free operation of the shade. Edges of light trap coming into contact with the shade cloth are smooth pile light seal. The exposed face of the head box is hinged or removable for access to the shade roller. The interior or unexposed surfaces of the light trap have a finish coat of flat black enamel. The exposed portions of the light trap have a factory-applied priming coat of gray paint.
- c. Provide type of cloth for blackout purposes. Provide shade from a single piece of PVC polyester.
- d. Fit the bottom edge of the shade with a steel operating bar. Shades to engage positively with bottom rail through operating bar or chain pull. Paint bars with flat black enamel. Make pull cords of beaded chain having not less than 175 pounds breaking strength.

2.2 COLOR

Provide color, pattern and texture for metal trim and shade fabric as indicated; colors listed are not intended to limit the selection of equal colors from other manufacturers.

PART 3 EXECUTION

3.1 FIELD MEASUREMENTS

After becoming familiar with details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 ROLLER WINDOW SHADE PLACEMENT SCHEDULE

All exterior windows include double roller shades.

3.3 INSTALLATION

Do not install building construction materials that show visual evidence of biological growth.

Provide roller window shades, complete with necessary brackets, fittings, and hardware in accordance with paragraph ROLLER WINDOW SHADE PLACEMENT SCHEDULE as indicated on drawings..

Perform installation in accordance with the approved detailed drawings and manufacturer's installation instructions. Install units level, plumb, secure, and at proper height and location relative to window units. Provide and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Do not start installation until completion of room painting and finishing operations.

3.4 CLEAN-UP

Upon completion of the installation, clean window treatments and exposed components as recommended by manufacturer. Adjust window treatment for form and appearance and proper operating condition. Repair or replace damaged units as directed by the Contracting Officer. Isolate metal parts from direct contact with concrete, mortar, or dissimilar metals. Ensure shades installed in recessed pockets can be removed without disturbing the pocket. The entire shade, when retracted, is contained inside the pocket. For shades installed outside the jambs and mullions, overlap each jamb and mullion 0.75 inch or more when the jamb and mullion sizes permit. Include all hardware, brackets, anchors, fasteners, and accessories necessary for a complete, finished installation.

-- End of Section --

SECTION 21 13 13

WET PIPE SPRINKLER SYSTEMS, FIRE PROTECTION
08/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(2020) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(2016) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2016) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.21	(2016) Nonmetallic Flat Gaskets for Pipe Flanges

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1013	(2011) Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers - (ANSI approved 2010)
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AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA M14	(2015) Manual: Recommended Practice for Backflow Prevention and Cross-Connection Control

ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2018; E 2018) Standard
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	Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A135/A135M	(2009; R2014) Standard Specification for Electric-Resistance-Welded Steel Pipe
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A183	(2014; R 2020) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM F442/F442M	(2020) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
FM GLOBAL (FM)	
FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
INTELLIGENCE COMMUNITY STANDARD (ICS)	
ICS 705-1	(2010) Physical and Technical Security Standard for Sensitive Compartmented Information Facilities
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-71	(2018) Gray Iron Swing Check Valves, Flanged and Threaded Ends
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 13	(2019; Errata 19-1; Errata 19-2; TIA 19-1; TIA 19-2; TIA 19-3; TIA 19-4; Errata 19-3; Errata 20-4; TIA 19-5; TIA 19-6) Standard for the Installation of Sprinkler Systems
NFPA 13R	(2013) Standard for the Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height
NFPA 24	(2019; TIA 19-1) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 101	(2021) Life Safety Code

NFPA 291 (2016) Recommended Practice for Fire Flow Testing and Marking of Hydrants

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1014-7 (2012) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout

UNDERWRITERS LABORATORIES (UL)

UL 199 (2020) UL Standard for Safety Automatic Sprinklers for Fire-Protection Service

UL 262 (2004; Reprint Oct 2011) Gate Valves for Fire-Protection Service

UL 312 (2010; Reprint Mar 2018) UL Standard for Safety Check Valves for Fire-Protection Service

UL 405 (2013; Bul. 2020) UL Standard for Safety Fire Department Connection Devices

UL 668 (2004; Reprint Jul 2016) UL Standard for Safety Hose Valves for Fire-Protection Service

UL 789 (2004; Reprint May 2017) UL Standard for Safety Indicator Posts for Fire-Protection Service

UL 1626 (2008; Bul. 2018) UL Standard for Safety Residential Sprinklers for Fire-Protection Service

UL Fire Prot Dir (2015) Fire Protection Equipment Directory

1.2 SYSTEM DESCRIPTION

Provide wet pipe sprinkler system(s) in all areas of the building. Except as modified herein, the system must meet the requirements of NFPA 13 NFPA 13R. Pipe sizes which are not indicated on the Contract drawings must be determined by hydraulic calculations.

1.2.1 Hydraulic Design

1.2.1.1 Basis for Calculations

A waterflow test was performed on 3/9/21 at Building 512 and resulted in a static pressure of 66 psi with a residual pressure of 62 psi while flowing 1130 gpm. Perform a fire hydrant flow test prior to shop drawing submittal in accordance with NFPA 291. Results must include hydrant elevations relative to the building and hydrant number/identifiers for the tested hydrants, including which were flowed, which had a gauge. This information must be presented in a tabular form if multiple hydrants were

flowed. The results must be included with the hydraulic calculations. Hydraulic calculations must be based on flow test noted in this paragraph, unless verified by the NAVFAC Fire Protection Engineer and approved by Contracting Officer. Hydraulic calculations must be based upon the Hazen-Williams formula with a "C" value noted in NFPA 13 for piping.

1.2.1.2 Hydraulic Calculations

- a. Water supply curves and system requirements must be plotted on semi-logarithmic graph ($N^{1.85}$) paper so as to present a summary of the complete hydraulic calculation.
- b. Provide a summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, minimum discharge pressures and minimum flows. Elevations of hydraulic reference points (nodes) must be indicated.
- c. Documentation must identify each pipe individually and the nodes connected thereto. Indicate the diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient for each pipe.
- d. Where the sprinkler system is supplied by interconnected risers, the sprinkler system must be hydraulically calculated using the hydraulically most demanding single riser. The calculations must not assume the simultaneous use of more than one riser.
- e. All calculations must include the backflow preventer manufacturer's stated friction loss at the design flow or 12 psi for reduced pressure backflow preventer, whichever is greater.
- f. All calculations must be performed back to the actual location of the flow test, taking into account the direction of flow in the service main at the test location.
- g. For gridded systems, calculations must show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. A flow diagram indicating the quantity and direction of flows must be included.

1.2.1.3 Design Criteria

Hydraulically design the system to discharge a minimum density as indicated on the drawings. Hydraulic calculations must be in accordance with the Area/Density Method of NFPA 13. Add an allowance for exterior hose streams of 250 gpm to the sprinkler system demand at the fire hydrant shown on the drawings closest to the point where the water service enters the building.

1.2.2 Sprinkler Coverage

Sprinklers must be uniformly spaced on branch lines. Provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms (regardless of the fire resistance rating of the enclosure), boiler rooms, switchgear rooms, transformer rooms, attached electrical vaults and other electrical and mechanical spaces. Coverage per sprinkler must be in accordance with NFPA 13. Provide sprinklers below all obstructions in accordance with

NFPA 13. Exceptions are as follows:

- a. Sprinklers may be omitted from small rooms which are exempted for specific occupancies in accordance with NFPA 101.
- b. Facilities that are designed in accordance with NFPA 13R.

1.2.3 Qualified Fire Protection Engineer (QFPE)

An individual who is a licensed professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveying (NCEES) and has relevant fire protection engineering experience. Services of the QFPE must include:

- a. Reviewing SD-02, SD-03, and SD-05 submittal packages for completeness and compliance with the provisions of this specification. Working (shop) drawings and calculations must be prepared by, or prepared under the immediate supervision of, the QFPE. The QFPE must affix their professional engineering stamp with signature to the shop drawings, calculations, and material data sheets, indicating approval prior to submitting the shop drawings to the DFPE.
- b. Provide a letter documenting that the SD-02, SD-03, and SD-05 submittal package has been reviewed and noting all outstanding comments.
- c. Performing in-progress construction surveillance prior to installation of ceilings (rough-in inspection).
- d. Witnessing pre-Government and final Government functional performance testing and performing a final installation review.
- e. Signing applicable certificates under SD-07.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualified Fire Protection Engineer (QFPE)

Sprinkler System Designer

Sprinkler System Installer

SD-02 Shop Drawings

Shop Drawing

SD-03 Product Data

Pipe

Fittings

Valves, including gate, check, butterfly, and globe

Relief Valves

Sprinklers

Pipe Hangers and Supports

Sprinkler Alarm Switch

Valve Supervisory (Tamper) Switch

Fire Department Connection

Backflow Prevention Assembly

Air Vent

Hose Valve

Nameplates

SD-05 Design Data

Hydraulic Calculations

SD-06 Test Reports

Test Procedures

SD-07 Certificates

Verification of Compliant Installation

Request for Government Final Test

SD-10 Operation and Maintenance Data

Operating and Maintenance (O&M) Instructions

Spare Parts Data

SD-11 Closeout Submittals

As-built drawings

1.4 QUALITY ASSURANCE

1.4.1 Preconstruction Submittals

Within 36 days of contract award but no less than 14 days prior to commencing work on site, the prime Contractor must submit the following for review and approval. SD-02, SD-03 and SD-05 submittals received prior to the review and approval of the qualifications will be returned Disapproved Without Review.

1.4.1.1 Shop Drawing

Six copies of the shop drawings, no later than 28 days prior to the start of system installation. Working drawings conforming to the requirements

prescribed in NFPA 13 and must be no smaller than the Contract Drawings. Each set of drawings must include the following:

- a. A descriptive index with drawings listed in sequence by number. A legend sheet identifying device symbols, nomenclature, and conventions used in the package.
- b. Floor plans drawn to a scale not less than 1/8-inch equals 1-foot clearly showing locations of devices, equipment, risers, and other details required to clearly describe the proposed arrangement.
- c. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross mains and branch lines to finished floor and roof or ceiling. A detail must show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.
- d. Longitudinal and transverse building sections showing typical branch line and cross main pipe routing, elevation of each typical sprinkler above finished floor and elevation of "cloud" or false ceilings in relation to the building ceilings.
- e. Plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance.
- f. Riser layout drawings drawn to a scale of not less than 1/2-inch equals 1-foot to show details of each system component, clearances between each other and from other equipment and construction in the room.
- g. Details of each type of riser assembly, pipe hanger, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring. The dimension from the edge of vertical piping to the nearest adjacent wall(s) must be indicated on the drawings when vertical piping is located in stairs or other portions of the means of egress.
- h. Details of each type of pipe hanger and related components.

1.4.1.2 Product Data

Six copies of annotated catalog data to show the specific model, type, and size of each item. Catalog cuts must also indicate the NRTL listing. The data must be highlighted to show model, size, options, and other pertinent information, that are intended for consideration. Data must be adequate to demonstrate compliance with all contract requirements. Product data for all equipment must be combined into a single submittal.

1.4.1.3 Hydraulic Calculations

Calculations must be as outlined in NFPA 13 except that calculations must be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings.

1.4.1.4 Operating and Maintenance (O&M) Instructions

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA as supplemented and modified by this specification section.

Provide six manuals and one pdf version on electronic media. The manuals must include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted must be capable of providing 4-hour on-site response to a service call on an emergency basis.

Submit spare parts data for each different item of material and equipment specified. The data must include a complete list of parts and supplies, and a list of parts recommended by the manufacturer to be replaced after 1-year and 3 years of service. Include a list of special tools and test equipment required for maintenance and testing of the products supplied.

1.4.2 Qualifications

1.4.2.1 Sprinkler System Designer

The sprinkler system designer must be certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Water-Based Systems Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7.

1.4.2.2 Sprinkler System Installer

The sprinkler system installer must be regularly engaged in the installation of the type and complexity of system specified in the contract documents, and must have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.4.3 Regulatory Requirements

Equipment and material must be listed or approved. Listed or approved, as used in this Section, means listed, labeled or approved by a Nationally Recognized Testing Laboratory (NRTL) such as UL Fire Prot Dir or FM APP GUIDE. The omission of these terms under the description of an item or equipment described must not be construed as waiving this requirement. All listings or approvals by testing laboratories must be from an existing ANSI or UL published standard. The recommended practices stated in the manufacturer's literature or documentation are mandatory requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect all equipment delivered and placed in storage from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. All pipes must be either capped or plugged until installed.

1.6 EXTRA MATERIALS

Spare sprinklers and wrench(es) must be provided as spare parts in accordance with NFPA 13.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Standard Products

Provide materials, equipment, and devices listed for fire protection service when so required by NFPA 13 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for a classification of material. Material and equipment must be standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid.

2.1.2 Nameplates

Major components of equipment must have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new name plate permanently affixed to the item or equipment. Nameplates must be etched metal or plastic, permanently attached by screws to control units, panels or adjacent walls.

2.1.3 Identification and Marking

Pipe and fitting markings must include name or identifying symbol of manufacturer and nominal size. Pipe must be marked with ASTM designation. Valves and equipment markings must have name or identifying symbol of manufacturer, specific model number, nominal size, name of device, arrow indicating direction of flow, and position of installation (horizontal or vertical), except if valve can be installed in either position. Markings must be included on the body casting or on an etched or stamped metal nameplate permanently on the valve or cover plate.

2.1.4 Pressure Ratings

Valves, fittings, couplings, alarm switches, and similar devices must be rated for the maximum working pressures that can be experienced in the system, but in no case less than 175 psi.

2.2 UNDERGROUND PIPING COMPONENTS

2.2.1 Pipe

Pipe must comply with NFPA 24. Minimum pipe size is 4 inches. Piping more than 5 feet outside the building walls must comply with Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING. A continuous section of welded stainless steel fire water service piping from a point outside the building perimeter to a flanged fitting at least 1-foot above the finished floor within the building is acceptable.

2.2.2 Fittings and Gaskets

Fittings must be ductile-iron conforming to AWWA C110/A21.10 with cement mortar lining conforming to AWWA C104/A21.4. Gaskets must be suitable in design and size for the pipe with which such gaskets are to be used. Gaskets for ductile-iron pipe joints must conform to AWWA C111/A21.11.

2.2.3 Gate Valve and Indicator Posts

Installation must comply with NFPA 24. Gate valves for use with indicator post must conform to UL 262. Indicator posts must conform to UL 789. Provide each indicator post with one coat of primer and two coats of red enamel paint.

2.2.4 Buried Utility Warning and Identification Tape

Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape must be detectable by an electronic detection instrument. Provide tape, 3 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold block letters continuously and repeatedly over the entire tape length. Warning and identification must read "CAUTION BURIED WATER PIPING BELOW" or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.3 ABOVEGROUND PIPING COMPONENTS

2.3.1 Steel Piping Components

2.3.1.1 Steel Pipe

Except as modified herein, steel pipe must be black as permitted by NFPA 13 and conform to the applicable provisions of ASTM A53/A53M, ASTM A135/A135M or ASTM A153/A153M.

Steel pipe must be minimum Schedule 40 for sizes 2 inches and less; and minimum Schedule 10 for sizes larger than 2 inches. Steel piping with wall thickness less than Schedule 40 must not be threaded.

2.3.1.2 Fittings

Fittings must be welded, threaded, or grooved-end type. Threaded fittings must be cast-iron conforming to ASME B16.4, malleable-iron conforming to ASME B16.3 or ductile-iron conforming to ASTM A536. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe, steel press fittings and field welded fittings are not permitted. Fittings, mechanical couplings, and rubber gaskets must be supplied by the same manufacturer. Threaded fittings must use Teflon tape or manufacturer's approved joint compound. Saddle tees using rubber gasketed fittings are permitted only when connecting to existing piping for additions or modifications. Saddle tees must use a connection method that completely wraps around the pipe. Reducing couplings are not permitted except as allowed by NFPA 13.

2.3.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings must be designed for not less than 175 psi service and the product of the same manufacturer. Field welded fittings must not be used. Fitting and coupling housing must be malleable-iron conforming to ASTM A47/A47M, Grade 32510; ductile-iron conforming to ASTM A536, Grade 65-45-12. Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 2 inches and larger. Gasket must be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts must be heat-treated steel conforming to ASTM A183 and must be cadmium-plated or zinc-electroplated.

2.3.1.4 Flanges

Flanges must conform to NFPA 13 and ASME B16.1. Gaskets must be non-asbestos compressed material in accordance with ASME B16.21, 1/16-inch thick, and full face or self-centering flat ring type.

2.3.2 Plastic Piping Components

2.3.2.1 Plastic Pipe

Plastic pipe must be chlorinated polyvinyl chloride (CPVC) conforming to ASTM F442/F442M, 175 psi rating and listed for use in wet pipe sprinkler systems.

2.3.2.2 Plastic Fittings

Plastic fittings must be chlorinated polyvinyl chloride (CPVC) and listed for use in wet pipe sprinkler systems.

2.3.3 Flexible Sprinkler Hose

The use of flexible hose is not permitted.

2.3.4 Pipe Hangers and Supports

Provide galvanized pipe hangers and supports in accordance with NFPA 13.

2.3.5 Valves

Provide valves of types approved for fire service. Valves must open by counterclockwise rotation.

2.3.5.1 Control Valve

Manually operated sprinkler control/gate valve must be outside stem and yoke (OS&Y) type or butterfly type and must be listed.

2.3.5.2 Check Valves

Check valves must comply with UL 312. Check valves 4 inches and larger must be of the swing type, have a clear waterway and meet the requirements of MSS SP-71, for Type 3 or 4. Inspection plate must be provided on valves larger than 6 inches.

2.3.5.3 Hose Valve

Valve must comply with UL 668.

2.3.6 Riser Check Valves

Provide riser check valve, pressure gauges and main drain.

2.4 ALARM INITIATING AND SUPERVISORY DEVICES

2.4.1 Sprinkler Alarm Switch

Vane or pressure-type flow switch(es). Connection of switch must be by the fire alarm installer. Vane type alarm actuating devices must have

mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and must instantly recycle.

2.4.2 Valve Supervisory (Tamper) Switch

Switch must be integral to the control valve or suitable for mounting to the type of control valve to be supervised open. The switch must be tamper resistant and contain SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.5 BACKFLOW PREVENTION ASSEMBLY

Reduced-pressure principle valve assembly backflow preventer complying with ASSE 1013, and AWWA M14. Each check valve must have a drain. Backflow prevention assemblies must have current "Certificate of Approval from the Foundation for Cross-Connection Control and Hydraulic Research, FCCCHR List" and be listed for fire protection use. Listing of the specific make, model, design, and size in the FCCCHR List is acceptable as the required documentation.

2.5.1 Backflow Preventer Test Connection

Test connection must consist of a series of listed hose valves with 2 1/2-inch National Standard male hose threads with cap and chain.

2.6 FIRE DEPARTMENT CONNECTION

Fire department connection must be projecting type with cast-brass body, matching wall escutcheon lettered "Auto Spkr" with a polished-brass finish. The connection must have individual self-closing clappers, caps with drip drains and chains. Female inlets must have 5-inch diameter Storz. Comply with UL 405.

2.7 SPRINKLERS

Sprinklers must comply with UL 199 and NFPA 13. Sprinklers with internal O-rings are not acceptable. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters must have temperature classification in accordance with NFPA 13. Extended coverage sprinklers are permitted for loading docks, residential occupancies and high-piled storage applications only.

2.7.1 Pendent Sprinkler

Pendent sprinkler must be recessed quick-response type with nominal K-factor of 5.6. Pendent sprinklers must have a white polyester finish. Assembly must include an integral escutcheon.

2.7.2 Upright Sprinkler

Upright sprinkler must be brass quick-response type and have a nominal K-factor of 5.6.

2.7.3 Sidewall Sprinkler

Sidewall sprinkler must be the quick-response recessed type. Sidewall sprinkler must have a nominal K-factor of 5.6. Sidewall sprinkler must have a white polyester finish.

2.7.4 Residential Sprinkler

Residential sprinkler must be recessed pendent type with nominal K-factor of 5.6. Residential sprinkler must have a white polyester finish. Sprinkler must comply with UL 1626.

2.7.5 Corrosion-Resistant Sprinkler

Corrosion-resistant sprinkler must be the pendent type installed in locations as indicated. Corrosion-resistant coatings must be factory-applied by the sprinkler manufacturer.

2.8 ACCESSORIES

2.8.1 Sprinkler Cabinet

Provide spare sprinklers in accordance with NFPA 13 and must be placed in a suitable metal or plastic cabinet of sufficient size to accommodate all the spare sprinklers and wrenches in designated locations. Spare sprinklers must be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed as required by NFPA 13. At least one wrench of each type required must be provided.

2.8.2 Pendent Sprinkler Escutcheon

Escutcheon must be one-piece metallic type with a depth of less than 3/4-inch and suitable for installation on pendent sprinklers. The escutcheon must have a factory finish that matches the pendent sprinkler.

2.8.3 Pipe Escutcheon

Provide split hinge metal plates for piping entering walls, floors, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.8.4 Sprinkler Guard

Listed guard must be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards must be provided on sprinklers located within 7 feet of the floor.

2.8.5 Relief Valve

Relief valves must be listed and installed at the riser in accordance with NFPA 13.

2.8.6 Air Vent

Air vents must be of the automatic type and piped to drain to the building exterior.

2.8.7 Identification Sign

Valve identification sign must be minimum 6 inches wide by 2 inches high with enamel baked finish on minimum 18 gage steel or 0.024-inch aluminum with red letters on a white background or white letters on red background. Wording of sign must include, but not be limited to "main

drain", "auxiliary drain", "inspector's test", "alarm test", "alarm line", and similar wording as required to identify operational components. Where there is more than one sprinkler system, signage must include specific details as to the respective system.

PART 3 EXECUTION

3.1 VERIFYING ACTUAL FIELD CONDITIONS

Before commencing work, examine all adjoining work on which the contractor's work that is dependent for perfect workmanship according to the intent of this specification section, and report to the Contracting Officer's Representative a condition that prevents performance of first class work. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed before submittal of a proposal.

3.2 INSTALLATION

The installation must be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Locate sprinklers in a consistent pattern with ceiling grid, lights, and air supply diffusers. Install sprinkler system over and under ducts, piping and platforms when such equipment can negatively affect or disrupt the sprinkler discharge pattern and coverage.

- a. Piping offsets, fittings, and other accessories required must be furnished to provide a complete installation and to eliminate interference with other construction.
- b. Wherever the contractor's work interconnects with work of other trades the Contractor must coordinate with other Contractors to insure all Contractors have the information necessary so that they may properly install all necessary connections and equipment. Identify all work items needing access (dampers and similar equipment) that are concealed above hung ceilings by permanent color coded pins/tabs in the ceiling directly below the item.
- c. Provide required supports and hangers for piping, conduit, and equipment so that loading will not exceed allowable loadings of structure. Submittal of a bid must be a deemed representation that the contractor submitting such bid has ascertained allowable loadings and has included in his estimates the costs associated in furnishing required supports.

3.2.1 Waste Removal

At the conclusion of each day's work, clean up and stockpile on site all waste, debris, and trash which may have accumulated during the day as a result of work by the contractor and of his presence on the job. Sidewalks and streets adjoining the property must be kept broom clean and free of waste, debris, trash and obstructions caused by work of the contractor, which will affect the condition and safety of streets, walks, utilities, and property.

3.3 UNDERGROUND PIPING INSTALLATION

The fire protection water main must be laid, and joints anchored, in accordance with NFPA 24. Minimum depth of cover must be 3 feet or the

frost line, whichever is deeper. The supply line must terminate inside the building with a flanged piece, the bottom of which must be set not less than 1-foot above the finished floor. A blind flange must be installed temporarily on top of the flanged piece to prevent the entrance of foreign matter into the supply line. A concrete thrust block must be provided at the elbow where the pipe turns up toward the floor. In addition, joints must be anchored in accordance with NFPA 24. Buried steel components must be provided with a corrosion protective coating in accordance with AWWA C203. Piping more than 5 feet outside the building walls must meet the requirements of Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING.

3.4 ABOVEGROUND PIPING INSTALLATION

The methods of fabrication and installation of the aboveground piping must fully comply with the requirements and recommended practices of NFPA 13 and this specification section.

3.4.1 Protection of Piping Against Earthquake Damage

Seismic restraint is not required.

3.4.2 Piping in Exposed Areas

Install exposed piping without diminishing exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, must be installed to provide maximum headroom.

3.4.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping must be concealed above ceilings. Piping must be inspected, hydrostatically tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas must be concealed.

3.4.4 Pendent Sprinklers

- a. Drop nipples to pendent sprinklers must consist of minimum 1-inch pipe with a reducing coupling into which the sprinkler must be threaded.
- b. Where sprinklers are installed below suspended or dropped ceilings, drop nipples must be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling must not extend below the underside of the ceiling.
- c. Recessed pendent sprinklers must be installed such that the distance from the sprinkler deflector to the underside of the ceiling must not exceed the manufacturer's listed range and must be of uniform depth throughout the finished area.
- d. Pendent sprinklers in suspended ceilings must be located in the center of the tile (plus or minus 2 inches).
- e. Where the maximum static or flowing pressure, whichever is greater at the sprinkler, applied other than through the fire department connection, exceeds 100 psi and a branch line above the ceiling supplies sprinklers in a pendent position below the ceiling, the

cumulative horizontal length of an unsupported armover to a sprinkler or sprinkler drop must not exceed 12 inches for steel pipe and 6 inches for copper tube.

3.4.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers must contain no fittings between the branch line tee and the reducing coupling at the sprinkler.

3.4.6 Pipe Joints

Pipe joints must conform to NFPA 13, except as modified herein. Not more than four threads must show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints must be provided where indicated or required by NFPA 13. Grooved pipe and fittings must be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools must be products of the same manufacturer. For copper tubing, pipe and groove dimensions must comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field must be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe must be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances.

3.4.7 Reducers

Reductions in pipe sizes must be made with one-piece tapered reducing fittings. When standard fittings of the required size are not manufactured, single bushings of the face or hex type will be permitted. Where used, face bushings must be installed with the outer face flush with the face of the fitting opening being reduced. Bushings cannot be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2-inch.

3.4.8 Pipe Penetrations

- a. Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors must be core-drilled and provided with pipe sleeves. Each sleeve must be Schedule 40 galvanized steel, ductile-iron or cast-iron pipe and extend through its respective wall or floor and be cut flush with each wall surface. Sleeves must provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe must be firmly packed with mineral wool insulation.
- b. Where pipes and sleeves penetrate fire walls, fire partitions, or floors, pipes/sleeves must be firestopped in accordance with Section 07 84 00 FIRESTOPPING.
- c. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe must be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.

- d. All penetrations through the boundary of rooms/areas identified as secure space area must meet ICS 705-1.

3.4.9 Escutcheons

Escutcheons must be provided for pipe penetration in finished areas of ceilings, floors and walls. Escutcheons must be securely fastened to the pipe at surfaces through which piping passes.

3.4.10 Inspector's Test Connection

Unless otherwise indicated, the test connection must consist of 1-inch pipe connected at the riser as a combination test and drain valve; a test valve located approximately 7 feet above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test". All test connection piping must be inside of the building and penetrate the exterior wall at the location of the discharge orifice only. The discharge orifice must be located outside the building wall no more than 2 feet above finished grade, directed so as not to cause damage to adjacent construction or landscaping during full flow discharge, or to the sanitary sewer. Discharge to the exterior must not interfere with exiting from the facility. Water discharge or runoff must not cross the path of egress from the building. Do not discharge to the roof. Discharge to floor drains, janitor sinks or similar fixtures is not permitted.

Provide concrete splash blocks at all drain and inspector's test connection discharge locations if not discharging to a concrete surface. Splash blocks must be large enough to mitigate erosion and not become dislodged during a full flow of the drain. Ensure all discharged water drains away from the facility and does not cause property damage.

3.4.11 Backflow Preventer

Locate within the building or in a heated enclosure in locations subject to freezing. For heated enclosures, provide a low temperature supervisory alarm connected to the facility fire alarm system. Heat trace is not permitted to be used.

Install backflow preventers so that the bottom of the assembly is a minimum of 6 inches above the finished floor/grade. Install horizontal backflow preventers so that the bottom of the assembly is no greater than 24 inches above the finished floor/grade. Install vertical backflow preventers so that the upper operating handwheel is no more than 6 feet above the finished floor/grade. Clearance around control valve handles must be minimum 6 inches above grade/finished floor and away from walls.

3.4.11.1 Test Connection

Provide downstream of the backflow prevention assembly UL 668 hose valves with 2.5-inch National Standard male hose threads with cap and chain. Provide one valve for each 250 gpm of system demand or fraction thereof. Provide a permanent sign in accordance with paragraph entitled "Identification Signs" which reads, "Test Valve". Indicate location of test header. If an exterior connection, provide a control valve inside a heated mechanical room to prevent freezing.

3.4.12 Drains

- a. Main drain piping must be provided to discharge at a safe point outside the building, no more than 2 feet above finished grade. Provide a concrete splash block at drain outlet. Discharge to the exterior must not interfere with exiting from the facility. Water discharge or runoff must not cross the path of egress from the building.
- b. Auxiliary drains must be provided as required by NFPA 13. Auxiliary drains are permitted to discharge to a floor drain if the drain is sized to accommodate full flow (min 40 gpm). Discharge to service sinks or similar plumbing fixtures is not permitted.

3.4.13 Installation of Fire Department Connection

Connection must be mounted on the exterior wall approximately 3 feet above finished grade adjacent to and on the sprinkler system side of the backflow preventer. The piping between the connection and the check valve must be provided with an automatic drip in accordance with NFPA 13 and piped to drain to the outside or a floor drain within the same room.

3.4.14 Identification Signs

Signs must be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Main drain test results must be etched into main drain identification sign. Hydraulic design data must be etched into the nameplates and permanently affixed to each sprinkler riser as specified in NFPA 13. Provide labeling on the surfaces of all feed and cross mains to show the pipe function (e.g., "Sprinkler System", "Fire Department Connection", "Standpipe") and normal valve position (e.g. "Normally Open", "Normally Closed"). For pipe sizes 4-inch and larger provide white painted stenciled letters and arrows, a minimum of 2 inches in height and visible from at least two sides when viewed from the floor. For pipe sizes less than 4-inch, provide white painted stenciled letters and arrows, a minimum of 0.75-inch in height and visible from the floor.

3.5 ELECTRICAL

Except as modified herein, electric equipment and wiring must be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Alarm signal wiring connected to the building fire alarm control system must be by the fire alarm installer.

3.6 PAINTING

Color code mark piping red.

3.7 FIELD QUALITY CONTROL

3.7.1 Test Procedures

Submit detailed test procedures, prepared and signed by the NICET Level III Fire Sprinkler Technician, and the representative of the installing company, and reviewed by the QFPE 60 days prior to performing system tests. Detailed test procedures must list all components of the installed system. Test procedures must include sequence of testing, time estimate for each test, and sample test data forms. The test data forms must be in

a check-off format (pass/fail with space to add applicable test data; similar to the forms in NFPA 13). The test procedures and accompanying test data forms must be used for the pre-Government testing and the Government final testing.

- a. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

3.7.2 Pre-Government Testing

3.7.2.1 Verification of Compliant Installation

Conduct inspections and tests to ensure that equipment is functioning properly. Tests must meet the requirements of paragraph entitled "Minimum System Tests" and "System Acceptance" as noted in NFPA 13. The Contractor must be in attendance at the pre-Government testing to make necessary adjustments. After inspection and testing is complete, provide a signed Verification of Compliant Installation letter by the QFPE that the installation is complete, compliant with the specification and fully operable. The letter must include the names and titles of the witnesses to the pre-Government tests. Provide all completion documentation as required by NFPA 13 and the test reports noted below.

- a. NFPA 13 Aboveground Material and Test Certificate
- b. NFPA 13 Underground Material and Test Certificate

3.7.2.2 Request for Government Final Test

When the verification of compliant installation has been completed, submit a formal request for Government final test to the Designated Fire Protection Engineer (DFPE) and Contracting Officers Designated Representative (COR). Government final testing will not be scheduled until the DFPE has received copies of the request for Government final testing and Verification of Compliant Installation letter with all required reports. Government final testing will not be performed until after the connections to the installation fire alarm reporting system have been completed and tested to confirm communications are fully functional. Submit request for test at least 15 calendar days prior to the requested test date.

3.7.3 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, perform corrective actions and repeat the tests. Tests must be conducted and repeated if necessary until the system has been demonstrated to comply with all contract requirements.

3.7.4 Government Final Tests

The tests must be performed in accordance with the approved test procedures in the presence of the DFPE. Furnish instruments and personnel required for the tests. The following must be provided at the job site for Government Final Testing:

- a. The manufacturer's technical representative.
- b. The contractor's Qualified Fire Protection Engineer (QFPE).

- c. Marked-up red line drawings of the system as actually installed.

Government Final Tests will be witnessed by the Designated Fire Protection Engineer and Contracting Officer. At this time, all required tests noted in the paragraph "Minimum System Tests" must be repeated at their discretion.

3.8 MINIMUM SYSTEM TESTS

The system, including the underground water mains, and the aboveground piping and system components, must be tested to ensure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure must be tested in accordance with NFPA 13 and NFPA 24.

3.8.1 Underground Piping

3.8.1.1 Flushing

Underground piping must be flushed at a minimum of 10 fps in accordance with NFPA 24.

3.8.1.2 Hydrostatic Test

New underground piping must be hydrostatically tested in accordance with NFPA 24.

3.8.2 Aboveground Piping

3.8.2.1 Hydrostatic Test

Aboveground piping must be hydrostatically tested in accordance with NFPA 13. There must be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure must be read from a gauge located at the low elevation point of the system or portion being tested.

3.8.2.2 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly must be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. The Contractor must provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5-inch diameter hoses, playpipe nozzles or flow diffusers, calibrated pressure gauges, and pitot tube gauge. The Contractor must provide all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction loss) across the assembly must be recorded. A metal placard must be provided on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate determined during the preliminary testing. The pressure drop must be compared to the manufacturer's data and the readings observed during the final inspections and tests.

3.8.3 Main Drain Flow Test

Following flushing of the underground piping, a main drain test must be made to verify the adequacy of the water supply. Static and residual

pressures must be recorded on the certificate specified in paragraph SUBMITTALS.

3.9 SYSTEM ACCEPTANCE

Following acceptance of the system, as-built drawings and O&M manuals must be delivered to the Contracting Officer for review and acceptance. Submit six sets of detailed as-built drawings. The drawings must show the system as installed, including deviations from both the project drawings and the approved shop drawings. These drawings must be submitted within two weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings must be provided at the time of, or prior to the final acceptance test.

- a. Provide one set of full size paper as-built drawings and schematics. The drawings must be prepared electronically and sized no less than the contract drawings. Furnish one set of CDs or DVDs containing software back-up and CAD based drawings in latest version of AutoCAD, DXF and portable document formats of as-built drawings and schematics.
- b. Provide operating and maintenance (O&M) instructions.

3.10 ONSITE TRAINING

Conduct a training course for the responding fire department and operating and maintenance personnel as designated by the Contracting Officer. Training must be performed on two separate days (to accommodate different shifts of Fire Department personnel) for a period of 4 hours of normal working time and must start after the system is functionally complete and after the final acceptance test. The on-site training must cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

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SECTION 21 13 16

DRY PIPE SPRINKLER SYSTEMS, FIRE PROTECTION
08/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(2020) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.3	(2016) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2016) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.21	(2016) Nonmetallic Flat Gaskets for Pipe Flanges

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1013	(2011) Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers - (ANSI approved 2010)
ASSE 1015	(2011) Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies - (ANSI approved 2010)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA M14	(2015) Manual: Recommended Practice for Backflow Prevention and Cross-Connection Control
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ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2020) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A135/A135M	(2009; R2014) Standard Specification for Electric-Resistance-Welded Steel Pipe
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A183	(2014; R 2020) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
FM GLOBAL (FM)	
FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
INTELLIGENCE COMMUNITY STANDARD (ICS)	
ICS 705-1	(2010) Physical and Technical Security Standard for Sensitive Compartmented Information Facilities
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-71	(2018) Gray Iron Swing Check Valves, Flanged and Threaded Ends
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 13	(2019; Errata 19-1; Errata 19-2; TIA 19-1; TIA 19-2; TIA 19-3; TIA 19-4; Errata 19-3; Errata 20-4; TIA 19-5; TIA 19-6) Standard for the Installation of Sprinkler Systems
NFPA 24	(2019; TIA 19-1) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 101	(2021) Life Safety Code
NFPA 291	(2016) Recommended Practice for Fire Flow Testing and Marking of Hydrants
NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)	
NICET 1014-7	(2012) Program Detail Manual for Certification in the Field of Fire Protection Engineering Technology (Field Code 003) Subfield of Automatic Sprinkler System Layout
UNDERWRITERS LABORATORIES (UL)	
UL 199	(2020) UL Standard for Safety Automatic Sprinklers for Fire-Protection Service

UL 312	(2010; Reprint Mar 2018) UL Standard for Safety Check Valves for Fire-Protection Service
UL 405	(2013; Bul. 2020) UL Standard for Safety Fire Department Connection Devices
UL 668	(2004; Reprint Jul 2016) UL Standard for Safety Hose Valves for Fire-Protection Service
UL Fire Prot Dir	(2015) Fire Protection Equipment Directory

1.2 SYSTEM DESCRIPTION

Provide dry pipe sprinkler system(s) in areas indicated on the drawings. Except as modified herein, the system must meet the requirements of NFPA 13. Dry pipe systems must utilize nitrogen. Pipe sizes which are not indicated on the Contract drawings must be determined by hydraulic calculations.

1.2.1 Hydraulic Design

1.2.1.1 Basis for Calculations

A waterflow test was performed on (DATE) at (LOCATION) and resulted in a static pressure of 66 psi with a residual pressure of 62 psi while flowing 1250gpm. Perform a fire hydrant flow test prior to shop drawing submittal in accordance with NFPA 291. Results must include hydrant elevations relative to the building and hydrant number/identifiers for the tested hydrants, including which were flowed, which had a gauge. This information must be presented in a tabular form if multiple hydrants were flowed. The results must be included with the hydraulic calculations. Hydraulic calculations must be based on flow test noted in this paragraph, unless Fire Protection Engineer and approved by Contracting Officer. Hydraulic calculations must be based upon the Hazen-Williams formula with a "C" value noted in NFPA 13 for piping. A "C" value of 120 is permitted to be used in hydraulic calculations when nitrogen is utilized. The minimum residual pressure in a service lateral (lead-in) at the design flow rate must be 20 psi at the inlet to the backflow preventer.

1.2.1.2 Hydraulic Calculations

- Water supply curves and system requirements must be plotted on semi-logarithmic graph ($N^{1.85}$) paper so as to present a summary of the complete hydraulic calculation.
- Provide a summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, minimum discharge pressures and minimum flows. Elevations of hydraulic reference points (nodes) must be indicated.
- Documentation must identify each pipe individually and the nodes connected thereto. Indicate the diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient for each pipe.
- Where the sprinkler system is supplied by interconnected risers, the

sprinkler system must be hydraulically calculated using the hydraulically most demanding single riser. The calculations must not assume the simultaneous use of more than one riser.

- e. All calculations must include the backflow preventer manufacturer's stated friction loss at the design flow or 12 psi for reduced pressure backflow preventer, whichever is greater.
- f. All calculations must be performed back to the actual location of the flow test, taking into account the direction of flow in the service main at the test location.

1.2.1.3 Design Criteria

Hydraulically design the system to discharge a minimum density of 0.1 gpm/square foot over the hydraulically most demanding 2535 square feet of floor area. Hydraulic calculations must be in accordance with the Area/Density Method of NFPA 13. Add an allowance for exterior hose streams of 250 gpm to the sprinkler system demand at the fire hydrant shown on the drawings closest to the point where the water service enters the building.

1.2.2 Sprinkler Coverage

Sprinklers must be uniformly spaced on branch lines. Provide coverage throughout 100 percent of the building. This includes, but is not limited to, telephone rooms, electrical equipment rooms (regardless of the fire resistance rating of the enclosure), boiler rooms, switchgear rooms, transformer rooms, attached electrical vaults and other electrical and mechanical spaces. Coverage per sprinkler must be in accordance with NFPA 13. Provide sprinklers below all obstructions in accordance with NFPA 13. Exceptions are as follows:

- a. Sprinklers may be omitted from small rooms which are exempted for specific occupancies in accordance with NFPA 101.

1.2.3 System Volume Limitations

Where the volume of an individual system piping exceeds 500 gallons, provide the dry pipe valve with a quick-opening device. The maximum system capacity controlled by one dry pipe valve must not exceed 750 gallons, unless it complies with the dry pipe system water delivery calculations noted in NFPA 13.

1.2.4 Qualified Fire Protection Engineer (QFPE)

An individual who is a licensed professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveying (NCEES) and has relevant fire protection engineering experience. Services of the QFPE must include:

- a. Reviewing SD-02, SD-03, and SD-05 submittal packages for completeness and compliance with the provisions of this specification. Working (shop) drawings and calculations must be prepared by, or prepared under the immediate supervision of, the QFPE. The QFPE must affix their professional engineering stamp with signature to the shop drawings, calculations, and material data sheets, indicating approval prior to submitting the shop drawings to the DFPE.

- b. Provide a letter documenting that the SD-02, SD-03, and SD-05 submittal package has been reviewed and noting outstanding comments.
- c. Performing in-progress construction surveillance prior to installation of ceilings (rough-in inspection).
- d. Witnessing pre-Government and final Government functional performance testing and performing a final installation review.
- e. Signing applicable certificates under SD-07.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Partial submittals and submittals not fully complying with NFPA 13 and this specification section must be returned disapproved without review. SD-02, SD-03 and SD-05 must be submitted simultaneously.

Shop drawings (SD-02), product data (SD-03) and calculations (SD-05) must be prepared by the designer and combined and submitted as one complete package. The QFPE must review the SD-02/SD-03/SD-05 submittal package for completeness and compliance with the Contract provisions prior to submission to the Government. The QFPE must provide a Letter of Confirmation that they have reviewed the submittal package for compliance with the contract provisions. This letter must include their professional engineer stamp and signature. Partial submittals and submittals not reviewed by the QFPE must be returned disapproved without review.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualified Fire Protection Engineer (QFPE)

Sprinkler System Designer

Sprinkler System Installer

Nitrogen Generation System Commissioning Technician

SD-02 Shop Drawings

Shop Drawing

SD-03 Product Data

Pipe

Fittings

Valves, including gate, check, butterfly, and globe

Relief Valves

Sprinklers

Pipe Hangers and Supports

Sprinkler Alarm Switch

Valve Supervisory (Tamper) Switch

Fire Department Connection

Backflow Prevention Assembly

High/Low-Nitrogen Pressure Supervisory Switch

Nitrogen Generation System

Nameplates

Dry Pipe Valve

SD-05 Design Data

Load calculations for sizing of seismic bracing

Hydraulic Calculations

SD-06 Test Reports

Test Procedures

SD-07 Certificates

Verification of Compliant Installation

Request for Government Final Test

SD-10 Operation and Maintenance Data

Operating and Maintenance (O&M) Instructions

Spare Parts Data

SD-11 Closeout Submittals

As-built drawings

1.4 QUALITY ASSURANCE

1.4.1 Preconstruction Submittals

Within 36 days of contract award but no less than 14 days prior to commencing work on site, the prime Contractor must submit the following for review and approval. SD-02, SD-03 and SD-05 submittals received prior to the review and approval of the qualifications must be returned Disapproved Without Review. All resultant delays are the sole responsibility of the prime Contractor.

1.4.1.1 Shop Drawing

3 copies of the shop drawings, no later than 28 days prior to the start of system installation. Working drawings conforming to the requirements prescribed in NFPA 13 and must be no smaller than the Contract Drawings. Each set of drawings must include the following:

1. A descriptive index with drawings listed in sequence by number. A legend sheet identifying device symbols, nomenclature, and conventions used in the package.
2. Floor plans drawn to a scale not less than 1/8-inch equals 1-foot clearly showing locations of devices, equipment, risers, electrical power connections and other details required to clearly describe the proposed arrangement.
3. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross mains and branch lines to finished floor and roof or ceiling. A detail must show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.
4. Longitudinal and transverse building sections showing typical branch line and cross main pipe routing, elevation of each typical sprinkler above finished floor and elevation of "cloud" or false ceilings in relation to the building ceilings.
5. Plan and elevation views which establish that the equipment will fit the allotted spaces with clearance for installation and maintenance.
6. Riser layout drawings drawn to a scale of not less than 1/2-inch equals 1-foot to show details of each system component, clearances between each other and from other equipment and construction in the room.
7. Details of each type of riser assembly, pipe hanger, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring. The dimension from the edge of vertical piping to the nearest adjacent wall(s) must be indicated on the drawings when vertical piping is located in stairs or other portions of the means of egress.
8. Details of each type of pipe hanger and related components.
9. The calculated volume of each system.

1.4.1.2 Product Data

3 copies of annotated catalog data to show the specific model, type, and size of each item. Catalog cuts must also indicate the NRTL listing. The data must be highlighted to show model, size, options, and other pertinent information, that are intended for consideration. Data must be adequate to demonstrate compliance with all contract requirements. Product data for all equipment must be combined into a single submittal.

1.4.1.3 Hydraulic Calculations

Calculations must be as outlined in NFPA 13 except that calculations must be performed by computer using software intended specifically for fire

protection system design using the design data shown on the drawings. Calculations must include isometric diagram indicating hydraulic nodes and pipe segments.

1.4.1.4 Operating and Maintenance (O&M) Instructions

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA as supplemented and modified by this specification section.

Provide six manuals and one pdf version on electronic media. The manuals must include the manufacturer's name, model number, parts list, list of parts and tools that should be kept in stock by the owner for routine maintenance, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization (including address and telephone number) for each item of equipment. Each service organization submitted must be capable of providing 4-hour on-site response to a service call on an emergency basis.

Submit spare parts data for each different item of material and equipment specified. The data must include a complete list of parts and supplies, and a list of parts recommended by the manufacturer to be replaced after 1-year and 3 years of service. Include a list of special tools and test equipment required for maintenance and testing of the products supplied.

1.4.2 Qualifications

1.4.2.1 Sprinkler System Designer

The sprinkler system designer must be certified as a Level III Technician by National Institute for Certification in Engineering Technologies (NICET) in the Water-Based Systems Layout subfield of Fire Protection Engineering Technology in accordance with NICET 1014-7.

1.4.2.2 Sprinkler System Installer

The sprinkler system installer must be regularly engaged in the installation of the type and complexity of system specified in the contract documents, and must have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

1.4.2.3 Nitrogen Generation System Commissioning Technician

Commissioning technician of nitrogen generation system(s) must have one of the following qualifications. Qualifications must be provided prior to preliminary inspection and tests.

- a. Commissioning of nitrogen generation system must be carried out by technician employed by and certified by the nitrogen generation system manufacturer.
- b. In lieu of manufacturer's commissioning technician, the fire sprinkler contractor must provide proof their commissioning technician has manufacturer's certified training for the equipment being installed and proof of at least five previous installations of manufacturer's equipment where the contractor's commissioning technician has successfully conducted commissioning under the direct supervision of the manufacturer's commissioning representative. Contractor must provide proof the five supervised commissioning occurred AFTER

contractor's commissioning agent has obtained the certified training. Commissioning carried out prior to factory training, or without supervision of manufacturer's technician or commissioning of other manufacturer's equipment does not qualify as applicable experience. Conduct preliminary inspections and testing does not qualify as applicable experience.

1.4.3 Regulatory Requirements

Equipment and material must be listed or approved. Listed or approved, as used in this Section, means listed, labeled or approved by a Nationally Recognized Testing Laboratory (NRTL) such as UL Fire Prot Dir or FM APP GUIDE. The omission of these terms under the description of an item of equipment described must not be construed as waiving this requirement. All listings or approvals by testing laboratories must be from an existing ANSI or UL published standard. The recommended practices stated in the manufacturer's literature or documentation are mandatory requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect all equipment delivered and placed in storage from the weather, excessive humidity and temperature variations, dirt and dust, or other contaminants. All pipes must be either capped or plugged until installed.

1.6 EXTRA MATERIALS

Spare sprinklers and wrench(es) must be provided as spare parts in accordance with NFPA 13.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Standard Products

Provide materials, equipment, and devices listed for fire protection service when so required by NFPA 13 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for a particular classification of materials. Material and equipment must be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 2 years prior to bid.

2.1.2 Nameplates

Major components of equipment must have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new name plate permanently affixed to the item or equipment. Nameplates must be etched metal or plastic, permanently attached by screws to control units, panels or adjacent walls.

2.1.3 Identification and Marking

Pipe and fitting markings must include name or identifying symbol of manufacturer and nominal size. Pipe must be marked with ASTM designation. Valves and equipment markings must have name or identifying symbol of manufacturer, specific model number, nominal size, name of

device, arrow indicating direction of flow, and position of installation (horizontal or vertical), except if valve can be installed in either position. Markings must be included on the body casting or on an etched or stamped metal nameplate permanently on the valve or cover plate.

2.1.4 Pressure Ratings

Valves, fittings, couplings, alarm switches, and similar devices must be rated for the maximum working pressures that can be experienced in the system, but in no case less than 175 psi.

2.2 ABOVEGROUND PIPING COMPONENTS

2.2.1 Steel Piping Components

2.2.1.1 Steel Pipe

Except as modified herein, steel pipe must be black as permitted by NFPA 13 and conform to the applicable provisions of ASTM A53/A53M, ASTM A135/A135M or ASTM A153/A153M.

Steel pipe must be Schedule 40 only. Steel piping with wall thickness less than Schedule 40 must not be threaded. Grooved pipe must be cut-grooved.

2.2.1.2 Fittings

Fittings must be welded, threaded, or grooved-end type. Threaded fittings must be cast-iron conforming to ASME B16.4, malleable-iron conforming to ASME B16.3 or ductile-iron conforming to ASTM A536. Plain-end fittings with mechanical couplings, fittings that use steel gripping devices to bite into the pipe, steel press fittings and field welded fittings are not permitted. Fittings, mechanical couplings, and rubber gaskets must be supplied by the same manufacturer. Threaded fittings must use Teflon tape or manufacturer's approved joint compound. Saddle tees using rubber gasketed fittings are permitted only when connecting to existing piping for additions or modifications. Saddle tees must use a connection method that completely wraps around the pipe. Reducing couplings are not permitted except as allowed by NFPA 13.

2.2.1.3 Grooved Mechanical Joints and Fittings

Joints and fittings must be designed for not less than 175 psi service and the product of the same manufacturer. Field welded fittings must not be used. Fitting and coupling housing must be malleable-iron conforming to ASTM A47/A47M, Grade 32510; ductile-iron conforming to ASTM A536, Grade 65-45-12. Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 2 inches and larger. Gasket must be of silicon compound and listed for dry fire protection systems. Gasket must be the flush type that fills the entire cavity between the fitting and the pipe. Nuts and bolts must be heat-treated steel conforming to ASTM A183 and must be cadmium-plated or zinc-electroplated.

2.2.1.4 Flanges

Flanges must conform to NFPA 13 and ASME B16.1. Gaskets must be non-asbestos compressed material in accordance with ASME B16.21, 1/16-inch thick, and full face or self-centering flat ring type.

2.2.2 Pipe Hangers and Supports

Provide galvanized pipe hangers, and supports in accordance with NFPA 13..

2.2.3 Valves

Provide valves of types approved for fire service. Valves must open by counterclockwise rotation.

2.2.3.1 Control Valve

Manually operated sprinkler control/gate valve must be outside stem and yoke (OS&Y) type or butterfly type and must be listed.

2.2.3.2 Check Valves

Check valves must comply with UL 312. Check valves 4 inches and larger must be of the swing type, have a clear waterway and meet the requirements of MSS SP-71, for Type 3 or 4. Inspection plate must be provided on valves larger than 6 inches.

2.3 DRY PIPE VALVE ASSEMBLY

The dry pipe valve must be a listed, latching differential type be complete with trim piping, valves, fittings, pressure gauges, priming water fill cup, velocity drip check, drip cup, and other ancillary components as required for proper operation. The assembly must include a quick-opening device by the same manufacturer as the dry pipe valve for systems over 500 gallons in capacity and in all cases when needed to achieve the timed test requirements in part 3 of this specification section.

2.4 SUPERVISORY NITROGEN SYSTEM

Provide a nitrogen supply system in accordance with NFPA 13. The connection pipe from the nitrogen generator must not be less than 1/2-inch in diameter and must enter the system above the priming water level of the dry pipe valve. Install a check valve in the system supply nitrogen piping from the generator. A shutoff valve of the renewable disc type must be installed upstream of this check valve. The nitrogen supply system must be sized to pressurize the sprinkler system to 40 psi within 20 minutes.

2.4.1 Nitrogen Generation System

The nitrogen generation system (NGS) must be installed with a compressor sized appropriately for the application and capable of achieving system pressure within 30 minutes in accordance with the requirements of NFPA 13. The nitrogen generation system must be designed to achieve a nitrogen concentration of 98% or greater and maintain that concentration within the fire sprinkler system continuously. The output nitrogen quality must be confirmed by using a gas stream analyzer. Where multiple dry pipe sprinkler risers are present, provide a manifold adjacent to the dry pipe sprinkler risers. Manifold system must include automatic vent and air maintenance devices for each sprinkler system riser. Nitrogen generation system requires a dedicated, hardwired 120V AC power supply.

2.4.1.1 Design of Nitrogen Generation System

Design the system so all equipment is installed within the confines of the riser room with the exception of a connection for a manual or automatic gas analyzer. Provide a system that is capable of delivering a minimum of 98 percent nitrogen composition throughout all of the system piping within 14 days from the commencement of the inerting process. Provide membrane type nitrogen generators that provide "instant on-instant off" nitrogen gas production without the need for nitrogen storage tanks. The complete nitrogen generator system must be self-contained and skid mounted with "drop-in" operability with a simple one step direct connection of the nitrogen gas supply line to each zone/riser. Provide an automatic "fill and purge" breathing process. This must be done while the sprinkler system is fully functional and must not alter the design performance of the sprinkler system. A process that involves continuous venting of the piping network is not permitted. Air maintenance devices used in conjunction with the nitrogen generation system must be listed for use on sprinkler systems. At the riser and at the end of each zone, provide a connection for a automatic gas analyzer.

2.4.1.2 Nitrogen Air Compressor

Air compressors to be used in conjunction with the nitrogen generator must be capable of the following:

- a. Capable of producing a continuous stream of compressed air at 100+ psig.
- b. Capable of automatic cut in and cut out.
- c. Equipped with an on-board after-cooler.
- d. Equipped with an on-board automatic water blow down system.
- e. Equipped with vibration dampening system.
- f. Equipped with an air storage tank to provide continuous delivery of compressed air to the nitrogen generator.
- g. Rated for continuous duty service.
- h. Compressors less than 3.0 hp must be an oil-less design.
- i. Oil-less compressors must be such that the manufacturer has designed the oil-less compressor to provide 5000 hours of continuous duty service before requiring a gasket and seal rebuild.

2.4.1.3 Nitrogen Venting Device

The functional component of the nitrogen venting device for use in the "fill and purge" breathing process must:

- a. Be NRTL listed for use on sprinkler systems.
- b. Not require plumbing to drain.
- c. Close automatically at the completion of the nitrogen inerting process without manual intervention.

- d. Be installed on each zone in the riser room.

2.4.1.4 Supervision of Nitrogen Generator

Nitrogen generator must be able to provide the following monitoring options:

- a. Power supply "on" for nitrogen generators.
- b. Power supply "on" for compressor.
- c. Amp draw for compressor.
- d. Line pressure (psig).
- e. Nitrogen purity at discharge (sample port for use with automatic gas analyzer).

2.4.2 Nitrogen Pressure Maintenance Device

Device must be a pressure regulator that automatically reduces supply air pressure to the minimum pressure required to be maintained in the piping system. The device must have a cast bronze body and valve housing complete with diaphragm assembly, spring, filter, ball check to prevent backflow, 1/16-inch restriction to prevent rapid pressurization of the system, and adjustment screw. The device must be capable of reducing maximum inlet pressure of 100 psi to a fixed outlet pressure adjustable to 10 psi.

2.5 ALARM INITIATING AND SUPERVISORY DEVICES

2.5.1 Sprinkler Alarm Switch

pressure-type flow switch(es). Connection of switch must be by the fire alarm installer.

2.5.2 High/Low-Nitrogen Pressure Supervisory Switch

Each dry pipe valve must be provided with a nitrogen pressure switch connected to the control unit. The pressure switch must supervise the nitrogen pressure in the system and set to activate at 10 psi above the dry pipe valve trip point pressure (low) and 10 psi above normal nitrogen pressure (high). The switch must have an adjustable range between 5 and 80 psi. The switch must have screw terminal connection and capable of being wired for normally open or normally closed circuit.

2.5.3 Valve Supervisory (Tamper) Switch

Switch must be integral to the control valve or suitable for mounting to the type of control valve to be supervised open. The switch must be tamper resistant and contain SPDT (Form C) contacts arranged to transfer upon removal of the housing cover or closure of the valve of more than two rotations of the valve stem.

2.6 BACKFLOW PREVENTION ASSEMBLY

Reduced-pressure principle valve assembly backflow preventer complying with ASSE 1013, ASSE 1015 and AWWA M14. Each check valve must have a drain. Backflow prevention assemblies must have current "Certificate of

Approval from the Foundation for Cross-Connection Control and Hydraulic Research, FCCCHR List" and be listed for fire protection use. Listing of the specific make, model, design, and size in the FCCCHR List is acceptable as the required documentation.

2.7 FIRE DEPARTMENT CONNECTION

Fire department connection must be projecting type with cast-brass body, matching wall escutcheon lettered "Auto Spkr" with a chromium-plated finish. The connection must have individual self-closing clappers, caps with drip drains and chains. Female inlets must have 5-inch diameter. Comply with UL 405.

2.8 SPRINKLERS

Sprinklers must comply with UL 199 and NFPA 13. Sprinklers with internal O-rings are not acceptable. Sprinklers in high heat areas including attic spaces or in close proximity to unit heaters must have temperature classification in accordance with NFPA 13. Extended coverage sprinklers are permitted for loading docks, residential occupancies and high-piled storage applications only.

2.8.1 Upright Sprinkler

Upright sprinkler must be chrome-plated quick-response type with a nominal K-factor of 5.6.

2.9 ACCESSORIES

2.9.1 Sprinkler Cabinet

Provide spare sprinklers in accordance with NFPA 13 and must be placed in a suitable metal or plastic cabinet of sufficient size to accommodate all the spare sprinklers and wrenches in designated locations. Spare sprinklers must be representative of, and in proportion to, the number of each type and temperature rating of the sprinklers installed as required by NFPA 13. At least one wrench of each type required must be provided.

2.9.2 Pendent Sprinkler Escutcheon

Escutcheon must be one-piece metallic type with a depth of less than 3/4-inch and suitable for installation on pendent sprinklers. The escutcheon must have a factory finish that matches the pendent sprinkler.

2.9.3 Pipe Escutcheon

Provide split hinge metal plates for piping entering walls, floors, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.9.4 Sprinkler Guard

Listed guard must be a steel wire cage designed to encase the sprinkler and protect it from mechanical damage. Guards must be provided on sprinklers located within 7 feet of the floor.

2.9.5 Relief Valve

Relief valves must be listed and installed at there riser in accordance with NFPA 13.

2.9.6 Identification Sign

Valve identification sign must be minimum 6 inches wide by 2 inches high with enamel baked finish on minimum 18 gage steel or 0.024-inch aluminum with red letters on a white background or white letters on red background. Wording of sign must include, but not be limited to "main drain", "auxiliary drain", "inspector's test", "alarm test", "alarm line", and similar wording as required to identify operational components. Where there is more than one sprinkler system, signage must include specific details as to the respective system.

PART 3 EXECUTION

3.1 VERIFYING ACTUAL FIELD CONDITIONS

Before commencing work, examine all adjoining work on which the contractor's work that is dependent for perfect workmanship according to the intent of this specification section, and report to the Contracting Officer's Representative a condition which prevents performance of first class work. No "waiver of responsibility" for incomplete, inadequate or defective adjoining work will be considered unless notice has been filed before submittal of a proposal.

3.2 INSTALLATION

The installation must be in accordance with the applicable provisions of NFPA 13, NFPA 24 and publications referenced therein. Locate sprinklers in a consistent pattern with ceiling grid, lights, and air supply diffusers. Install sprinkler system over and under ducts, piping and platforms when such equipment can negatively affect or disrupt the sprinkler discharge pattern and coverage.

- a. Piping offsets, fittings, and other accessories required must be furnished to provide a complete installation and to eliminate interference with other construction.
- b. Wherever the contractor's work interconnects with work of other trades the Contractor must coordinate with other Contractors to insure all Contractors have the information necessary so that they may properly install all necessary connections and equipment. Identify all work items needing access (dampers and similar equipment) concealed above hung ceilings by permanent color coded pins/tabs in the ceiling directly below the item.
- c. Provide required supports and hangers for piping, conduit, and equipment so that loading will not exceed allowable loadings of structure. Submittal of a bid must be a deemed representation that the contractor submitting such bid has ascertained allowable loadings and has included in his estimates the costs associated in furnishing required supports.

3.2.1 Waste Removal

At the conclusion of each day's work, clean up and stockpile on site all

waste, debris, and trash which may have accumulated during the day as a result of work by the contractor and of his presence on the job. Sidewalks and streets adjoining the property must be kept broom clean and free of waste, debris, trash and obstructions caused by work of the contractor, which will affect the condition and safety of streets, walks, utilities, and property.

3.3 ABOVEGROUND PIPING INSTALLATION

The methods of fabrication and installation of the aboveground piping must fully comply with the requirements and recommended practices of NFPA 13 and this specification section.

3.3.1 Protection of Piping Against Earthquake Damage

Seismic restraint is not required.

3.3.2 Piping in Exposed Areas

Install exposed piping without diminishing exit access widths, corridors or equipment access. Exposed horizontal piping, including drain piping, must be installed to provide maximum headroom.

3.3.3 Piping in Finished Areas

In areas with suspended or dropped ceilings and in areas with concealed spaces above the ceiling, piping must be concealed above ceilings. Piping must be inspected, hydrostatically tested and approved before being concealed. Risers and similar vertical runs of piping in finished areas must be concealed.

3.3.4 Pendent Sprinklers

- a. Drop nipples to pendent sprinklers must consist of minimum 1-inch pipe with a reducing coupling into which the sprinkler must be threaded.
- b. Where sprinklers are installed below suspended or dropped ceilings, drop nipples must be cut such that sprinkler ceiling plates or escutcheons are of a uniform depth throughout the finished space. The outlet of the reducing coupling must not extend below the underside of the ceiling.
- c. Recessed pendent sprinklers must be installed such that the distance from the sprinkler deflector to the underside of the ceiling must not exceed the manufacturer's listed range and must be of uniform depth throughout the finished area.
- d. Pendent sprinklers in suspended ceilings must be located in the center of the tile (+/- 2 inches).
- e. Where the maximum static or flowing pressure, whichever is greater at the sprinkler, applied other than through the fire department connection, exceeds 100 psi and a branch line above the ceiling supplies sprinklers in a pendent position below the ceiling, the cumulative horizontal length of an unsupported armover to a sprinkler or sprinkler drop must not exceed 12 inches for steel pipe and 6 inches for copper tube.
- f. Sprinklers installed in the pendent position must be of the listed dry

pendent type or on return bends, unless otherwise indicated.

3.3.5 Upright Sprinklers

Riser nipples or "sprigs" to upright sprinklers must contain no fittings between the branch line tee and the reducing coupling at the sprinkler.

3.3.6 Pipe Joints

Pipe joints must conform to NFPA 13, except as modified herein. Not more than four threads must show after joint is made up. Welded joints will be permitted, only if welding operations are performed as required by NFPA 13 at the Contractor's fabrication shop, not at the project construction site. Flanged joints must be provided where indicated or required by NFPA 13. Grooved pipe and fittings must be prepared in accordance with the manufacturer's latest published specification according to pipe material, wall thickness and size. Grooved couplings, fittings and grooving tools must be products of the same manufacturer. For copper tubing, pipe and groove dimensions must comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field must be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe must be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances.

3.3.7 Reducers

Reductions in pipe sizes cannot be made with one-piece tapered reducing fittings. When standard fittings of the required size are not manufactured, single bushings of the face or hex type will be permitted. Where used, face bushings must be installed with the outer face flush with the face of the fitting opening being reduced. Bushings must not be used in elbow fittings, in more than one outlet of a tee, in more than two outlets of a cross, or where the reduction in size is less than 1/2-inch.

3.3.8 Pipe Penetrations

- a. Cutting structural members for passage of pipes or for pipe-hanger fastenings will not be permitted. Pipes that must penetrate concrete or masonry walls or concrete floors must be core-drilled and provided with pipe sleeves. Each sleeve must be Schedule 40 galvanized steel, ductile-iron or cast-iron pipe and extend through its respective wall or floor and be cut flush with each wall surface. Sleeves must provide required clearance between the pipe and the sleeve per NFPA 13. The space between the sleeve and the pipe must be firmly packed with mineral wool insulation.
- b. Where pipes and sleeves penetrate fire walls, fire partitions, or floors, pipes/sleeves must be firestopped in accordance with Section 07 84 00 FIRESTOPPING.
- c. In penetrations that are not fire-rated or not a floor penetration, the space between the sleeve and the pipe must be sealed at both ends with plastic waterproof cement that will dry to a firm but pliable mass or with a mechanically adjustable segmented elastomer seal.
- d. All penetrations through the boundary of rooms/areas identified as

secure space area must meet ICS 705-1.

3.3.9 Escutcheons

Escutcheons must be provided for pipe penetration in finished areas of ceilings, floors and walls. Escutcheons must be securely fastened to the pipe at surfaces through which piping passes.

3.3.10 Inspector's Test Connection

Unless otherwise indicated, the test connection must consist of 1-inch pipe connected to the remote branch line; a test valve located approximately 7 feet above the floor; a smooth bore brass outlet equivalent to the smallest orifice sprinkler used in the system; and a painted metal identification sign affixed to the valve with the words "Inspector's Test". All test connection piping must be inside of the building and penetrate the exterior wall at the location of the discharge orifice only. The discharge orifice must be located outside the building wall no more than 2 feet above finished grade, directed so as not to cause damage to adjacent construction or landscaping during full flow discharge, or to the sanitary sewer. Discharge to the exterior must not interfere with exiting from the facility. Water discharge or runoff must not cross the path of egress from the building. Do not discharge to the roof. Discharge to floor drains, janitor sinks or similar fixtures is not permitted.

Provide concrete splash blocks at all drain and inspector's test connection discharge locations if not discharging to a concrete surface. Splash blocks must be large enough to mitigate erosion and not become dislodged during a full flow of the drain. Ensure all discharged water drains away from the facility and does not cause property damage.

3.3.11 Backflow Preventer

Locate within the building or in a heated enclosure in locations subject to freezing. For heated enclosures, provide a low temperature supervisory alarm connected to the facility fire alarm system. Heat trace is not permitted to be used.

Install backflow preventers so that the bottom of the assembly is a minimum of 6 inches above the finished floor/grade. Install horizontal backflow preventers so that the bottom of the assembly is no greater than 24 inches above the finished floor/grade. Clearance around control valve handles must be minimum 6 inches above grade/finished floor and away from walls.

3.3.11.1 Test Connection

Provide downstream of the backflow prevention assembly UL 668 hose valves with 2.5-inch National Standard male hose threads with cap and chain. Provide one valve for each 250 gpm of system demand or fraction thereof. Provide a permanent sign in accordance with paragraph entitled "Identification Signs" which reads, "Test Valve". Indicate location of test header. If an exterior connection, provide a control valve inside a heated mechanical room to prevent freezing. The piping between the backflow preventer test header control valve and the exterior test header must be provided with an automatic drip arranged to drain to the outside.

3.3.12 Drains

- a. Main drain piping must be provided to discharge at a safe point outside the building, no more than 2 feet above finished grade at the location indicated. Provide a concrete splash block at drain outlet. Discharge to the exterior must not interfere with exiting from the facility. Water discharge or runoff must not cross the path of egress from the building.
- b. Auxiliary drains must be provided as required by NFPA 13. Auxiliary drains are permitted to discharge to a floor drain if the drain is sized to accommodate full flow (min 40 gpm). Discharge to service sinks or similar plumbing fixtures is not permitted.

3.3.13 Installation of Fire Department Connection

Connection must be mounted on the exterior wall approximately 3 feet above finished grade. The piping between the connection and the check valve must be provided with an automatic drip in accordance with NFPA 13 and piped to drain to the outside or a floor drain within the same room.

3.3.14 Identification Signs

Signs must be affixed to each control valve, inspector test valve, main drain, auxiliary drain, test valve, and similar valves as appropriate or as required by NFPA 13. Main drain test results must be etched into main drain identification sign. Hydraulic design data must be etched into the nameplates and permanently affixed to each sprinkler riser as specified in NFPA 13. Provide labeling on the surfaces of all feed and cross mains to show the pipe function (e.g., "Sprinkler System", "Fire Department Connection", "Standpipe") and normal valve position (e.g. "Normally Open", "Normally Closed"). For pipe sizes 4-inch and larger provide white painted stenciled letters and arrows, a minimum of 2 inches in height and visible from at least two sides when viewed from the floor. For pipe sizes less than 4-inch, provide white painted stenciled letters and arrows, a minimum of 0.75-inch in height and visible from the floor.

3.4 ELECTRICAL

Except as modified herein, electric equipment and wiring must be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Alarm signal wiring connected to the building fire alarm control system must be by the fire alarm installer.

3.5 PAINTING

Color code mark piping red.

3.6 FIELD QUALITY CONTROL

3.6.1 Test Procedures

Submit detailed test procedures, prepared and signed by the NICET Level III or IV Fire Sprinkler Technician, and the representative of the installing company, and reviewed by the QFPE 60 days prior to performing system tests. Detailed test procedures must list all components of the installed system. Test procedures must include sequence of testing, time estimate for each test, and sample test data forms. The test data forms must be in a check-off format (pass/fail with space to add applicable test data; similar to the forms in NFPA 13.) The test procedures and

accompanying test data forms must be used for the pre-Government testing and the Government final testing.

- a. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

3.6.2 Pre-Government Testing

3.6.2.1 Verification of Compliant Installation

Conduct inspections and tests to ensure that equipment is functioning properly. Tests must meet the requirements of paragraph entitled "Minimum System Tests" and "System Acceptance" as noted in NFPA 13. The Contractor and QFPE must be in attendance at the pre-Government testing to make necessary adjustments. After inspection and testing is complete, provide a signed Verification of Compliant Installation letter by the QFPE that the installation is complete, compliant with the specification and fully operable. The letter must include the names and titles of the witnesses to the pre-Government tests. Provide all completion documentation as required by NFPA 13 and the test reports noted below.

- a. NFPA 13 Aboveground Material and Test Certificate
- b. NFPA 13 Underground Material and Test Certificate

3.6.2.2 Request for Government Final Test

When the verification of compliant installation has been completed, submit a formal request for Government final test to the Contracting Officers Designated Representative (COR). Government final testing will not be scheduled until the DFPE has received copies of the request for Government final testing and Verification of Compliant Installation letter with all required reports. Government final testing will not be performed until after the connections to the building fire alarm system have been completed and tested to confirm communications are fully functional. Submit request for test at least 15 calendar days prior to the requested test date.

3.6.3 Correction of Deficiencies

If equipment was found to be defective or non-compliant with contract requirements, perform corrective actions and repeat the tests. Tests must be conducted and repeated if necessary until the system has been demonstrated to comply with all contract requirements.

3.6.4 Government Final Tests

The tests must be performed in accordance with the approved test procedures in the presence of the DFPE. Furnish instruments and personnel required for the tests. The following must be provided at the job site for Government Final Testing:

- a. The manufacturer's technical representative.
- b. Marked-up red line drawings of the system as actually installed.

Government Final Tests will be witnessed by the Contracting Officer, Qualified Fire Protection Engineer (QFPE). At this time, all required

tests noted in the paragraph "Minimum System Tests" must be repeated at their discretion.

3.7 MINIMUM SYSTEM TESTS

The system, including the underground water mains, and the aboveground piping and system components, must be tested to ensure that equipment and components function as intended. The underground and aboveground interior piping systems and attached appurtenances subjected to system working pressure must be tested in accordance with NFPA 13 and NFPA 24.

3.7.1 Underground Piping

3.7.1.1 Flushing

Underground piping must be flushed in accordance with NFPA 24.

3.7.1.2 Hydrostatic Test

New underground piping must be hydrostatically tested in accordance with NFPA 24.

3.7.2 Aboveground Piping

3.7.2.1 Hydrostatic Test

Aboveground piping must be hydrostatically tested in accordance with NFPA 13. There must be no drop in gauge pressure or visible leakage when the system is subjected to the hydrostatic test. The test pressure must be read from a gauge located at the low elevation point of the system or portion being tested.

3.7.2.2 Air Pressure Test

As specified in NFPA 13, an air pressure leakage test at 50 psi must be conducted for 24 hours. There must be no drop in gauge pressure in excess of 1.5 psi for the 24 hours. This air pressure test is in addition to the required hydrostatic test.

3.7.2.3 Backflow Prevention Assembly Forward Flow Test

Each backflow prevention assembly must be tested at system flow demand, including all applicable hose streams, as specified in NFPA 13. The Contractor must provide all equipment and instruments necessary to conduct a complete forward flow test, including 2.5-inch diameter hoses, playpipe nozzles or flow diffusers, calibrated pressure gauges, and pitot tube gauge. The Contractor must provide all necessary supports to safely secure hoses and nozzles during the test. At the system demand flow, the pressure readings and pressure drop (friction loss) across the assembly must be recorded. A metal placard must be provided on the backflow prevention assembly that lists the pressure readings both upstream and downstream of the assembly, total pressure drop, and the system test flow rate determined during the preliminary testing. The pressure drop must be compared to the manufacturer's data and the readings observed during the final inspections and tests.

3.7.3 Dry Pipe Valve Trip Test

Each dry pipe valve must be trip-tested by reducing normal system nitrogen

pressure through operation of the inspector's test connection. Systems equipped with quick-opening devices must first be tested without the operation of the quick-opening device and then with it in operation. Test results will be witnessed and recorded. Test results must include the number of seconds elapsed between the time the test valve is opened and tripping of the dry valve; trip-point nitrogen pressure of the dry pipe valve; water pressure prior to valve tripping; and number of seconds elapsed between time the inspector's test valve is opened and water reaches the orifice. The delivery of water from the dry pipe valve to the system test connection must not exceed 60 seconds, regardless of system size. Water delivery times must be measured starting at the normal nitrogen pressure on the system.

3.7.4 Main Drain Flow Test

Following flushing of the underground piping, a main drain test must be made to verify the adequacy of the water supply. Static and residual pressures must be recorded on the certificate specified in paragraph SUBMITTALS.

3.7.5 Supervisory Nitrogen System Test

System supervisory nitrogen pressure must be reduced from the normal system pressure to the point at which a low-pressure alarm is sounded. Nitrogen pressure must be restored to verify trouble signal restoration. Automatic start/stop features of nitrogen generator must be tested.

3.8 SYSTEM ACCEPTANCE

Following acceptance of the system, as-built drawings and O&M manuals must be delivered to the Contracting Officer for review and acceptance. Submit six sets of detailed as-built drawings. The drawings must show the system as installed, including deviations from both the project drawings and the approved shop drawings. These drawings must be submitted within two weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings must be provided at the time of, or prior to the final acceptance test.

- a. Provide one set of full size paper as-built drawings and schematics. The drawings must be prepared electronically and sized no less than the contract drawings. Furnish one set of CDs or DVDs containing software back-up and CAD based drawings in latest version of AutoCAD, DXF and portable document formats of as-built drawings and schematics.
- b. Provide operating and maintenance (O&M) instructions.

3.9 ONSITE TRAINING

Conduct a training course for the responding fire department and operating and maintenance personnel as designated by the Contracting Officer. Training must be performed on two separate days (to accommodate different shifts of Fire Department personnel) for a period of 4 hours of normal working time and must start after the system is functionally complete and after the final acceptance test. The on-site training must cover all of the items contained in the approved Operating and Maintenance Instructions.

-- End of Section --

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE

12/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 1010 (2002) Self-Contained, Mechanically Refrigerated Drinking-Water Coolers

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22 (1999; A 2001) Relief Valves for Hot Water Supply Systems

ANSI Z124.3 (1995) Plastic Lavatories

ANSI Z124.6 (1997) Plastic Sinks

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP (2016) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001 (2002) Atmospheric Type Vacuum Breakers

ASSE 1003 (2001; Errata, 2003) Performance Requirements for Water Pressure Reducing Valves

ASSE 1005 (1999) Water Heater Drain Valves 3/4 Inch Size

ASSE 1010 (2004) Water Hammer Arresters

ASSE 1011 (2004; Errata 2004) Hose Connection Vacuum Breakers

ASSE 1012 (2002) Backflow Preventer with Intermediate Atmospheric Vent

ASSE 1013 (2011) Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire

Protection Principle Backflow Preventers -
(ANSI approved 2010)

ASSE 1017 (2009) Performance Requirements for
Temperature Actuated Mixing Valves for Hot
Water Distribution Systems - (ANSI
approved 2010)

ASSE 1018 (2001) Trap Seal Primer Valves - Potable,
Water Supplied

ASSE 1020 (2004; Errata 2004; Errata 2004) Pressure
Vacuum Breaker Assembly

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084 (2005) Standard Methods for the
Examination of Water and Wastewater

AWWA B300 (2018) Hypochlorites

AWWA B301 (2010) Liquid Chlorine

AWWA C203 (2008) Coal-Tar Protective Coatings and
Linings for Steel Water Pipelines - Enamel
and Tape - Hot-Applied

AWWA C606 (2006) Grooved and Shouldered Joints

AWWA C651 (2014) Standard for Disinfecting Water
Mains

AWWA C652 (2002) Disinfection of Water-Storage
Facilities

AWWA C700 (2015) Cold-Water Meters - Displacement
Type, Metal Alloy Main Case

AWWA C701 (2015) Cold-Water Meters - Turbine Type
for Customer Service

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M (2004; Errata 2004) Specification for
Filler Metals for Brazing and Braze Welding

AWS B2.2 (1991) Brazing Procedure and Performance
Qualification

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.1.2 (2004) Standard for Air Gaps in Plumbing
Systems (For Plumbing Fixtures and
Water-Connected Receptors)

ASME A112.14.1 (2003) Backwater Valves

ASME A112.19.2M (2003) Standard for Vitreous China
Plumbing Fixtures and Hydraulic

	Requirements for Water Closets and Urinals
ASME A112.36.2M	(1991; R 2002) Cleanouts
ASME A112.6.1M	(1997; R 2002) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.6.3	(2001; R 2007) Standard for Floor and Trench Drains
ASME B1.20.1	(1983; R 2006) Pipe Threads, General Purpose (Inch)
ASME B16.12	(1998; R 2006) Cast Iron Threaded Drainage Fittings
ASME B16.15	(1985; R 2004) Cast Bronze Threaded Fittings Classes 125 and 250
ASME B16.18	(2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2016) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2001; R 2005) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2002; Errata 2003; R 2006) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2001) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 400, 600, 900, 1500, and 2500
ASME B16.29	(2001) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.3	(2016) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2004) Valves - Flanged, Threaded and Welding End
ASME B16.4	(2016) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B31.1	(2014; INT 1-47) Power Piping
ASME B31.5	(2001; Addenda 2004) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2006) Pressure Gauges and Gauge Attachments

ASME BPVC SEC IX (2007) Boiler and Pressure Vessel Code;
Section IX, Welding and Brazing
Qualifications

ASME CSD-1 (2016) Control and Safety Devices for
Automatically Fired Boilers

ASTM INTERNATIONAL (ASTM)

ASTM A 105/A 105M (2005) Standard Specification for Carbon
Steel Forgings for Piping Applications

ASTM A 193/A 193M (2007) Standard Specification for
Alloy-Steel and Stainless Steel Bolting
Materials for High-Temperature Service

ASTM A 515/A 515M (2003) Standard Specification for Pressure
Vessel Plates, Carbon Steel, for
Intermediate- and Higher-Temperature
Service

ASTM A 516/A 516M (2006) Standard Specification for Pressure
Vessel Plates, Carbon Steel, for Moderate-
and Lower-Temperature Service

ASTM A 518/A 518M (1999; R 2003) Standard Specification for
Corrosion-Resistant High-Silicon Iron
Castings

ASTM A 53/A 53M (2006a) Standard Specification for Pipe,
Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless

ASTM A 74 (2006) Standard Specification for Cast
Iron Soil Pipe and Fittings

ASTM A 888 (2007a) Standard Specification for Hubless
Cast Iron Soil Pipe and Fittings for
Sanitary and Storm Drain, Waste, and Vent
Piping Applications

ASTM B 117 (2007) Standard Practice for Operating
Salt Spray (Fog) Apparatus

ASTM B 32 (2004) Standard Specification for Solder
Metal

ASTM B 370 (2003) Standard Specification for Copper
Sheet and Strip for Building Construction

ASTM B 42 (2002e1) Standard Specification for
Seamless Copper Pipe, Standard Sizes

ASTM B 813 (2000e1) Standard Specification for Liquid
and Paste Fluxes for Soldering of Copper
and Copper Alloy Tube

ASTM B 828 (2002) Standard Practice for Making

Capillary Joints by Soldering of Copper
and Copper Alloy Tube and Fittings

ASTM B 88	(2003) Standard Specification for Seamless Copper Water Tube
ASTM B 88M	(2005) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C 564	(2003a) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D 2564	(2004) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2665	(2007) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2822	(2005) Asphalt Roof Cement
ASTM D 2855	(1996; R 2002) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3139	(1998; R 2005) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	(1996a; R 2003e1) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3311	(2006a) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM E 1	(2005) Standard Specification for ASTM Liquid-in-Glass Thermometers
ASTM F 409	(2002) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 477	(2007) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2004) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(2004) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings

for Sanitary and Storm Drain, Waste, and
Vent Piping Applications

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015 (1994; R 1995) Copper Tube Handbook

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH
(FCCCHR)

FCCCHR Manual (1988e9) Manual of Cross-Connection Control

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1 (2003; R 2004) Standard for Accessible and
Usable Buildings and Facilities

ICC NCPC (2006) North Carolina Plumbing Code

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-110 (1996) Ball Valves Threaded,
Socket-Welding, Solder Joint, Grooved and
Flared Ends

MSS SP-25 (1998) Standard Marking System for Valves,
Fittings, Flanges and Unions

MSS SP-58 (2002) Standard for Pipe Hangers and
Supports - Materials, Design and
Manufacture

MSS SP-67 (2002a; R 2004) Standard for Butterfly
Valves

MSS SP-69 (2003; R 2004) Standard for Pipe Hangers
and Supports - Selection and Application

MSS SP-70 (2006) Standard for Cast Iron Gate Valves,
Flanged and Threaded Ends

MSS SP-71 (2018) Gray Iron Swing Check Valves,
Flanged and Threaded Ends

MSS SP-72 (1999) Standard for Ball Valves with
Flanged or Butt-Welding Ends for General
Service

MSS SP-73 (2003) Brazing Joints for Copper and
Copper Alloy Pressure Fittings

MSS SP-78 (2005a) Cast Iron Plug Valves, Flanged and
Threaded Ends

MSS SP-80 (2019) Bronze Gate, Globe, Angle and Check
Valves

MSS SP-85 (2002) Standard for Cast Iron Globe &

Angle Valves, Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 31 (2016) Standard for the Installation of Oil-Burning Equipment
- NFPA 54 (2018) National Fuel Gas Code
- NFPA 90A (2015) Standard for the Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

- NSF 61 (2007) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

- PPFA-01 (1998) Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

- PDI WH 201 (2006) Water Hammer Arresters Standard

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

- SAE J1508 (1997) Hose Clamp Specifications

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

- PL 93-523 (1974; A 1999) Safe Drinking Water Act

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- PL 102-486 (1992) Residential Energy Efficiency Ratings

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System

Detail drawings consisting of schedules, performance charts, instructions, diagrams, and other information to illustrate the requirements and operations of systems that are not covered by the Plumbing Code.. Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection

diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details shall include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, shall be drawn to scale.

SD-03 Product Data

Fixtures

List of installed fixtures with manufacturer, model, and flow rate.

Flush valve water closets

Wall hung lavatories

Countertop lavatories

Service sinks

Drinking-water coolers

Pumps

Backflow prevention assemblies

Shower Faucets

Welding

Vibration-Absorbing Features

Plumbing System

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

SD-06 Test Reports

Tests, Flushing and Disinfection

Test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

Test of Backflow Prevention Assemblies.

Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor shall have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation of the tests performed and signed by the individual performing the tests.

Prefunctional Construction Checklists.

Completed Prefunctional Construction Checklist provided by Commissioning Authority shall be completed and submitted to Government's Commissioning Authority.

SD-07 Certificates

Materials and Equipment

Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation shall conform to the code.

Bolts

Written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements.

SD-09 Manufacturer's Field Reports

Completed start up report by manufacturer representative or certified equipment start up person documenting manufacturer's recommended start up procedure.

SD-10 Operation and Maintenance Data

Plumbing System; G.

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.3 STANDARD PRODUCTS

Specified materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.3.1 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.3.2 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment

installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.3.3 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.3.4 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.3.4.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.3.4.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.5 PERFORMANCE REQUIREMENTS

1.5.1 Welding

Piping shall be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests, and the tests shall be performed at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld

they make as a permanent record.

1.5.2 Plumbing Fixtures

Water flow and consumption rates shall at a minimum comply with requirements in PL 102-486.

1.6 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work shall be in accordance with ICC NPCC.

1.7 PROJECT/SITE CONDITIONS

The Contractor shall become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.8 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

1.9 ACCESSIBILITY OF EQUIPMENT

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 MATERIALS

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Material or equipment containing lead shall not be used in any potable water system. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets,

residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF 61, Section 9. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors. Plastic pipe shall not be installed in air plenums.

2.1.1.1 Pipe Joint Materials

Hubless cast-iron soil pipe shall not be used under ground. Solder containing lead shall not be used with copper pipe. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Institute. Joints and gasket materials shall conform to the following:

- a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A 74, AWWA C606. For hubless type: CISPI 310
- b. Coupling for Steel Pipe: AWWA C606.
- c. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
- d. Brazing Material: Brazing material shall conform to AWS A5.8/A5.8M, BCuP-5.
- e. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.
- f. Solder Material: Solder metal shall conform to ASTM B 32.
- g. Solder Flux: Flux shall be liquid form, non-corrosive, and conform to ASTM B 813, Standard Test 1.
- h. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe.
- i. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C 564.
- j. Flexible Elastomeric Seals: ASTM D 3139, ASTM D 3212 or ASTM F 477.
- k. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D 2564 and ASTM D 2855.
- l. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A 105/A 105M. Blind flange material shall conform to ASTM A 516/A 516M cold service and ASTM A 515/A 515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A 193/A 193M.

2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

- a. Water Hammer Arrestor: PDI WH 201. Water hammer arrester shall be diaphragm or piston type.
- b. Copper, Sheet and Strip for Building Construction: ASTM B 370.
- c. Asphalt Roof Cement: ASTM D 2822.
- d. Hose Clamps: SAE J1508.
- e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.
- f. Metallic Cleanouts: ASME A112.36.2M.
- g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.
- h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.
- i. Hypochlorites: AWWA B300.
- j. Liquid Chlorine: AWWA B301.
- k. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.
- l. Thermometers: ASTM E 1. Mercury shall not be used in thermometers.

2.1.3 Pipe Insulation Material

Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69.

2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70

Description	Standard
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASSE 1005
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

2.3.1 Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

2.3.2 Wall Faucets

Wall faucets with vacuum-breaker backflow preventer shall be brass with 3/4 inch male inlet threads, hexagon shoulder, and 3/4 inch hose connection. Faucet handle shall be securely attached to stem.

2.3.3 Yard Hydrants

Yard box or post hydrants shall have valve housings located below frost lines. Water from the casing shall be drained after valve is shut off. Hydrant shall be bronze with cast-iron box or casing guard. "T" handle key shall be provided.

2.3.4 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22. Relief valves for systems where the maximum rate of heat input is less than 200,000 Btuh shall have 3/4 inch minimum inlets, and 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 200,000 Btuh shall have 1 inch minimum inlets, and 1 inch outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.3.5 Thermostatic Mixing Valves

Provide thermostatic mixing valve for lavatory faucets. Mixing valves, thermostatic type, pressure-balanced or combination thermostatic and pressure-balanced shall be line size and shall be constructed with rough or finish bodies either with or without plating. Each valve shall be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element shall be of an approved type. The body shall be of heavy cast bronze, and interior parts shall be brass, bronze, corrosion-resisting steel or copper. The valve shall be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets. Mixing valves shall maintain water temperature within 5 degrees F of any setting.

2.4 FIXTURES

Fixtures shall be water conservation type, in accordance with ICC NCPC. Fixtures for use by the physically handicapped shall be in accordance with ICC A117.1. Vitreous china, nonabsorbent, hard-burned, and vitrified throughout the body shall be provided. Porcelain enameled ware shall have specially selected, clear white, acid-resisting enamel coating evenly applied on surfaces. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures shall be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the

material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years. Plastic in contact with hot water shall be suitable for 180 degrees F water temperature.

2.4.1 Lavatories

Vitreous china lavatories shall be provided with two integral molded lugs on the back-underside of the fixture and drilled for bolting to the wall in a manner similar to the hanger plate.

2.4.2 Flush Valve Water Closets

ASME A112.19.2M, white vitreous china, siphon jet, elongated bowl, floor-mounted, back outlet. Top of toilet seat height above floor shall be 14 to 15 inches, except 17 to 19 inches for accessible water closets. Provide wax bowl ring including plastic sleeve. Water flushing should be of the manual dual flush low flow type. The water closet flush valve shall be 1.6 gallons per flush for solid waste and 1.1 gallons per flush for liquid waste. The flush handle should operate such that the liquid waste (1.1 gpf) flush is down, and the solid waste (1.6 gpf) flush is up. Provide black solid plastic elongated open-front seat. Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components shall be chromium-plated or polished stainless steel. Flush valves shall be nonhold-open type. Mount flush valves not less than 11 inches above the fixture. Mounted height of flush valve shall not interfere with the hand rail in ADA stalls.

2.4.3 Wall Hung Lavatories

ASME A112.19.2M, white vitreous china, straight back type, minimum dimensions of 19 inches, wide by 17 inches front to rear, with supply openings for use with top mounted centerset faucets, and openings for concealed arm carrier installation. Provide aerator with faucet. Water flow rate shall not exceed 0.5 gpm when measured at a flowing water pressure of 60 psi. Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports and concealed arms for the lavatory. Mount lavatory with the front rim 34 inches above floor and with 29 inches minimum clearance from bottom of the front rim to floor. Provide top mounted washerless centerset lavatory faucets.

2.4.4 Countertop Lavatories

Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified. Bowl to be integrally molded with countertop, with supply openings for use with top mounted centerset faucets. Countertop to extend 1 inch beyond edge of vanity cabinet on all sides not in contact with a wall. Furnish template and mounting kit by lavatory manufacturer. Provide aerator with faucet. Water flow rate shall not exceed 1.0 gpm when measured at a flowing water pressure of 60 psi. Mount counter with the top surface 34 inches above floor and with 29 inches minimum clearance from bottom of the counter face to floor.

2.4.5 Service Sinks

ASME A112.19.2M, white vitreous china with integral back and wall hanger

supports, minimum dimensions of 22 inches wide by 20 inches front to rear, with two supply openings in 10 inch high back. Provide floor supported wall outlet cast iron P-trap and stainless steel rim guards as recommended by service sink manufacturer. Provide back mounted washerless service sink faucets with vacuum breaker and 0.75 inch external hose threads. Water flow rate shall not exceed 2.2 gpm when measured at a flowing water pressure of 60 psi.

2.4.6 Drinking-Water Coolers

AHRI 1010 with more than a single thickness of metal between the potable water and the refrigerant in the heat exchanger, wall-hung, bubbler style, air-cooled condensing unit, 4.75 gph minimum capacity, stainless steel splash receptor and basin, and stainless steel cabinet. Bubblers shall be controlled by push levers or push bars, front mounted or side mounted near the front edge of the cabinet. Bubbler spouts shall be mounted at maximum of 36 inches above floor and at front of unit basin. Spouts shall direct water flow at least 4 inches above unit basin and trajectory parallel or nearly parallel to the front of unit.

2.5 BACKFLOW PREVENTERS

Backflow preventers shall be approved and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCCHR Manual. Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Pressure vacuum breaker assembly shall conform to ASSE 1020. Air gaps in plumbing systems shall conform to ASME A112.1.2.

2.6 DRAINS

2.6.1 Floor and Shower Drains

Floor and shower drains shall consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains shall be cast iron except where metallic waterproofing membrane is installed. Drains shall be of double drainage pattern for embedding in the floor construction. The seepage pan shall have weep holes or channels for drainage to the drainpipe. The strainer shall be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane shall be provided when required. Drains shall be provided with threaded connection. Between the drain outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C 564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3. Provide drain with trap primer connection, trap primer, and connection piping where noted on the drawings. Primer shall meet ASSE 1018.

2.6.2 Shower Faucets and Drain Fittings

Provide single control pressure equalizing shower faucets with body

mounted from behind the wall with threaded connections. Provide ball joint self-cleaning shower heads. Provide shower heads which deliver a maximum of 2.0 GPM at 80 PSI per Energy Star requirements. Provide separate globe valves or angle valves with union connections in each supply to faucet. Provide back outlet drain fittings for drain installations. Provide shower valve with ball type control handle.

2.6.3 Area Drains

Area drains shall be plain pattern with polished stainless steel perforated or slotted grate and bottom outlet. The drain shall be circular or square with a 12 inch nominal overall width or diameter and 10 inch nominal overall depth. Drains shall be cast iron with manufacturer's standard coating. Grate shall be easily lifted out for cleaning. Outlet shall be suitable for inside caulked connection to drain pipe. Drains shall conform to ASME A112.6.3. Provide drain with trap primer connection, trap primer, and connection piping where noted on the drawings. Primer shall meet ASSE 1018.

2.7 TRAPS

Unless otherwise specified, traps shall be plastic per ASTM F 409. Traps shall be without a cleanout. The depth of the water seal shall be not less than 2 inches. The interior diameter shall be not more than 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout.

2.8 PUMPS

2.8.1 Sump Pumps

Sump pumps shall be of capacities indicated. The pumps shall be of the automatic, electric motor-driven, submerged type, complete with necessary control equipment and with a split or solid cast-iron or steel cover plate. The suction side of each pump shall have a strainer of ample capacity. A float switch assembly, with the switch completely enclosed, shall start and stop each motor at predetermined water levels. Duplex pumps shall be equipped with an automatic alternator to change the lead operation from one pump to the other, and for starting the second pump if the flow exceeds the capacity of the first pump. The discharge line from each pump shall be provided with a union or flange, a nonclog swing check valve, and a stop valve in an accessible location near the pump.

2.8.2 Circulating Pumps

Domestic hot water circulating pumps shall be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump capacities, efficiencies, motor sizes, speeds, and impeller types shall be as shown. Pump and motor shall be supported by the piping on which it is installed. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze. Motor shall be totally enclosed, fan-cooled and shall have sufficient horsepower for the service required. Each pump motor shall be equipped with an electrical disconnecting means. Fractional horsepower pump motors shall have integral thermal overload protection in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Guards shall shield exposed moving parts.

2.8.3 Flexible Connectors

Flexible connectors shall be provided at the suction and discharge of each pump that is 1 hp or larger. Connectors shall be constructed of neoprene, rubber, or braided bronze, with Class 150 standard flanges. Flexible connectors shall be line size and suitable for the pressure and temperature of the intended service.

2.9 DOMESTIC WATER SERVICE METER

Cold water meters 2 inches and smaller shall be positive displacement type conforming to AWWA C700. Cold water meters 2-1/2 inches and larger shall be turbine type conforming to AWWA C701. Meter register shall be indicating, round or straight reading type. Domestic water meters shall report back wirelessly via the basewide Itron Fixed Network 2.0.

2.10 THERMOSTATIC MIXING VALVE

Digitally controlled Thermostatic Mixing Valve (MV-1) shall be provided and installed per manufacturer's instructions with wall mounted bracket(s), brass valve finish, thermostat, RTD sensor/thermometer, shut-off valves on outlet and inlet and maximum acceptable pressure drop of 10 psi at 135 GPM. Valve shall control water temperature to +/- 3 degrees F in accordance with ASSE 1017. Local controller shall display outlet temperature in degrees F and be capable of setpoint adjustment. Lead Free Brass Design with 10 year warranty. Positive shutoff of flow in the event of cold supply line failure or thermostat failure.

2.11 ELECTRICAL WORK

Provide electrical motor driven equipment specified complete with motors, motor starters, and controls as specified herein and in Section 26 20 00, INTERIOR DISTRIBUTION SYSTEM. Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, corresponding to the applications in accordance with NEMA MG 11. Where indicated on drawings, provide polyphase, squirrel-cage medium induction motors with continuous ratings, including motors that are part of a system, that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period.

Controllers and contactors shall have auxiliary contacts for use with the controls provided. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers, including the required monitors and timed restart.

Power wiring and conduit for field installed equipment shall be provided

under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.12 MISCELLANEOUS PIPING ITEMS

2.12.1 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated or copper alloy plates or polished stainless steel finish in finished spaces. Provide paint finish on plates in unfinished spaces.

2.12.2 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide one inch minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material.

2.12.2.1 Sleeves in Masonry and Concrete

Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2.12.3 Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

2.12.4 Pipe Hangers (Supports)

Provide MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

2.12.5 Nameplates

Provide 0.125 inch thick melamine laminated plastic nameplates, black matte finish with white center core, for equipment, gages, thermometers, and valves; valves in supplies to faucets will not require nameplates. Accurately align lettering and engrave minimum of 0.25 inch high normal block lettering into the white core. Minimum size of nameplates shall be 1.0 by 2.5 inches. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed

near each system. Furnish two copies of each chart and schedule.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

Piping located in air plenums shall conform to NFPA 90A requirements. Plastic pipe shall not be installed in air plenums. Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA-01. The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Water and drainage piping shall be extended 5 feet outside the building, unless otherwise indicated. A gate valve or full port ball valve and drain shall be installed on the water service line inside the building approximately 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except as allowed by NCPC. Exterior underground utilities shall be at least 12 inches below the finish grade or as indicated on the drawings. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

The piping shall be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

3.1.1.4 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and

worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings, except that bending of pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

Pipe drains indicated shall consist of 3/4 inch hose bibb with renewable seat and ball valve ahead of hose bibb. At other low points, 3/4 inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, etc., where indicated and/or required. Risers shall be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.

3.1.1.7 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 4 inches in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by

galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.1.1.8 Commercial-Type Water Hammer Arresters

Commercial-type water hammer arresters shall be provided on hot- and cold-water supplies and shall be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to ASSE 1010. Vertical capped pipe columns will not be permitted.

3.1.2 Thermostatic Mixing Valve

Digitally controlled Thermostatic Mixing Valve (MV-1) shall be provided and installed per manufacturer's instructions with wall mounted bracket(s).

3.1.3 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.1.3.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.1.3.2 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 2-1/2 inches and smaller; flanges shall be used on pipe sizes 3 inches and larger.

3.1.3.3 Cast Iron Soil, Waste and Vent Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.1.3.4 Copper Tube and Pipe

- a. Brazed. Brazed joints shall be made in conformance with AWS B2.2, MSS SP-73, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.
- b. Soldered. Soldered joints shall be made with flux and are only acceptable for piping 2 inches and smaller. Soldered joints shall conform to ASME B31.5 and CDA A4015. Soldered joints shall not be used in compressed air piping between the air compressor and the

receiver.

3.1.4 Dissimilar Pipe Materials

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

3.1.5 Pipe Sleeves and Flashing

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.1.5.1 Sleeve Requirements

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for supply, drainage, waste and vent pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 4 inches above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed as indicated with sealants conforming to ASTM C 920 and with a primer, backstop material and surface preparation as specified in Section 07 92 00 JOINT SEALANTS. The annular space between pipe and sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed

1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and masonry wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07 84 00 FIRESTOPPING.

3.1.5.2 Flashing Requirements

Pipes passing through roof shall be installed through a 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.1.5.3 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 1/4 to 1/2 inch wide by 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07 92 00 JOINT SEALANTS.

3.1.5.4 Pipe Penetrations

Provide sealants for all pipe penetrations. All pipe penetrations shall be sealed to prevent infiltration of air, insects, and vermin.

3.1.6 Fire Seal

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07 84 00 FIRESTOPPING.

3.1.7 Supports

3.1.7.1 General

Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent

buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.1.7.2 Pipe Hangers, Inserts, and Supports

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.
- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and shall have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.
- e. Type 20 attachments used on angles and channels shall be furnished with an added malleable-iron heel plate or adapter.
- f. Type 24 may be used only on trapeze hanger systems or on fabricated frames.
- g. Type 39 saddles shall be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.
- h. Type 40 shields shall:
 - (1) Be used on insulated pipe less than 4 inches.
 - (2) Be used on insulated pipe 4 inches and larger when the temperature of the medium is 60 degrees F or less.
 - (3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 8 pcf or greater.
- i. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Operating temperatures in determining hanger spacing for PVC pipe shall be 120 degrees F. Horizontal pipe runs shall include allowances for expansion and contraction.
- j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 15 feet nor more than 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

- k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:
 - (1) On pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.
 - (2) On pipe less than 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
 - (3) On pipe 4 inches and larger carrying medium less than 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.
- l. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.
- m. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 4 inches or by an amount adequate for the insulation, whichever is greater.
- n. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

3.1.7.3 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

3.1.8 Welded Installation

Plumbing pipe weldments shall be as indicated. Changes in direction of piping shall be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings shall be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.1. Weld defects shall be removed and repairs made to the weld, or the weld joints shall be entirely removed and rewelded. After filler metal has been removed from its original package, it shall be protected or stored so that its

characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.9 Pipe Cleanouts

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe, where indicated, shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs, except plastic plugs shall be installed in plastic pipe. Plugs shall be the same size as the pipe up to and including soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron.

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

3.2.1 Relief Valves

No valves shall be installed between a relief valve and its water heater or storage tank. The P&T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the P&T valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 6 inches above the top of the tank or water heater.

3.2.2 Installation of Gas- and Oil-Fired Water Heater

Installation shall conform to NFPA 54 for gas fired and NFPA 31 for oil fired.

3.2.3 Heat Traps

Provide integral, factory manufactured or piping arranged heat traps on piping to and from each water heater and hot water storage tank on both hot and cold water connection. Piping arranged heat trap shall incorporate a minimum 12 inch deep loop to restrict natural tendency of hot water to rise during standby periods.

3.2.4 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.2.5 Expansion Tank

A pre-charged expansion tank shall be installed on the cold water supply between the water heater inlet and the cold water supply shut-off valve. The Contractor shall adjust the expansion tank air pressure, as recommended by the tank manufacturer, to match incoming water pressure.

3.2.6 Direct Fired and Domestic Water Heaters

Notify the Contracting Officer when any direct fired domestic water heater over 117,124.2 Watts (400,000 BTU/hour) is operational and ready to be inspected and certified.

3.3 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons shall be as specified. Drain lines and hot water lines of fixtures for handicapped personnel shall be insulated and do not require polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.3.1 Fixture Connections

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings shall be provided. Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.3.2 Installation and Start Up of Gas-Fired Water Heater

3.3.2.1 Installation

Installation shall conform to NFPA 54 for gas fired appliances.

3.3.2.2 Manufacturer Start-Up

Hot Water Heater Boiler start-up shall be performed by manufacturer technical start-up personnel.

3.3.3 Flushometer Valves

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be installed 39 inches above the floor, except at water closets intended for use by the physically handicapped where flushometer valves shall be mounted at approximately 30 inches above the floor and arranged to avoid interference with grab bars. In addition, for water closets intended for handicap use, the flush valve handle shall be installed on the wide side of the enclosure.

3.3.4 Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

3.3.5 Fixture Supports

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.5.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.3.5.2 Support for Concrete-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the concrete wall using through bolts and a back-up plate.

3.3.5.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.3.5.4 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 1/4 inch thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

3.3.5.5 Wall-Mounted Water Closet Gaskets

Where wall-mounted water closets are provided, reinforced wax, treated felt, or neoprene gaskets shall be provided. The type of gasket furnished shall be as recommended by the chair-carrier manufacturer.

3.3.6 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with ICC NCPC at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

3.3.7 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 2 inches above the flood rim of the funnel to provide an acceptable air gap.

3.3.8 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type. Traps installed on plastic pipe may be plastic conforming to ASTM D 3311. Traps for acid-resisting waste shall be of the same material as the pipe.

3.4 VIBRATION-ABSORBING FEATURES

Mechanical equipment, including compressors and pumps, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors. Isolation unit installation shall limit vibration to 10 percent of the lowest equipment rpm.

3.5 IDENTIFICATION SYSTEMS

3.5.1 Identification Tags

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 1-3/8 inch minimum diameter, and marking shall be stamped or

engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.6 ESCUTCHEONS

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.7 PAINTING

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09 90 00 PAINTS AND COATINGS.

3.7.1 PAINTING OF NEW EQUIPMENT

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

3.7.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B 117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

3.7.1.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

- a. Temperatures Less Than 120 Degrees F: Immediately after cleaning,

the metal surfaces subject to temperatures less than 120 degrees F shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat.

- b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.
- c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

3.8 TESTS, FLUSHING AND DISINFECTION

3.8.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with ICC NCPC, except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, the Contractor must submit a testing procedure to the Contracting Officer for approval.

- a. Drainage and Vent Systems Test. The final test shall include a smoke test.
- b. Building Sewers Tests.
- c. Water Supply Systems Tests. (Pressure tests shall use water - do not use air pressure)

3.8.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies. Gauges shall be tested annually for accuracy in accordance with the University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14). Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of
Gauges	

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.8.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.8.3 System Flushing

3.8.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with hot potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Contractor shall provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration.

3.8.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Comply with ASHRAE 90.1 - IP for minimum efficiency requirements.

3.8.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Coordinate operational test and equipment installation with commissioning as specified in Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

- a. Time, date, and duration of test.
- b. Water pressures at the most remote and the highest fixtures.
- c. Operation of each fixture and fixture trim.

- d. Operation of each valve, hydrant, and faucet.
- e. Pump suction and discharge pressures.
- f. Temperature of each domestic hot-water supply.
- g. Operation of each floor and roof drain by flooding with water.
- h. Operation of each vacuum breaker and backflow preventer.
- i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.
- j. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2 hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

3.8.5 Disinfection

After operational tests are complete, the entire domestic hot- and cold-water distribution system shall be disinfected. System shall be flushed as specified, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Except as herein specified, water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). A properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump, shall be used. If after the 24 hour and 6 hour holding periods, the residual solution contains less than 25 ppm and 50 ppm chlorine respectively, flush the piping and tank with potable water, and repeat the above procedures until the required residual chlorine levels are satisfied. The system including the tanks shall then be flushed with clean water until the residual chlorine level is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. Samples of water in disinfected containers shall be obtained from several locations selected by the Contracting Officer. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA 10084. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. Disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.9 WASTE MANAGEMENT

Place materials defined as hazardous or toxic waste in designated containers. Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal. Close and seal tightly partly used sealant and adhesive containers and store in protected, well-ventilated, fire-safe area at moderate temperature. Place used sealant and adhesive tubes and containers in areas designated for hazardous waste. Separate copper and ferrous pipe waste in accordance with the Waste Management Plan

and place in designated areas for reuse.

3.10 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.11 TABLES

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE					
Item #	Pipe and Fitting Materials	A	B	C	D	E	F
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A 74 with compression gaskets. Pipe and fittings shall be marked with the CISPI trademark.	X	X	X	X	X	
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A 888. Pipe and fittings shall be marked with the CISPI trademark.		X	X	X	X	
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X		X	X		
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X	X	
5	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X	X	
6	Steel pipe, seamless galvanized, ASTM A 53/A 53M, Type S, Grade B	X			X	X	
7	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X	
8	Cast copper alloy solder joint pressure fittings, ASME B16.18 for use with Item 14				X	X	

TABLE I
PIPE AND FITTING MATERIALS FOR
DRAINAGE, WASTE, AND VENT PIPING SYSTEMS

		SERVICE					
Item #	Pipe and Fitting Materials	A	B	C	D	E	F
9	Seamless copper pipe, ASTM B 42				X		
10	Cast bronze threaded fittings, ASME B16.15				X	X	
11	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X	
12	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X	
13	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D 2665,	X	X	X	X	X	X
14	High-silicon content cast iron pipe and fittings (hub and spigot, and mechanical joint), ASTM A 518/A 518M		X			X	X

SERVICE:

- A - Underground Building Soil, Waste and Storm Drain
- B - Aboveground Soil, Waste, Drain In Buildings
- C - Underground Vent
- D - Aboveground Vent
- E - Interior Rainwater Conductors Aboveground
- F - Corrosive Waste And Vent Above And Belowground
- * - Hard Temper

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

		SERVICE			
Item No.	Pipe and Fitting Materials	A	B	C	D
1	Seamless copper pipe, ASTM B 42	X	X		X
2	Seamless copper water tube, ASTM B 88, ASTM B 88M	X**	X**	X**	X***
3	Cast bronze threaded fittings, ASME B16.15 for use	X	X		X

TABLE II
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item No.	Pipe and Fitting Materials	SERVICE			
		A	B	C	D
	with Items 5 and 7				
4	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5, 7 and 8	X	X	X	X
5	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 8	X	X	X	X
6	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B 828	X	X		

A - Cold Water Service Aboveground

B - Hot and Cold Water Distribution 180 degrees F Maximum Aboveground

C - Compressed Air Lubricated

D - Cold Water Service Belowground

Indicated types are minimum wall thicknesses.

* - PEX shall only be used where called for on the drawings

** - Type L - Hard

*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors

**** - In or under slab floors only brazed joints

3.12 FUNCTIONAL TESTING AND ACCEPTANCE

3.12.1 Commissioning Functional Testing

Commissioning Authority will document and witness functional testing of the following equipment. Functional testing shall be completed after contractor has completed the Prefunctional Construction Checklists, performed overall system operational tests.

- a. Domestic Hot Water Heater
- b. Domestic Hot Water Recirculation Pump
- c. Thermostatic Mixing Valves

Functional testing shall consist of dynamically testing the function, modes of operation and operational functional performance of the equipment and systems to be commissioned.

3.12.2 Acceptance Criteria

The following shall be the minimum requirements for equipment/systems acceptance, subject to any additional acceptance requirements specified or required by the Government.

- a. Plumbing System acceptance shall be granted after the contractor has received approval of all required close out documentation.
- b. Completion of all required system and equipment QC testing specified.
- c. Completion of successful Functional testing.
- d. Performance Verification Testing performed by the Government.
- e. Training has been performed and accepted by the owner.
- f. Accepted resolution of all punch list items and Commissioning Issues.

-- End of Section --

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SECTION 23 03 00.00

BASIC MECHANICAL MATERIALS AND METHODS
04/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117 (2016) Standard Practice for Operating
Salt Spray (Fog) Apparatus

INTERNATIONAL CODE COUNCIL (ICC)

ICC IFGC (2015) International Fuel Gas Code

ICC IMC (2015) International Mechanical Code

ICC IPC (2015) International Plumbing Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2016; SUPP 2016) Motors and Generators

NEMA MG 11 (1977; R 2012) Energy Management Guide for
Selection and Use of Single Phase Motors

1.2 SUBMITTALS

Government approval is required for all submittals.

1.3 RELATED REQUIREMENTS

This section applies to all sections of Divisions: 21, FIRE SUPPRESSION; 22, PLUMBING; and 23, HEATING, VENTILATING, AND AIR CONDITIONING of this project specification, unless specified otherwise in the individual section.

1.4 QUALITY ASSURANCE

1.4.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use must include applications of equipment and materials under similar circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.4.2 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.4.3 Service Support

The equipment items must be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations must be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.4.4 Manufacturer's Nameplate

For each item of equipment, provide a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.4.5 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.4.5.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions must be considered mandatory, the word "should" is interpreted as "must." Reference to the "code official" must be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" must be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" must be interpreted to mean the "lessor." References to the "permit holder" must be interpreted to mean the "Contractor."

1.4.5.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, must be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors must conform to and have electrical connections provided under Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Controllers and contactors shall have a maximum of 120 volt control circuits, and must have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work must be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment must be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.6.1 Motor Voltage

Provide motors rated for the voltage supplied. Motors shall be suitable for use at 90% to 110% of the nominal voltage and shall have a service factor of at least 1.1 at that nominal voltage.

1.6.2 Single Phase Motor Efficiency

Unless otherwise specified, single-phase fractional-horsepower alternating-current motors must be high efficiency types corresponding to the applications listed in NEMA MG 11.

1.6.3 Poly Phase Motor Efficiency

Unless other specified polyphase squirrel-cage induction motors must be premium efficiency with continuous ratings that meet or exceed energy efficient ratings in accordance with Table 12-12 of NEMA MG 1

1.6.4 Three-Phase Motor Protection

Provide controllers for motors rated three horsepower and larger with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

1.7 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors must be thoroughly familiar with all parts of the installation and must be trained in operating theory as well as practical operation and maintenance work.

Instruction must be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished must be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

1.8 ACCESSIBILITY

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

1.9 EQUIPMENT INVENTORY UPDATE

Submit information for each piece of equipment removed and supplied for use of Camp Lejeune to update the Maximo equipment inventory. For the purposes of this paragraph, inventoried equipment is defined as equipment listed on the Maximo Equipment Inventory Update form.

1.9.1 Requirements

The contractor shall prepare and submit one Maximo Equipment Inventory Update form for each individual item of inventoried equipment that is demolished, removed, replaced, or installed. (ex: three new condensing units would require the submission of three Equipment Inventory Update forms. The replacement of two existing air handling units with two new air handling units would require the submission of two Equipment Inventory Update forms). The contractor shall prepare and submit a VAV/TAB Room Number List for each VAV/Tab model installed in a single building. Only one Maximo Equipment Inventory Update form is required for each model of VAV or TAB in a single building.

1.9.1.1 Demolition of all equipment in a structure or facility

When all the inventoried equipment in a building or structure is demolished or removed, and not replaced, an Equipment Inventory Update form is not required.

1.9.2 Standards

The contractor shall provide accurate, complete, and legible information on all required forms. All required forms shall be completed and delivered to the Contracting Officer on or before the Beneficial Occupancy Date. All information on Equipment Inventory Update forms shall be obtained by visual inspection of equipment data plate(s).

1.9.3 Form Preparation

Each required Maximo Equipment Inventory Update form shall contain the following information:

(1) The name and telephone number of an individual who can be contacted for clarification or additional information pertaining to the data on the form.

(2) The date of data collection

(3) The building or structure identification number and the specific location of the equipment within the structure (ex: 3d deck mech room)

- (4) A check adjacent to the description of the new or replacement item, and a check adjacent to the supplemental description if applicable (ex: circulating pump and HVAC or steam)
- (5) The Maximo number or serial number of the demolished or removed item, if applicable
- (6) All applicable data from the equipment data plate

Each Room Number List form shall contain the following information:

- (1) The name and telephone number of the individual providing the information
- (2) The date the form was completed
- (3) The building or structure identification number
- (4) A check in the box adjacent to each applicable room number

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 Manufacturer's Recommendations

All material and equipment shall be installed in accordance with the manufacturer's recommendations for the intended purpose. Use the more stringent methods when manufacturer's recommendations, and plan & specification requirements differ. The contractor shall notify the government of any conflicts between manufacturer's recommendations and plans & specification requirements.

3.2 International Construction Codes

All material, equipment and installation shall be in accordance with the ICC IFGC, ICC IPC, and ICC IMC unless noted otherwise on the drawings and/or specifications. The contractor shall notify the government of any conflicts between ICC code requirements and contract requirements.

3.3 FUNCTIONAL TESTING AND ACCEPTANCE

3.3.1 Commissioning Functional Testing

Commissioning Authority will document and witness functional testing of the following equipment. Functional testing shall be completed after contractor has completed the Prefunctional Construction Checklists, performed overall system operational tests.

- a. Air Cooled Chiller
- b. Chilled Water Pumps
- c. Boilers
- d. Hot Water Pumps

- e. Unit Heaters
- f. Air Handling Units/DOAS
- g. Exhaust Fans
- h. Through Wall Heat Pumps
- i. Ductless Split Systems
- j. Dehumidifiers
- k. HVAC controls

Functional testing shall consist of dynamically testing the function, modes of operation and operational functional performance of the equipment and systems to be commissioned.

3.3.2 Acceptance Criteria

The following shall be the minimum requirements for equipment/systems acceptance, subject to any additional acceptance requirements specified or required by the Government.

- a. HVAC System acceptance shall be granted after the contractor has received approval of all required close out documentation.
- b. Completion of all required system and equipment QC testing specified.
- c. Completion of successful Functional testing
- d. Performance Verification Testing performed by the Government
- e. Training has been performed and accepted by the owner.
- f. Accepted resolution of all punch list items and Commissioning Issues.
- g. Completed Maximo Equipment Inventory Updates
- h. Manufacturer's Field Reports

3.4 PAINTING OF NEW EQUIPMENT

New equipment painting must be factory applied or shop applied, and must be as specified herein, and provided under each individual section.

3.4.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors must withstand 500 hours in a salt-spray fog test. Salt-spray fog test must be in accordance with ASTM B117, and for that test the acceptance criteria must be as follows: immediately after completion of the test, the paint must show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen must show no signs of rust creepage

beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment must not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system must be designed for the temperature service.

3.4.2 Shop Painting Systems for Metal Surfaces

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 120 degrees F must be cleaned to bare metal.

Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat must be aluminum or light gray.

- a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F must receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of 1 mil; and two coats of enamel applied to a minimum dry film thickness of 1 mil per coat.
- b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F must receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum

thickness of 2 mils.

- c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F must receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

MAXIMO EQUIPMENT INVENTORY UPDATE

Employee: _____ Phone: _____ Date: ____/____/____

Bldg: _____ Specific Location: _____

<input type="checkbox"/> AC, Computer Room	<input type="checkbox"/> Heat Pump, Indoor Unit
<input type="checkbox"/> AC, Package	<input type="checkbox"/> Heat Pump, Outdoor Unit
<input type="checkbox"/> AC, Package Terminal	<input type="checkbox"/> Heat Pump, Package
<input type="checkbox"/> Assembly, Trap line	<input type="checkbox"/> Heat Pump, Package Terminal
<input type="checkbox"/> Backflow Preventer	<input type="checkbox"/> Pump, Circulating, Chilled Water
<input type="checkbox"/> Boiler	<input type="checkbox"/> Pump, Circulating, Domestic Water
<input type="checkbox"/> Chiller, Air Cooled Recip	<input type="checkbox"/> Pump, Circulating, Dual Temp Water
<input type="checkbox"/> Chiller, Air Cooled Screw	<input type="checkbox"/> Pump, Circulating, Heating Water
<input type="checkbox"/> Chiller, Air Cooled Scroll	<input type="checkbox"/> Pump, Condensate
<input type="checkbox"/> Chiller, Water Cooled Recip	<input type="checkbox"/> Pump, Sump
<input type="checkbox"/> Chiller, Water Cooled Screw	<input type="checkbox"/> Regulator, Temperature
<input type="checkbox"/> Compressor, Control Air	<input type="checkbox"/> Tank, Hot Water Storage
<input type="checkbox"/> Compressor, Industrial Air	<input type="checkbox"/> Tower, Cooling
<input type="checkbox"/> Dryer, Refrigerated Air	<input type="checkbox"/> Unit, Air Handling
<input type="checkbox"/> Exchanger, Heat	<input type="checkbox"/> Unit, AC Condensing
<input type="checkbox"/> Evaporator, Freezer	<input type="checkbox"/> Unit, Freezer Condensing
<input type="checkbox"/> Evaporator, Refrigerator	<input type="checkbox"/> Unit, Refrigerator Condensing
<input type="checkbox"/> Fan, Exhaust	<input type="checkbox"/> Unit, Fan Coil
<input type="checkbox"/> Generator	<input type="checkbox"/> Unit, TAB (Attach Room No. List)
<input type="checkbox"/> Heater, Space	<input type="checkbox"/> Unit, VAV (Attach Room No. List)
<input type="checkbox"/> Heater, Unit	<input type="checkbox"/> Valve, Pressure Reducing
<input type="checkbox"/> Heat Pump, Geo-Thermal	<input type="checkbox"/> Valve, Steam Pilot
	<input type="checkbox"/> Water Heater

Demolished/Removed Equipment

Maximo no: _____ or Ser no: _____

New Equipment

Manufacturer: _____

Model no: _____

Ser no: _____

Type: ☐Elec ☐Oil ☐LP Gas ☐Nat Gas ☐Steam ☐Water ☐Air

Motor Data: HP_____ Volts_____ Phase_____ RLA_____ RPM_____ Frame_____

Tons_____ No. of Motors_____ no. of Belts_____ Belt size(s)_____ CFM_____

KW_____ Refrig type_____ Refrig Qty_____ Filter Size(s)_____

-- End of Section --

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SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

06/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)

AMCA 203 (1990; R 2011) Field Performance
Measurements of Fan Systems

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

ASHRAE 62.1 (2013) Ventilation for Acceptable Indoor
Air Quality

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (2002; 6th ed) National Standards for
Total System Balance

AABC MN-4 (1996) Test and Balance Procedures

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB MASV (2006) Procedural Standards for
Measurements and Assessment of Sound and
Vibration

NEBB PROCEDURAL STANDARDS (2005) Procedural Standards for TAB
(Testing, Adjusting and Balancing)
Environmental Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
(SMACNA)

SMACNA 1972 CD (1985) HVAC Air Duct Leakage Test Manual,
2nd Edition

SMACNA 1780 (2002) HVAC Systems - Testing, Adjusting
and Balancing, 3rd Edition

SMACNA 1858 (2004) HVAC Sound And Vibration Manual -
First Edition

1.2 DEFINITIONS

- a. AABC: Associated Air Balance Council.
- b. COTR: Contracting Officer's Technical Representative.
- c. DALT: Duct air leakage test
- d. DALT'd: Duct air leakage tested
- e. HVAC: Heating, ventilating, and air conditioning; or heating, ventilating, and cooling.
- f. NEBB: National Environmental Balancing Bureau
- g. Out-of-tolerance data: Pertains only to field acceptance testing of Final DALT or TAB report. When applied to DALT work, this phase means "a leakage rate measured during DALT field acceptance testing which exceeds the leakage rate allowed by Appendix C REQUIREMENTS FOR DUCT AIR LEAK TESTING." When applied to TAB work this phase means "a measurement taken during TAB field acceptance testing which does not fall within the range of plus 5 to minus 5 percent of the design for a specific parameter."
- h. Season of maximum heating load: The time of year when the outdoor temperature at the project site remains below 45 degrees Fahrenheit, throughout the period of TAB data recording.
- i. Season of maximum cooling load: The time of year when the outdoor temperature at the project site remains above 85 degrees Fahrenheit dry bulb and 76 degrees Fahrenheit wet bulb of the project site's summer outdoor design temperature, throughout the period of TAB data recording. The season of maximum cooling load shall fall within June, July, August, or September.
- j. Season 1, Season 2: Depending upon when the project HVAC is completed and ready for TAB, Season 1 is defined, thereby defining Season 2. Season 1 could be the season of maximum heating load, or the season of maximum cooling load.
- k. Sound measurements terminology: Defined in AABC MN-1, NEBB MASV, or SMACNA 1858 (TABB).
- l. TAB: Testing, adjusting, and balancing (of HVAC systems).
- m. TAB'd: HVAC Testing/Adjusting/Balancing procedures performed.
- n. TAB Agency: TAB Firm
- o. TAB team field leader: TAB team field leader
- p. TAB team supervisor: TAB team engineer, TAB specialist.
- q. TAB team technicians: TAB team assistants.
- r. TABB: Testing Adjusting and Balancing Bureau.

1.2.1 Similar Terms

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results.

The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC, NEBB, or TABB requirements where differences exist.

SIMILAR TERMS			
Contract Term	AABC Term	NEBB Term	TABB Term
TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems	International Standards for Environmental Systems Balance
TAB Specialist	TAB Engineer	TAB Supervisor	TAB Supervisor
Systems Readiness Check	Construction Phase Inspection	Field Readiness Check & Preliminary Field Procedures	Field Readiness Check & Prelim. Field Procedures

1.3 WORK DESCRIPTION

The work includes duct air leakage testing (DALT) and testing, adjusting, and balancing (TAB) of new heating, ventilating, and cooling (HVAC) air and water distribution systems including equipment and performance data, ducts, and piping which are located within, on, under, between, and adjacent to buildings.

Perform TAB in accordance with the requirements of the TAB procedural standard recommended by the TAB trade association that approved the TAB Firm's qualifications. Comply with requirements of AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 (TABB) as supplemented and modified by this specification section. All recommendations and suggested practices contained in the TAB procedural standards are considered mandatory.

Conduct DALT and TAB of the indicated existing systems and equipment and submit the specified DALT and TAB reports for approval. Conduct DALT testing in compliance with the requirements specified in SMACNA 1143, except as supplemented and modified by this section. Conduct DALT and TAB work in accordance with the requirements of this section.

1.3.1 Air Distribution Systems

Test, adjust, and balance systems (TAB) in compliance with this section. Obtain Contracting Officer's written approval before applying insulation

to exterior of air distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

1.3.2 Water Distribution Systems

TAB systems in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to water distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. At Contractor's option and with Contracting Officer's written approval, the piping systems may be insulated before systems are TAB'd.

Terminate piping insulation immediately adjacent to each flow control valve, automatic control valve, or device. Seal the ends of pipe insulation and the space between ends of pipe insulation and piping, with waterproof vapor barrier coating.

After completion of work under this section, insulate the flow control valves and devices as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

1.3.3 Related Requirements

Section 23 73 33 HEATING, VENTILATING, AND COOLING SYSTEM applies to work specified in this section.

Specific requirements relating to Reliability Centered Maintenance (RCM) principals and Predictive Testing and Inspection (PTI), by the construction contractor to detect latent manufacturing and installation defects must be followed as part of the Contractor's Quality Control program. Refer to the paragraph titled "Sustainability" for detailed requirements.

Requirements for price breakdown of HVAC TAB work are specified in Section 01 20 00 PRICE AND PAYMENT PROCEDURES.

1.3.4 Projects with Phased Construction

This specification section is structured as though the HVAC construction, and thereby the TAB work, will be completed in a single phase. When the construction is completed in phases, the DALT work and TAB work must be planned, completed, and accepted for each construction phase, unless otherwise noted. At completion of the final phase, compile all reports and submit as one final document.

1.4 SUBMITTALS

All submitted documentation must be typed, neat and organized unless otherwise noted. All reports must have a waterproof front and back cover, a title page, a certification page, sequentially numbered pages throughout, and a table of contents. Tables, lists, and diagrams must be titled. Generate and submit for approval the following documentation:

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES to:

ROICC, Jacksonville, North Carolina Area, 1005 Michael Road, Camp Lejeune, NC 28542-2521

SD-01 Preconstruction Submittals

Independent TAB Agency and Personnel Qualifications

TAB Design Review Report

Pre-Field TAB Engineering Report

DALT and TAB Work Execution Schedule

SD-02 Shop Drawings

TAB Schematic Drawings;

Report Forms;

SD-03 Product Data

Equipment and Performance Data;

Calibration;

TAB procedures;

TAB verification;

SD-06 Test Reports

Pre-Final DALT Report;

Final DALT report;

Pre-Final TAB Report for Proportional Balancing

Pre-Final TAB Report for Season 1;

Pre-FinalTAB Report for Season 2;

Final TAB Report for Proportional Balancing

Final TAB Report for Season 1

Final TAB Report for Season 2

SD-07 Certificates

Independent TAB agency and personnel qualifications

Advance Notice of Final DALT Field Work

1.4.1 Design Review Report

Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

1.4.2 Pre-Field TAB Engineering Report

Submit report containing the following information:

a. Step-by-step TAB procedure:

- (1) Strategy: Describe the method of approach to the TAB field work from start to finish. Include in this description a complete methodology for accomplishing each seasonal TAB field work session.
- (2) Air System Diagrams: Use the contract drawings and duct fabrication drawings if available to provide air system diagrams (TAB Schematic Drawings) in the report showing the location of all terminal outlet supply, return, exhaust and transfer registers, grilles and diffusers. Use a key numbering system on the diagrams which identifies each outlet contained in the outlet airflow report sheets. Show intended locations of all traverses and static pressure readings.
- (3) Procedural steps: Delineate fully the intended procedural steps to be taken by the TAB field team to accomplish the required TAB work of each air distribution system and each water distribution system. Include intended procedural steps for TAB work for subsystems and system components.

b. Pre-field data: Submit AABC or NEBB or SMACNA 1780 data report forms with the following pre-field information filled in:

- (1) Design data obtained from system drawings, specifications, and approved submittals.
- (2) Notations detailing additional data to be obtained from the contract site by the TAB field team.
- (3) Designate the actual data to be measured in the TAB field work.
- (4) Provide a list of the types of instruments, and the measuring range of each, which are anticipated to be used for measuring in the TAB field work. By means of a keying scheme, specify on each TAB data report form submitted, which instruments will be used for measuring each item of TAB data. If the selection of which instrument to use, is to be made in the field, specify from which instruments the choice will be made. Place the instrument key number in the blank space where the measured data would be entered.

c. Prerequisite HVAC work checkout list: Provide a list of inspections and work items which are to be completed by the Contractor. This list must be acted upon and completed by the Contractor and then submitted and approved by the Contracting Officer prior to the TAB team coming to the contract site.

At a minimum, a list of the applicable inspections and work items listed in the NEBB PROCEDURAL STANDARDS, Section III, "Preliminary TAB Procedures" under paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" must be provided for each separate system to be TAB'd.

1.4.3 Work Execution Schedule

Submit a detailed schedule indicating the anticipated calendar date for each submittal and each portion of work required under this section. For each work entry, indicate the support personnel (such as controls provider, HVAC mechanic, etc.) that are needed to accomplish the work. Arrange schedule entries chronologically.

1.4.4 Pre-Final DALT Report for COTR DALT Field Acceptance Testing

Report the data for the Pre-Final DALT Report meeting the following requirements:

- a. Provide notations describing how actual field procedures differed from the procedures listed.
- b. Report format: Submit a comprehensive report for the DALT field work data using data presentation forms equivalent to the "Air Duct Leakage Test Summary Report Forms" located in the SMACNA 1972 CD. In addition, submit in the report, a marked duct shop drawing which identifies each section of duct tested with assigned node numbers for each section. Node numbers shall be included in the completed report forms to identify each duct section.
- c. Calculations: Include a copy of all calculations prepared in determining the duct surface area of each duct test section. Include in the DALT reports copy(s) of the calibration curve for each of the DALT test orifices used for testing.
- d. Instruments: List the types of instruments actually used to measure the data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date. Instruments are to be calibrated within one year of the date of use in the field; instrument calibration is to be traceable to the measuring standards of the National Institute of Standards and Technology.
- e. TAB Supervisor Approval: Include on the submitted report the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

1.4.5 Final DALT Report

On successful completion of all COTR field acceptance testing of the Pre-final DALT Report data for all systems, the TABS Supervisor shall assemble, review, sign and submit the Final DALT Report to the Contracting Officer for approval.

1.4.6 TAB Reports

Submit TAB Report for Proportional Balancing, Season 1, and Season 2 in the following manner:

- a. Procedure Summary: Submit a copy of the approved DALT and TAB Procedures Summary. When applicable, provide notations describing how actual field procedures differed from the procedures listed.
- b. Report format: Submit the completed data forms approved in the pre-field TAB Engineering Report completed by TAB field team,

reviewed, approved and signed by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten for final TAB Report. Handwritten report forms or report data are acceptable for pre-final TAB Report.

- c. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded.
- d. Air System Diagrams: Provided updated diagrams with final installed locations of all terminals and devices, any numbering changes, and actual test locations.
- e. Air Static Pressure Profiles: Report static pressure profiles for all air duct systems. Report static pressure data for all supply, return, exhaust and outside air ducts for the systems listed. The static pressure report data shall include, in addition to AABC or NEBB or TABB required data, the following:

- (1) Report supply fan, return fan, and exhaust fan inlet and discharge static pressures.
- (2) Report static pressure drop across chilled water coils, DX coils, hot water coils, and heat reclaim devices installed in unit cabinetry or the system ductwork.
- (3) Report static pressure drop across outside air, return air, and supply air automatic control dampers, both proportional and two-position, installed in unit cabinetry.
- (4) Report static pressure drop across air filters, air flow measuring stations or other pressure drop producing specialty items installed in unit cabinetry, or in the system ductwork. Examples of these specialty items are smoke detectors.

Do not report static pressure drop across duct fittings provided for the sole purpose of conveying air, such as elbows, transitions, offsets, plenums, manual dampers, and branch takes-offs.

- (5) Report static pressure drop across outside air and relief/exhaust air louvers.
- (6) For air moving systems, report static pressure readings of supply air, return air, exhaust/relief air, and outside air in duct at the point where these ducts connect to each air moving unit and also at the following locations:

Branch Main Ducts: Take readings at branch main ducts.

- f. Duct Transverses: Report duct traverses for main and branch main supply, return, exhaust, relief and outside air ducts. This shall include all ducts, including those which lack 7 1/2 duct diameters upstream and 2 1/2 duct diameters downstream of straight duct unobstructed by duct fittings/offsets/elbows. The TAB Agency shall evaluate and report findings on the duct traverses taken. Evaluate

the suitability of the duct traverse measurement based on satisfying the qualifications for a pitot traverse plane as defined by AMCA 203, "Field Measurements", Section 8, paragraph 8.3, "Location of Traverse Plane".

- g. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

Instrumentation, used for taking wet bulb temperature readings shall provide accuracy of plus or minus 5 percent at the measured face velocities. Submit instrument manufacturer's literature to document instrument accuracy performance is in compliance with that specified.

- h. Certification: Include the type name of the TAB supervisor and the dated signature of the TAB supervisor.
- i. Performance Curves: The TAB Supervisor shall include, in the TAB Reports, factory pump curves and fan curves for pumps and fans TAB'd on the job.
- j. Calibration Curves: The TAB Supervisor shall include, in the TAB Reports, a factory calibration curve for installed flow control balancing valves, flow venturi's and flow orifices TAB'd on the job.
- k. Report flow rates through and pressure drops across all contract applicable hydronic components such as: balancing valves, coils, pumps, chillers, condensers, cooling towers, hot water converters, boilers, and flow measuring devices.

1.5 QUALITY ASSURANCE

1.5.1 Independent TAB Agency and Personnel Qualifications

To secure approval for the proposed agency, submit information certifying that the TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract, including design, furnishing equipment, construction, or commissioning. Further, submit the following, for the agency, to Contracting Officer for approval:

- a. Independent AABC or NEBB or TABB TAB agency:

TAB agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification; or TABB certification number and expiration date of current certification.

TAB team supervisor: Name and copy of AABC or NEBB or TABB TAB supervisor certificate and expiration date of current certification.

TAB team field leader: Name and documented evidence that the team field leader has satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract's bid opening date.

TAB team field technicians: Names and documented evidence that each field technician has satisfactorily assisted a TAB team field

leader in performance of TAB work in the field for not less than one year immediately preceding this contract's bid opening date.

Current certificates: Registrations and certifications are current, and valid for the duration of this contract. Renew Certifications which expire prior to completion of the TAB work, in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification are not to perform TAB work on this contract.

- b. TAB Team Members: TAB team approved to accomplish work on this contract are full-time employees of the TAB agency. No other personnel is allowed to do TAB work on this contract.
- c. Replacement of TAB team members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Contracting Officer.

1.5.1.1 TAB Standard

Perform TAB in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard are considered mandatory. Use the provisions of the TAB Standard, including checklists, report forms, etc., as nearly as practical, to satisfy the Contract requirements. Use the TAB Standard for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, adhere to the manufacturer's recommendations.

All quality assurance provisions of the TAB Standard such as performance guarantees are part of this contract. For systems or system components not covered in the TAB Standard, TAB procedures must be developed by the TAB Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements are considered mandatory, including the latest requirements of ASHRAE 62.1.

1.5.1.2 Qualifications

a. Tab Firm

The TAB Firm must be either a member of AABC or certified by the NEBB or the TABB and certified in all categories and functions where measurements or performance are specified on the plans and specifications, including TAB of environmental systems the performance of clean rooms and clean air devices and the measuring of sound and vibration in environmental systems.

Certification must be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, the Contractor must immediately notify the Contracting Officer and submit another TAB Firm for approval. Any firm that has been the subject of disciplinary

action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award is not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections to be performed by the TAB Firm will be considered invalid if the TAB Firm loses its certification prior to Contract completion and must be performed by an approved successor.

These TAB services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The TAB Firm must be a prime subcontractor of the Contractor and be financially and corporately independent of the mechanical subcontractor, reporting directly to and paid by the Contractor.

b. TAB Specialist

The TAB Specialist must be either a member of AABC, an experienced technician of the Firm certified by the NEBB, or a Supervisor certified by the TABB. The certification must be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, immediately notify the Contracting Officer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award is not eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB Specialist will be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by the approved successor.

c. TAB Related HVAC Submittals

The TAB Specialist must prepare a list of the submittals from the Contract Submittal Register that relate to the successful accomplishment of all HVAC TAB. Accompany the submittals identified on this list with a letter of approval signed and dated by the TAB Specialist when submitted to the Government. Ensure that the location and details of ports, terminals, connections, etc., necessary to perform TAB are identified on the submittals.

1.5.2 Responsibilities

The Contractor is responsible for ensuring compliance with all requirements of this specification section. However, the following delineation of specific work items is provided to facilitate and coordinate execution of the various work efforts by personnel from separate organizations.

1.5.2.1 Contractor

- a. TAB personnel: Ensure that the DALT work and the TAB work is accomplished by a group meeting the requirements specified in paragraph entitled "TAB Personnel Qualification Requirements."
- b. HVAC documentation: Provide pertinent contract documentation to the TAB firm, to include the following: the contract drawings and specifications, copies of the approved submittal data for all HVAC

equipment, air distribution devices, and air/water measuring/balancing devices; the construction work schedule; and other applicable documents requested by TAB firm. Provide the TAB Firm copies of contract revisions and modifications as they occur.

- c. Schedules: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.
- d. Pre-DALT and TAB meetings: Arrange and conduct the Pre-DALT and TAB meetings. Ensure that a representative is present for the sheet metal contractor, the mechanical contractor, the electrical contractor, and the automatic temperature controls contractor.
- e. Coordinate Support: Provide and coordinate support personnel required by the TAB Firm in order to accomplish the DALT and TAB field work. Support personnel may include factory representatives, HVAC controls installer, HVAC equipment mechanics, sheet metal workers, pipe fitters, and insulators. Ensure support personnel are present at the work site at the times required.
- f. Correct Deficiencies: Ensure the notifications of Construction Deficiencies are provided as specified herein. Refer to paragraph entitled "Construction Deficiencies." Correct each deficiency as soon as practical with the Contracting Officer, and submit revised schedules and other required documentation.
- g. Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's pre-field engineering report. Do not allow the TAB team to commence TAB field work until all of the following are completed.
 - (1) HVAC system installations are fully complete.
 - (2) HVAC prerequisite checkout work lists specified in the paragraph "Pre-Field TAB Engineering Report" are completed, submitted, and approved. At a minimum, complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Ensure that the TAB Agency gets a copy of the approved prerequisite HVAC work checklist.
 - (3) DALT field checks for all systems are completed.
 - (4) Provide new throwaway HVAC filters and/or clean washable HVAC filters within seven days before both Season 1 and Season 2 TAB field work.
 - (5) All fan belts on equipment involved in the TAB field work shall be checked, adjusted, and replaced as necessary to bring within the manufacturer's recommended tolerances within seven days before both Season 1 and Season 2 TAB field work.
 - (6) If Season 2 TAB field work is out of compliance, the Contractor shall be responsible for inspecting and cleaning all strainers, hot water, and chilled water coils as necessary, after which Season 2 TAB field work shall be repeated as necessary to prove compliance.

- i. Advance notice: Furnish to the Contracting Officer with advance written notice for the commencement of the DALT field work and for the commencement of the TAB field work.
- j. Insulation work: For required DALT work , ensure that insulation is not installed on ducts to be DALT'd until DALT work on the subject ducts is complete. Later, ensure that openings in duct and machinery insulation coverings for TAB test ports are marked, closed and sealed.

1.5.2.2 TAB Agency

Provide the services of a TAB team which complies with the requirements of paragraph entitled "Independent TAB Agency Personnel Qualifications". The work to be performed by the TAB agency is limited to testing, adjusting, and balancing of HVAC air and water systems to satisfy the requirements of this specification section.

1.5.2.3 TAB Team Specialist

- a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.
- b. Schedule: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.
- c. Submittals: Provide the submittals specified herein.
- d. Pre-DALT/TAB meeting: Attend meeting with Contractor. Ensure TAB personnel that will be involved in the TAB work under this contract attend the meeting.
- e. Design review report: Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.
- f. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the pre-field engineering report, the during the DALT or TAB field work.
- g. Ensure all inspections and verifications for the Pre-Final DALT and Pre-TAB Checklists are completely and successfully conducted before DALT and TAB field work is performed.
- h. Advance Notice: Monitor the completion of the duct system installations and provide the Advance Notice for Pre-Final DALT field work as specified herein.
- e. Pre-field DALT preliminary notification: Monitor the completion of the duct installation of each system and provide the necessary written notification to the Contracting Officer.

- f. Pre-field engineering report: Utilizing the following HVAC-related documentation; contract drawings and specifications, approved submittal data for equipment, up-to-date revisions and change orders; prepare this report.
- g. Prerequisite HVAC work checklist: Ensure the Contractor gets a copy of this checklist at the same time as the pre-field engineering report is submitted.
- h. Technical assistance for DALT work.
 - (1) Technical assistance: Provide immediate technical assistance to TAB field team.
 - (2) DALT field visit: Near the end of the DALT field work effort, visit the contract site to inspect the HVAC installation and the progress of the DALT field work. Conduct a site visit to the extent necessary to verify correct procedures are being implemented and to confirm the accuracy of the Pre-final DALT Report data which has been reported. Also, perform sufficient evaluation to allow the TAB supervisor to issue certification of the final report.
- i. Final DALT report: Certify the DALT report. This certification includes the following work:
 - (1) Review: Review the Pre-final DALT report data. From these field reports, prepare the Certified Final DALT report.
 - (2) TAB Verification: Verify adherence, by the TAB field team, to the procedures specified in this section.
- j. Technical Assistance for TAB Work: Provide immediate technical assistance to the TAB field team for the TAB work.
 - (1) TAB field visit: Near the end of the TAB field work effort, visit the contract site to inspect the HVAC installation and the progress of the TAB field work. Review the TAB final report data and certify the TAB final report.
- k. Certified TAB report: Certify the TAB report. This certification includes the following work:
 - (1) Review: Review the TAB field data report. From this field report, prepare the certified TAB report.
 - (2) Verification: Verify adherence, by the TAB field team, to the TAB plan prescribed by the pre-field engineering report and verify adherence to the procedures specified in this section.
- l. Design/Construction deficiencies: Within 3 working days after the TAB Agency has encountered any design or construction deficiencies, the TAB Supervisor must submit written notification directly to the Contracting Officer, with a separate copy to the Contractor, of all such deficiencies. Provide in this submittal a complete explanation, including supporting documentation, detailing deficiencies. Where deficiencies are encountered that are believed to adversely impact successful completion of TAB, the TAB Agency must issue notice and

request direction in the notification submittal.

1.5.2.4 TAB Team Field Leader

- a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, "Execution."
- b. Full time: Be present at the contract site when DALT field work or TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.
- c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC Checklist, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

1.6 DALT AND TAB SUBMITTAL AND WORK SCHEDULE

1.6.1 Pre-Construction Submittals

Within 60 calendar days after date of contract award, submit the following:

Independent TAB Agency and Personnel Qualifications and
Certificates

TAB Design Review Report

Pre-Field TAB Engineering Report

DALT and TAB Work Execution Schedule

1.6.2 Pre-DALT Meeting

A minimum of 30 calendar days prior to the start of DALT.

1.6.3 Pre-DALT Preliminary Notification

A minimum of 7 calendar days prior to the start of DALT notify the Contracting Officer in writing of the start of DALT.

1.6.4 DALT Field Work

1.6.5 Submit Pre-Final DALT Report

Within two working days after completion of DALT field work. Separate Pre-Final DALT reports may be submitted to allow phase testing from system to system.

1.6.6 COTR DALT Field Acceptance Testing

Upon approval of the Pre-Final DALT Report, schedule the DALT field check work with the Contracting Officer.

1.6.7 Submit Final DALT Report

Within 15 calendar days after completion of successful COTR DALT Field Acceptance Testing.

1.6.8 Pre-TAB Meeting

A minimum 30 calendar days prior to the start of TAB field work.

1.6.9 Pre-TAB Preliminary Notification

A minimum of 7 calendar days prior to the start of TAB notify the Contracting Officer in writing of the start of TAB.

1.6.10 HVAC Work Check Out List

Complete HVAC Work Check Out List for proportional balancing and Season 1 thermal performance prior to start of TAB work.

1.6.11 TAB Field Work

Tab Field Work for proportional balancing shall be completed a minimum of 90 calendar days prior to CCD.

1.6.12 Submit Pre-Final TAB for Proportional Balancing Report

Within seven working days after completion of TAB field work.

1.6.13 TAB Field Acceptance Testing for Proportional Balancing

Upon approval of the Pre-Final TAB Report, schedule the TAB work field check with the Contracting Officer. TAB for proportional balancing shall be approved prior to BOD.

1.6.14 Submit Final TAB Report for Proportional Balancing

Within 15 calendar days after completion of successful TAB Work Field Check.

1.6.15 Seasonal 1 Thermal Performance TAB Work

Normally, Season 1 thermal performance TAB work will be accomplished during TAB for proportional balancing. If it cannot be performed concurrently due to weather; the TAB for Season 1 will follow the same sequence as TAB for proportionally balanced. TAB for Season 1 shall be complete and TAB Field Acceptance Testing approved prior to BOD.

1.6.16 Pre-Season 2 TAB Preliminary Notification

A minimum of 7 calendar days prior to the start of TAB notify the Contracting Officer in writing of the start of TAB.

1.6.17 HVAC Work Check Out List

Complete HVAC Work Check Out List for Season 2 thermal performance prior to start of TAB work.

1.6.18 TAB Field Work for Proportional Balancing

TAB Field Work for proportional balancing shall be completed within 240 calendar days after commencement of the Season 1 TAB field work and when the ambient temperature is within Season 2 limits.

1.6.19 Submit Pre-Final TAB for Season 2 Report

Within seven working days after completion of TAB field work.

1.6.20 TAB Field Acceptance Testing for Season 2

Upon approval of the Pre-Final TAB Report, schedule the TAB work field check with the Contracting Officer. TAB for proportional balancing shall be approved prior to BOD.

1.6.21 Submit Final TAB Report for Proportional Balancing

Within 15 calendar days after completion of successful TAB Work Field Check.

1.6.22 Maximum Cooling Thermal Performance

Season of maximum cooling thermal performance shall be conducted in June - September.

1.7 WARRANTY

Furnish workmanship and performance warranty for the DALT and TAB system work performed for a period not less than 2 years from the date of Government acceptance of the work; issued directly to the Government. Include provisions that if within the warranty period the system shows evidence of major performance deterioration, or is significantly out of tolerance, resulting from defective TAB or DALT workmanship, the corrective repair or replacement of the defective materials and correction of the defective workmanship is the responsibility of the TAB firm. Perform corrective action that becomes necessary because of defective materials and workmanship while system TAB and DALT is under warranty 7 days after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within the specified period of time constitutes grounds for having the corrective action and repairs performed by others and the cost billed to the TAB firm. The Contractor must also provide a 2 year contractor installation warranty.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 WORK DESCRIPTIONS OF PARTICIPANTS

Comply with requirements of this section as specified in Appendix A WORK DESCRIPTIONS OF PARTICIPANTS.

3.2 PRE-DALT/TAB MEETING

Meet with the Contracting Officer's technical representative (COTR) to develop a mutual understanding relative to the details of the DALT work and TAB work requirements. Ensure that the TAB supervisor is present at this meeting. Requirements to be discussed include required submittals, work schedule, and field quality control.

3.3 DALT PROCEDURES

3.3.1 Instruments, Consumables and Personnel

Provide instruments, consumables and personnel required to accomplish the DALT field work. Follow the same basic procedure specified below for TAB Field Work, including maintenance and calibration of instruments, accuracy of measurements, preliminary procedures, field work, workmanship and treatment of deficiencies. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

3.3.2 Advance Notice of Final DALT Field Work

On completion of the installation of each duct system indicated to be DALT'd, notify the Contracting Officer in writing prior to the COTR's duct selection field visit.

3.3.3 Ductwork To Be DALT'd

All (100%) new duct shall be DALT'd.

3.3.4 DALT Testing

Seal class A, leakage class: Round and oval = 3, rectangular duct = 6; test pressure of 1-inch unless noted otherwise, to comply with the procedures specified in SMACNA 1972 CD. Negative pressure ducts may be tested at positive or negative pressure.

In spite of specifications of SMACNA 1972 CD to the contrary, DALT ductwork of construction class of 3-inch water gauge static pressure and below if indicated to be DALT'd. Ducts downstream of series fan powered VAV terminal boxes do not receive DALT unless otherwise noted.

3.3.5 Pre-final DALT Report

After completion of the DALT work, prepare a Pre-final DALT Report meeting the additional requirements specified in Appendix B REPORTS - DALT and TAB. Data required by those data report forms shall be furnished by the TAB team. Prepare the report neatly and legibly; the Pre-final DALT report shall provide the basis for the Final DALT Report.

TAB supervisor shall review, approve and sign the Pre-Final DALT Report and submit this report within one day of completion of DALT field work. Verbally notify the COTR that the field check of the Pre-Final DALT Report data can commence.

3.3.6 Quality Assurance - COTR DALT Field Acceptance Testing

In the presence of the COTR and TAB team field leader, verify for accuracy Pre-final DALT Report data selected by the COTR. For each duct system, this acceptance testing shall be conducted on a maximum of 25 percent of the duct sections DALT'd.

3.3.7 Additional COTR Field Acceptance Testing

If any of the duct sections checked for a given system are determined to have a leakage rate measured that exceeds the leakage rate specified, terminate data checking for that section. The associated Pre-final DALT Report data for the given duct system will be disapproved. Make the

necessary corrections and prepare a revised Pre-final DALT Report. Reschedule a field check of the revised report data with the COTR.

Further, if any data on the Pre-final DALT report form for a given duct section is out-of-tolerance, then field acceptance testing shall be conducted on data for one additional duct section, preferably in the same duct system, in the presence of the COTR.

3.3.8 Certified Final DALT Report

On successful completion of all field checks of the Pre-Final DALT Report data for all systems, the TAB Supervisor shall assemble, review, approve, sign and submit the Final DALT Report to the Contracting Officer for approval.

3.3.9 Prerequisite for TAB Field Work

Do not commence TAB field work prior to the completion and approval, for all systems, of the Final DALT Report.

3.4 TAB PROCEDURES

3.4.1 TAB Field Work

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. Provide a proportional balance of air and water flow. Outside air to exhaust air flow ratio shall be balanced to -0/+5% of design.

That is, comply with the requirements of AABC MN-1 and AABC MN-4, NEBB PROCEDURAL STANDARDS, NEBB MASV, or SMACNA 1780 (TABB) and SMACNA 1858 (TABB), except as supplemented and modified by this section.

Provide instruments and consumables required to accomplish the TAB work. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. Conduct TAB work, including measurement accuracy, and sound measurement work in conformance with the AABC MN-1 and AABC MN-4, or NEBB TABES and NEBB MASV, or SMACNA 1780 (used by TABB) and SMACNA 1858 sound measurement procedures, except as supplemented and modified by this section. The only water flow and air flow reporting which can be deferred until the Season 2 is that data which would be affected in terms of accuracy due to outside ambient conditions.

3.4.2 Preliminary Procedures

Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. TAB engineer is to locate, in the field, test ports required for testing. It is the responsibility of the sheet metal contractor to provide and install test ports as required by the TAB engineer.

3.4.3 TAB Air Distribution Systems

3.4.3.1 Units With Coils

Report heating and cooling performance capacity tests for hot water, chilled water, DX and steam coils for the purpose of verifying that the coils meet the indicated design capacity. Submit the following data and calculations with the coil test reports:

- a. For air handlers with capacities greater than 7.5 tons (90,000 Btu) cooling, such as factory manufactured units, central built-up units and rooftop units, conduct capacity tests in accordance with AABC MN-4, procedure 3.5, "Coil Capacity Testing."

Do not determine entering and leaving wet and dry bulb temperatures by single point measurement, but by the average of multiple readings in compliance with paragraph 3.5-5, "Procedures", (in subparagraph d.) of AABC MN-4, Procedure 3.5, "Coil Capacity Testing."

Submit part-load coil performance data from the coil manufacturer converting test conditions to design conditions; use the data for the purpose of verifying that the coils meet the indicated design capacity in compliance with AABC MN-4, Procedure 3.5, "Coil Capacity Testing," paragraph 3.5.7, "Actual Capacity Vs. Design Capacity" (in subparagraph c.).

- b. For units with capacities of 7.5 tons (90,000 Btu) or less, such as fan coil units, duct mounted reheat coils associated with VAV terminal units, and unitary units, such as through-the-wall heat pumps:

Determine the apparent coil capacity by calculations using single point measurement of entering and leaving wet and dry bulb temperatures; submit the calculations with the coil reports.

3.4.3.2 Air Handling Units

Air handling unit systems including fans (air handling unit fans, exhaust fans and winter ventilation fans), coils, ducts, plenums, mixing boxes, terminal units, variable air volume boxes, and air distribution devices for supply air, return air, outside air, mixed air relief air, and makeup air.

3.4.3.3 Rooftop Air Conditioning

Rooftop air conditioning systems including fans, coils, ducts, plenums, and air distribution devices for supply air, return air, and outside air.

For refrigeration compressors/condensers/condensing units/evaporators, report data as required by NEBB, AABC, and TABB standard procedures, including refrigeration operational data.

3.4.3.4 Heating and Ventilating Units

Heating and ventilating unit systems including fans, coils, ducts, plenums, roof vents, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.4.3.5 Makeup Air Units

Makeup air unit systems including fans, coils, ducts, plenums, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.4.3.6 Return Air Fans

Return air fan system including fan ducts, plenums, registers, diffusers, grilles, and louvers for supply air, return air, outside air, and mixed air.

3.4.3.7 Exhaust Fans

Exhaust fan systems including fans, ducts, plenums, grilles, and hoods for exhaust air.

3.4.3.8 Unit Heaters

3.4.3.9 Door Heaters

Door heater systems, including fans, coils, and diffusers.

3.4.3.10 Energy Recovery Ventilators (ERV)

Energy Recovery Ventilator including pressure and dry/wet bulb temperature profiles of both air streams, outside air, supply air, return air, and exhaust air distribution.

3.4.3.11 Dedicated Outside Air Systems (DOAS)

Dedicated Outside Air Systems including pressure and dry/wet bulb temperature profiles of both air streams, outside air, supply air, return air, and exhaust air distribution.

3.4.3.12 Unit Heaters

3.4.4 TAB Water Distribution Systems

3.4.4.1 Chilled Water

Chilled water systems including chillers, pumps, coils, system balance valves and flow measuring devices.

For water chillers, report data as required by AABC, NEBB and TABB standard procedures, except refrigeration operational data.

3.4.4.2 Heating Hot Water

Heating hot water systems including boilers, pumps, coils, system balancing valves and flow measuring devices.

3.4.5 TAB Work on Performance Tests With Seasonal Limitations

3.4.5.1 Performance Tests

Accomplish proportionate balancing TAB work on the air distribution systems and water distribution systems, in other words, accomplish adjusting and balancing of the air flows and water flows, any time during

the duration of this contract, subject to the limitations specified elsewhere in this section.

In addition to the TAB proportional balancing work on the air distribution systems and the water distribution systems, accomplish TAB work on the HVAC systems which directly transfer thermal energy within the seasons of maximum heating load and maximum cooling load.

3.4.5.2 Season Of Maximum Load

Visit the contract site for at least two TAB work sessions for TAB field measurements. Visit the contract site during the season of maximum heating load and visit the contract site during the season of maximum cooling load, the goal being to TAB the operational performance of the heating systems and cooling systems under their respective maximum outdoor environment-caused loading. During the seasonal limitations, TAB the operational performance of the heating systems and cooling systems.

3.4.5.3 Ambient Temperatures

On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. Record these temperatures at beginning and at the end of data taking.

3.4.6 Workmanship

Conduct TAB work on the HVAC systems until measured flow rates are within specified tolerance. This TAB work includes adjustment of balancing valves, balancing dampers, and sheaves. Further, this TAB work includes changing out fan sheaves and pump impellers if required to obtain air and water flow rates specified or indicated. The Contractor is responsible for cleaning strainers and coils (interior and exterior as necessary) if required to obtain air and water flow rates specified or indicated. If, with these adjustments and equipment changes, the specified or indicated design flow rates cannot be attained, contact the Contracting Officer for direction.

3.4.7 Deficiencies

Strive to meet the intent of this section to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the paragraph entitled "Workmanship," provide written notice as soon as possible to the Contractor and the Contracting Officer describing the deficiency and recommended correction.

Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor's.

3.4.8 TAB Reports

After completion of the TAB field work, prepare the Pre-Final TAB Report for TAB supervisor's review and certification, using the reporting forms approved in the pre-field engineering report. Data required by those

approved data report forms is to be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and thereby the TAB report is considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph entitled "Workmanship."

3.4.9 Quality Assurance - COTR TAB Field Acceptance Testing

3.4.9.1 TAB Field Acceptance Testing

During the field acceptance testing, verify, in the presence of the COTR, random selections of data (water, air quantities, air motion) recorded in the TAB Report. Points and areas for field acceptance testing are to be selected by the COTR. Measurement and test procedures are the same as approved for TAB work for the TAB Report.

Field acceptance testing includes verification of TAB Report data recorded for the following equipment groups:

Group 1: All chillers, boilers, and air handling units.

Group 2: 25 percent of the VAV terminal boxes and associated diffusers and registers.

Group 3: 25 percent of the supply diffusers, registers, grilles associated with constant volume air handling units.

Group 4: 25 percent of the return grilles, return registers, exhaust grilles and exhaust registers.

Group 5: 25 percent of the supply fans, exhaust fans, return fans and pumps.

If any of the acceptance testing measurements for a given equipment group is found not to fall within the range of plus 5 to minus 5 percent of the Design Value, terminate data verification for all affected data for that group. The affected data for the given group will be disapproved. Make the necessary corrections and prepare a revised TAB Report. Reschedule acceptance testing of the revised report data with the COTR.

Further, if any data on the TAB Report for a given field acceptance test group is out-of-tolerance, then field test data for one additional field test group as specified herein. Continue this increase field test work until out-of-tolerance data ceases to be found. This additional field testing is up and above the original 25 percent of the of reported data entries to be field tested.

If there are no more similar field test groups from which to choose, additional field testing from another, but different, type of field testing group must be tested.

3.4.9.2 Prerequisite for Approval

Compliance with the field acceptance testing requirements of this section is a prerequisite for the final Contracting Officer approval of the TAB Report submitted.

3.4.10 Final TAB Report

After acceptance of the TAB Field Acceptance testing, submit a Final TAB

Report including all adjustments/revisions made. The Final Report shall be neat, legible and type written.

3.5 MARKING OF SETTINGS

Upon the final TAB work approval, permanently mark the settings of HVAC adjustment devices including valves, gauges, splitters, and dampers so that adjustment can be restored if disturbed at any time. Provide permanent markings clearly indicating the settings on the adjustment devices which result in the data reported on the submitted TAB report.

3.6 MARKING OF TEST PORTS

The TAB team is to permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, make these markings on the exterior side of the duct insulation. Show the location of test ports on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.

3.7 APPENDICES

- Appendix A WORK DESCRIPTIONS OF PARTICIPANTS
- Appendix B REPORTS - DALT and TAB
- Appendix C DALT AND TAB SUBMITTAL AND WORK SCHEDULE
- Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING

Appendix A

WORK DESCRIPTIONS OF PARTICIPANTS

The Contractor is responsible for ensuring compliance with all requirements of this specification section. However, the following delineation of specific work items is provided to facilitate and co-ordinate execution of the various work efforts by personnel from separate organizations.

1. Contractor

- a. HVAC documentation: Provide pertinent contract documentation to the TAB Firm, to include the following: the contract drawings and specifications; copies of the approved submittal data for all HVAC equipment, air distribution devices, and air/water measuring/balancing devices; the construction work schedule; and other applicable documents requested by the TAB Firm. Provide the TAB Firm copies of contract revisions and modifications as they occur.
- b. Schedules: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.
- c. Pre-DALT and TAB meeting: Arrange and conduct the Pre-DALT and TAB meeting. Ensure that a representative is present for the sheet metal contractor, the mechanical contractor, the electrical contractor, and the automatic temperature controls contractor.
- d. Coordinate Support: Provide and coordinate support personnel required by the TAB Firm in order to accomplish the DALT and TAB field work. Support personnel may include factory representatives, HVAC controls installers, HVAC equipment mechanics, sheet metal workers, pipe fitters, and insulators. Ensure support personnel are present at the work site at the times required.
- e. Correct Deficiencies: Ensure the notifications of Construction Deficiencies are provided as specified herein. Refer to the paragraph CONSTRUCTION DEFICIENCIES. Correct each deficiency as soon as practical with the Contracting Officer, and submit revised schedules and other required documentation.
- f. Pre-TAB Work Checklists: Complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Include as pre-TAB work checklist items, the deficiencies pointed out by the TAB team supervisor in the design review report.

Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's DALT and TAB Work Procedures Summary. Do not allow the TAB team to commence TAB field work until all of the following are completed.

- g. Give Notice of Testing: Submit advance notice of proportional balancing, Season 1, and Season 2 TAB field work accompanied by completed prerequisite HVAC Work List

- h. Insulation work: Ensure that no insulation is shall not be installed on ducts to be DALT'd until DALT work on the subject ducts is complete.

Ensure the duct and piping systems are properly insulated and vapor sealed upon the successful completion and acceptance of the DALT and TAB work.

2. TAB Team Supervisor

- a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.
- b. Schedule: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.
- c. Submittals: Provide the submittals specified herein.
- d. Pre-DALT/TAB meeting: Attend meeting with Contractor. Ensure TAB personnel that will be involved in the TAB work under this contract attend the meeting.
- e. Design Review Report: Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.
- f. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the DALT and TAB Procedures Summary, the during the DALT or TAB field work.

Ensure the Contractor is properly notified and aware of all support personnel needed to perform the TAB work. Maintain communication with the Contractor regarding support personnel throughout the duration of the TAB field work, including the TAB field acceptance testing checking.

Ensure all inspections and verifications for the Pre-Final DALT and Pre-TAB Checklists are completely and successfully conducted before DALT and TAB field work is performed.

- g. Advance Notice: Monitor the completion of the duct system installations and provide the Advance Notice for Pre-Final DALT field work as specified herein.
- h. Technical Assistance: Provide technical assistance to the DALT and TAB field work.
- i. Deficiencies Notification: Ensure the notifications of Construction Deficiencies are provided as specified herein. Comply with requirements of the paragraph CONSTRUCTION DEFICIENCIES. Resolve each deficiency as soon as practical and submit revised schedules and other

required documentation.

- j. Procedures: Develop the required TAB procedures for systems or system components not covered in the TAB Standard.

3. TAB Team Field Leader

- a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, EXECUTION.
- b. Full time: Be present at the contract site when DALT field work or TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.
- c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC work list, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

Appendix B

REPORTS - DALT and TAB

All submitted documentation must be typed, neat, and organized. All reports must have a waterproof front and back cover, a title page, a certification page, sequentially numbered pages throughout, and a table of contents. Tables, lists, and diagrams must be titled. Generate and submit for approval the following documentation:

1. DALT and TAB Work Execution Schedule

Submit a detailed schedule indicating the anticipated calendar date for each submittal and each portion of work required under this section. For each work entry, indicate the support personnel (such as controls provider, HVAC mechanic, etc.) that are needed to accomplish the work. Arrange schedule entries chronologically.

2. DALT and TAB Procedures Summary

Submit a detailed narrative describing all aspects of the DALT and TAB field work to be performed. Clearly distinguish between DALT information and TAB information. Include the following:

- a. A list of the intended procedural steps for the DALT and TAB field work from start to finish. Indicate how each type of data measurement will be obtained. Include what Contractor support personnel are required for each step, and the tasks they need to perform.
- b. A list of the project's submittals that are needed by the TAB Firm in order to meet this Contract's requirements.
- c. The schematic drawings to be used in the required reports, which may include building floor plans, mechanical room plans, duct system plans, and equipment elevations. Indicate intended TAB measurement locations, including where test ports need to be provided by the Contractor.
- d. The data presentation forms to be used in the report, with the preliminary information and initial design values filled in.
- e. A list of DALT and TAB instruments to be used, edited for this project, to include the instrument name and description, manufacturer, model number, scale range, published accuracy, most recent calibration date, and what the instrument will be used for on this project.
- f. A thorough checklist of the work items and inspections that need to be accomplished before DALT field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-Final DALT Work Checklist before DALT field work can be accomplished.
- g. A thorough checklist of the work items and inspections that need to be accomplished before the Season 1 TAB field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Season 1 Pre-TAB Work Checklist before the Season 1 TAB field work can be accomplished.
- h. A thorough checklist of the work items and inspections that need to be

accomplished before the Season 2 TAB field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Season 2 Pre-TAB Work Checklist before the Season 2 TAB field work can be accomplished.

- i. The checklists specified above shall be individually developed and tailored specifically for the work under this contract. Refer to NEBB PROCEDURAL STANDARDS, Section III, "Preliminary TAB Procedures" under the paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" for examples of items to include in the checklists.

3. Design Review Report

Submit report containing the following information:

- a. Review the contract specifications and drawings to verify that the TAB work can be successfully accomplished in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.
- b. Submit a typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the DALT work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. If no deficiencies are evident, state so in the report.

4. Completed Pre-Final DALT Work Checklist

Report the data for the Pre-Final DALT Report meeting the following requirements:

- a. Submit a copy of the approved DALT and TAB Procedures Summary: Provide notations describing how actual field procedures differed from the procedures listed.
- b. Report format: Submit a comprehensive report for the DALT field work data using data presentation forms equivalent to the "Air Duct Leakage Test Summary Report Forms" located in the SMACNA 1972 CD. In addition, submit in the report, a marked duct shop drawing which identifies each section of duct tested with assigned node numbers for each section. Node numbers shall be included in the completed report forms to identify each duct section.
- c. Calculations: Include a copy of all calculations prepared in determining the duct surface area of each duct test section. Include in the DALT reports copy(s) of the calibration curve for each of the DALT test orifices used for testing.
- d. Instruments: List the types of instruments actually used to measure the data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date. Instruments are to be calibrated within one year of the date of use in the field; instrument calibration is to be traceable to the measuring standards of the National Institute of Standards and Technology.

- e. TAB Supervisor Approval: Include on the submitted report the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

5. Final DALT Report

On successful completion of all COTR field checks of the Pre-final DALT Report data for all systems, the TABS Supervisor shall assemble, review, sign and submit the Final DALT Report to the Contracting Officer for approval.

6. TAB Reports: Submit TAB Report for Proportional Balancing, Season 1, and Season 2 in the following manner:

- a. Procedure Summary: Submit a copy of the approved DALT and TAB Procedures Summary. When applicable, provide notations describing how actual field procedures differed from the procedures listed.
- b. Report format: Submit the completed data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed, approved and signed by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.
- c. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded. Include in the TAB report continuous time versus temperature recording data of wet and dry bulb temperatures for all zones.
 - (1) Data shall be measured and compiled on a continuous basis for the period in which TAB work affecting those rooms is being done.
 - (2) Data shall be measured/recorded only after the HVAC systems installations are complete, the systems fully balanced and the HVAC systems controls operating in fully automatic mode. Provide a detailed explanation wherever a final measurement did not achieve the required value.
 - (3) Data may be compiled using direct digital controls trend logging where available. Otherwise, the Contractor shall temporarily install calibrated time versus temperature/humidity recorders for this purpose. The HVAC systems and controls shall have been fully operational a minimum of 24 hours in advance of commencing data compilation. The specified data shall be included in the Season 1 and Season 2 TAB Report.
- d. Air System Diagrams: Provided updated diagrams with final installed locations of all terminals and devices, any numbering changes, and actual test locations.
- e. Air Static Pressure Profiles: Report static pressure profiles for air duct systems. Report static pressure data for all supply, return, relief, exhaust and outside air ducts for the systems listed. The static pressure report data shall include, in addition to AABC or NEBB

or TABB required data, the following:

- (1) Report supply fan, return fan, relief fan, and exhaust fan inlet and discharge static pressures.
- (2) Report static pressure drop across DX coils, electric resistance heating coils and heat reclaim devices installed in unit cabinetry or the system ductwork.
- (3) Report static pressure drop across outside air, return air, and supply air automatic control dampers, both proportional and two-position, installed in unit cabinetry.
- (4) Report static pressure drop across air filters, acoustic silencers, moisture eliminators, air flow straighteners, air flow measuring stations or other pressure drop producing specialty items installed in unit cabinetry, or in the system ductwork. Examples of these specialty items are smoke detectors, white sound generators, RF shielding, wave guides, security bars, blast valves, small pipes passing through ductwork, and duct mounted humidifiers.

Do not report static pressure drop across duct fittings provided for the sole purpose of conveying air, such as elbows, transitions, offsets, plenums, manual dampers, and branch takes-offs.

- (5) Report static pressure drop across outside air and relief/exhaust air louvers.
 - (6) Report static pressure readings of supply air, return air, exhaust/relief air, and outside air in duct at the point where these ducts connect to each air moving unit.
- g. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

Instrumentation, used for taking wet bulb temperature readings shall provide accuracy of plus or minus 5 percent at the measured face velocities. Submit instrument manufacturer's literature to document instrument accuracy performance is in compliance with that specified.

- h. Performance Curves: The TAB Supervisor shall include, in the TAB Reports, factory pump curves and fan curves for pumps and fans TAB'd on the job.
- i. Calibration Curves: The TAB Supervisor shall include, in the TAB Reports, a factory calibration curve for installed flow control balancing valves, flow venturis and flow orifices TAB'd on the job.
- j. Data From TAB Field Work: After completion of the TAB field work, prepare the TAB field data for TAB supervisor's review and approval signature, using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and thereby the TAB report shall be considered incomplete until the TAB work is

accomplished to within the accuracy range specified in the paragraph
WORKMANSHIP.

Appendix C

DALT AND TAB SUBMITTAL AND WORK SCHEDULE

Perform the following items of work in the order listed adhering to the dates schedule specified below. Include the major items listed in this schedule in the project network analysis schedule required.

Submit TAB Agency and TAB Personnel Qualifications: Within 42 calendar days after date of contract award.

Submit the DALT and TAB Work Execution Schedule: within 14 days after receipt of the TAB agency and TAB personnel qualifications approval. Revise and re-submit this schedule 28 days prior to commencement of DALT work and 28 days prior to the commencement of TAB Season 1 work and TAB Season 2 work.

Submit the DALT and TAB Work Procedures Summary: within 14 days after receipt of the initial approved DALT and TAB Work Execution Schedule.

Meet with the COTR at the Pre-DALT/TAB Meeting: Within 28 calendar days after receipt of the approved initial DALT/TAB Execution Schedule.

Submit Design Review Report: Within 56 calendar days after the receipt of the approved initial DALT and TAB Work Execution Schedule.

Advance Notice of Pre-Final DALT Field Work: After the completed installation of the HVAC duct system to be DALT'd, submit to the Contracting Officer an Advance Notice of Pre-Final DALT Field Work accompanied by the completed Pre-Final DALT Work Checklist for the subject duct system.

Ductwork Selected for DALT: Within 14 calendar days after receiving an acceptable completed Pre-Final DALT Work Checklist, the Contracting Officer's technical representative (COTR) will select the project ductwork sections to be DALT'd.

DALT Field Work: Within 48 hours of COTR's selection, complete DALT field work on selected project ductwork.

Submit Pre-Final DALT Report: Within two working days after completion of DALT field work, submit Pre-final DALT Report. Separate Pre-final DALT reports may be submitted to allow phased testing from system to system.

Quality Assurance - COTR DALT Field Checks: Upon approval of the Pre-final DALT Report, the COTR's DALT field check work shall be scheduled with the Contracting Officer.

Submit Final DALT Report: Within 14 calendar days after completion of successful DALT Work Field Check, submit Season 1 TAB report.

Advance Notice of Season 1 TAB Field Work: At a minimum of 14 calendar days prior to Season 1 TAB Field Work, submit advance notice of TAB field work accompanied by completed Season 1 Pre-TAB Work Checklist.

Season 1 TAB Field Work: At a minimum of 84 calendar days prior to

CCD, and when the ambient temperature is within Season 1 limits, accomplish Season 1 TAB field work.

Submit Season 1 TAB Report: Within 14 calendar days after completion of Season 1 TAB field work, submit initial Season 1 TAB report.

Season 1 Quality Assurance - COTR TAB Field Check: 30 calendar days after initial Season 1 TAB report is approved by the Contracting Officer, conduct Season 1 field check.

Complete Season 1 TAB Work: Prior to CCD, complete all TAB work except Season 2 TAB work and submit final.

Receive the approved TAB report: Within 21 calendar days, receive the report from Contracting Officer approved TAB report.

Advance Notice of Season 2 TAB Field Work: At a minimum of 126 calendar days after CCD, submit advance notice of Season 2 TAB field work accompanied by completed Season 2 Pre-TAB Work Checklist.

Season 2 TAB Field Work: Within 14 calendar days after date of advance notice of Season 2 TAB field work and when the ambient temperature is within Season 2 limits, accomplish Season 2 TAB field work.

Submit Season 2 TAB Report: Within 14 calendar days after completion of Season 2 TAB field work, submit Season 2 TAB report.

Season 2 Quality Assurance - COTR TAB Field Checks: 28 calendar days after the Season 2 TAB report is approved by the Contracting Officer, conduct Season 2 field check.

Complete Season 2 TAB Work: Within 14 calendar days after the completion of Season 2 TAB field data check, complete all TAB work.

Receive the approved TAB report: Within calendar 21 days, receive the report from Contracting Officer.

Appendix D			
REQUIREMENTS FOR DUCT AIR LEAK TESTING			
		SYSTEMS	
		All DOAS	All Ducted Air Handlers
Duct System Static Pressure, in inches W.C.	for Supply	2	2
	for Return	2	2
	for Exhaust	2	N/A
	for Outside Air	2	N/A
System Oval/Round Duct and Rectangular Duct SMACNA Seal Class	for Supply	A	A
	for Return	A	A
	for Exhaust	A	A
	for Outside Air	A	A
System Oval/Round Duct SMACNA Leak Class	for Supply	3	3
	for Return	3	3
	for Exhaust	3	N/A
	for Outside Air	3	N/A

Appendix D			
REQUIREMENTS FOR DUCT AIR LEAK TESTING			
		SYSTEMS	
		All DOAS	All Ducted Air Handlers
System Rectangular Duct SMACNA Leak Class	for Supply	6	6
	for Return	6	6
	for Exhaust	6	N/A
	for Outside Air	6	N/A
Duct Test Pressure, in inches W.C.	for Supply	1	1
	for Return	1	1
	for Exhaust	1	N/A
	for Outside Air	1	N/A

-- End of Section --

SECTION 23 07 00

INSULATION OF MECHANICAL SYSTEMS

03/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 240/A 240M	(1996) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C 177	(1985; R 1997) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
ASTM C 195	(1995) Mineral Fiber Thermal Insulating Cement
ASTM C 533	(1995) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534	(1994) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(1995) Mineral Fiber Preformed Pipe Insulation
ASTM C 552	(1991) Cellular Glass Thermal Insulation
ASTM C 553	(1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 578	(2009e1) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation

ASTM C 916	(1985; R 1990) Adhesives for Duct Thermal Insulation
ASTM C 1136	(2009) Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM D 828	(1993) Tensile Breaking Strength of Paper and Paperboard
ASTM E 84	(2000a) Surface Burning Characteristics of Building Materials
ASTM E 96	(1997; Rev A) Water Vapor Transmission of Materials

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS L-P-535	(Rev. E; Notice 2) Plastic Sheet (Sheeting): Plastic Strip: Poly (Vinyl Chloride) and Poly(Vinyl Chloride-Vinyl Acetate), Rigid
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U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-3316	(Rev. C; Am. 2) Adhesives, Fire-Resistant, Thermal Insulation
MIL-C-19565	(Rev. C; Am. 1) Coating Compounds, Thermal Insulation, Fire- and Water-Resistant, Vapor Barrier
MIL-C-20079	(Rev. H) Cloth, Glass: Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass
MIL-A-24179	(Rev. A) (Valid Notice 1) Adhesive, Flexible Unicellular-Plastic Thermal Insulation

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 255	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials
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UNDERWRITERS LABORATORIES (UL)

UL 723	(2018) UL Standard for Safety Test for Surface Burning Characteristics of Building Materials
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1.2 SYSTEM DESCRIPTION

Provide new field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems which are located within, on, under, and adjacent to buildings; and for plumbing piping systems.

1.2.1 Air Distribution System

Obtain Contracting Officer's written approval of systems under Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC before applying field-applied insulation to air distribution systems.

1.2.2 Piping Systems

Obtain Contracting Officer's written approval of HVAC water distribution systems under Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC before applying field-applied insulation to HVAC water distribution systems. At the Contractor's option and with Contracting Officer's written approval, the piping systems may be insulated before systems are tested, adjusted, and balanced (TAB'd). Piping insulation shall terminate immediately adjacent to each flow control valve, automatic control valve, or device. For chilled water and chilled-hot water piping, the ends of pipe insulation and the space between ends of pipe insulation and piping shall be sealed with waterproof vapor barrier coating. After systems are TAB'd, the control valves and devices shall be insulated.

1.3 DEFINITIONS

1.3.1 Finished Spaces

Spaces used for habitation or occupancy where rough surfaces are plastered, panelled, or otherwise treated to provide a pleasing appearance.

1.3.2 Unfinished Spaces

Spaces used for storage or work areas where appearance is not a factor, such as unexcavated spaces and crawl space.

1.3.3 Concealed Spaces

Spaces out of sight. For example, above ceilings; below floors; between double walls; furred-in areas; pipe and duct shafts; and similar spaces.

1.3.4 Exposed

Open to view. For example, pipe running through a room and not covered by other construction.

1.3.5 Fugitive Treatments

Treatment subject to deterioration due to aging, moisture, high humidity, oxygen, ozone, and heat. Fugitive materials are entrapped materials that can cause deterioration, such as solvents and water vapor.

1.3.6 Outside

Open to view up to 5 feet beyond the exterior side of walls, above the roof, and unexcavated or crawl spaces.

1.3.7 Conditioned Space

An area, room or space normally occupied and being heated or cooled for human habitation by any equipment.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-03 Product Data

Piping insulation

Piping insulation finishes

Heating, ventilating, and air conditioning systems insulation

Duct insulation finishes

Accessory materials

Adhesives, sealants, and coating compounds

1.5 QUALITY ASSURANCE

Every package or standard container of insulation, jackets, cements, adhesives, and coatings delivered to the project site shall have the manufacturer's stamp or label attached giving name of manufacturer, brand and description of material. Insulation packages and containers shall be asbestos-free.

1.6 FLAME-SPREAD AND SMOKE-DEVELOPED RATINGS

In accordance with NFPA 255, ASTM E 84 or UL 723, the materials on interior of the building shall have a flame-spread rating of not more than 25 and a smoke-developed rating of not more than 150 interior to the building.

1.6.1 Materials Tests

Test factory-applied materials as assembled. Field-applied materials may be tested individually. Use no fugitive or corrosive treatments to impart flame resistance. UL label or satisfactory certified test report from a testing laboratory will be required to indicate that fire hazard ratings for materials proposed for use do not exceed those specified. Flame-proofing treatments subject to deterioration due to effects of moisture or high humidity are not acceptable.

1.6.2 Materials Exempt From Fire-Resistant Rating

Nylon anchors.

PART 2 PRODUCTS

2.1 PIPING INSULATION

Piping systems, except buried pipe requiring insulation, types of insulation required, and insulation thickness shall be as listed in Tables I herein. Unless otherwise specified, insulate all fittings, flanges, and valves, except valve stems, hand wheels, and operators. Provide factory premolded, precut, or field-fabricated insulation of the same thickness and conductivity as insulation on adjacent piping. Insulation exterior shall be factory cleanable, grease resistant, non-flaking and

non-peeling. Pipe insulation shall conform to the referenced publications.

2.1.1 Flexible Unicellular Insulation

2.1.1.1 Recommended Adhesive

ASTM C 534. Provide adhesive as recommended by insulation manufacturer or conforming with MIL-A-24179, Type II, Class 1.

2.1.1.2 Polyolefin thermoplastic

Polyolefin thermoplastic meets ASTM C 534, except density.

2.1.1.3 Adhesive For Finishing Flexible Unicellular Insulation

MIL-A-3316, Class 1, Grade A.

2.1.1.4 Glass Cloth For Finishing Flexible Unicellular Insulation

MIL-C-20079, Type I, Class 1, 3, or 5.

2.1.2 Cellular Glass Insulation

ASTM C 552, Type II.

2.1.3 Cellular Phenolic Insulation

ASTM C 1136.

2.1.4 Mineral Fiber

ASTM C 547, Class I.

2.1.5 Calcium Silicate

ASTM C 533, Class I.

2.1.6 Cellular Polystyrene

ASTM C 578, Expanded Polystyrene (EPS).

2.1.7 Piping Insulation Finishes

2.1.7.1 All-Purpose Jacket

Provide a factory applied all-purpose jacket when field applied jacketing is not specified. All purpose jackets shall include integral vapor barrier as required by service. Provide jackets in exposed locations with a white surface suitable for field painting. Allow a maximum water vapor permeance of 0.05 perm in accordance with ASTM E 96, a puncture resistance of not less than 50 Beach units, and a minimum tensile strength of 35 pounds-force per inch of width in accordance with ASTM D 828.

2.1.7.2 Vapor-Barrier Material

ASTM C 1136. Resistant to flame, moisture penetration, and mold growth. Provide vapor-barrier material on pipe insulation as required in Table I.

2.1.7.3 Metal Jackets

- a. Aluminum Jackets: ASTM B 209, Temper H14, minimum thickness of 27 gage (0.016 inch), with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide smooth surface jackets for jacket outside diameters less than 8 inches. Provide corrugated surface jackets for jacket outside diameters 8 inches and larger. Provide stainless steel bands, minimum width of 0.5 inch. Provide factory prefabricated aluminum covers for insulation on fittings, valves and flanges.
- b. Stainless Steel Jackets: ASTM A 167 or ASTM A 240/A 240M; Type 304, minimum thickness of 33 gage (0.010 inch), smooth surface with factory-applied polyethylene and kraft paper moisture barrier on inside surface. Provide stainless steel bands, minimum width of 0.5 inch. Provide factory prefabricated stainless steel covers for insulation on fittings, valves, and flanges.
- c. Piping, Fittings, Flanges, and Valves in Outside Locations: Finish elbows and curved piping with factory-fabricated metal covers. Finish tees, flanges, and valves with metal covers. Covers shall be same thickness and material as jackets on adjacent piping.

2.2 HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS INSULATION

Provide insulation on ducts, plenums, mixing boxes, filter boxes, casings and diffusers of Heating, Ventilating and Air Conditioning Systems (HVAC).

2.2.1 Duct Insulation in Concealed Spaces

Blanket flexible mineral fiber insulation conforming to ASTM C 553, Type 1, Class B-3, .75 pound per cubic foot nominal, 3.0 inches thick, minimum installed R8. Provide flexible insulation in concealed spaces only.

2.2.2 Duct Insulation Not in Concealed Spaces

Mineral fiber in accordance with ASTM C 612, Class 2 (maximum surface temperature 400 degrees F), 6 pcf (pounds per cubic foot) average, 1.5 inch thick.

2.2.3 Duct Insulation Finishes

2.2.3.1 All-Purpose Jacket

Provide a factory applied all-purpose jacket with or without integral vapor barrier as required by the service. In exposed locations, provide jackets with a white surface suitable for field painting. All-purpose jacket shall have a maximum water vapor permeance of 0.05 perm per ASTM E 96; a puncture resistance of not less than 50 Beach units; and a tensile strength of not less than 35 pounds-force per inch of width in accordance with ASTM D 828.

2.2.3.2 Vapor-Barrier Material

ASTM C 1136, for duct in equipment room and exposed areas and Type I or II in remaining areas. Material shall be resistant to flame, moisture penetration, and shall not support mold growth. Provide vapor barrier on HVAC duct insulation, except insulation for heating only.

2.3 EQUIPMENT

Insulate all equipment and accessories as specified in Table II. In outside locations, provide insulation one inch thicker than specified. Increase the specified insulation thickness for equipment only where necessary to equal the thickness of angles or other structural members to make a smooth, exterior surface. Factory applied insulation shall meet the flame spread and smoke-developed rating of 25/50.

2.4 ADHESIVES, SEALANTS, AND COATING COMPOUNDS

2.4.1 Insulation and Vapor Barrier Adhesive

Provide ASTM C 916, Type I or Type II adhesive for securing insulation to metal surfaces and for vapor barrier lap only in building interior. Provide Type I when an adhesive in which the vehicle is nonflammable in the liquid (wet) state and which will pass the edge-burning test is required. Provide Type II when an adhesive in which the vehicle is nonflammable in the liquid (wet) state and which will not pass the edge-burning test is required.

2.4.2 Lagging Adhesive

MIL-A-3316, Class 1, for bonding fibrous glass cloth to unfaced fibrous glass insulation; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bounding fibrous glass tape to joints of fibrous glass board; or for bonding lagging cloth to thermal insulation, or Class 2, for attaching fibrous glass insulation to metal surfaces.

2.4.3 Mineral Fiber Insulation Cement

ASTM C 195, thermal conductivity 0.85 maximum at 200 degrees F mean when tested in accordance with ASTM C 177.

2.4.4 Vapor Barrier Coating

MIL-C-19565, Type II, indoor only above surface temperature 60 degrees F, color white.

2.4.5 Weatherproof Coating

For outside applications provide a weatherproof coating recommended by the manufacturer of the insulation and jackets.

2.4.6 Flexible Unicellular Insulation Adhesive

MIL-A-24179, Type II, Class 1 or Type III.

2.5 ACCESSORY MATERIALS

2.5.1 Staples

ASTM A 167, Type 304 or 316 stainless steel outside-clinch type.

2.5.2 Insulation Bands

1/2 inch wide; 0.24 gage galvanized steel or 0.26 gage stainless steel or

0.24 gage aluminum.

2.5.3 Bands for Metal Jackets

3/8-inch minimum width; 0.26 gage stainless steel or 0.24 gage aluminum.

2.5.4 Anchor Pins

Provide anchor pins and speed washers recommended by insulation manufacturer.

2.5.5 Glass Cloth and Tape

MIL-C-20079, Type I, Class 1 or Class 3 cloth, and Type II, Class 1 or tape; 20 by 20 maximum size mesh. Tape shall be 4-inch wide rolls. Class 3 tape shall be 4.5 ounces per square yard. In lieu of glass cloth and tape, open weave glass membrane may be provided.

2.5.6 Wire

Soft annealed stainless steel, 0.047-inch nominal diameter.

2.5.7 PVC Pipe Fitting Cover

FS L-P-535, Composition A, Type II, Grade GU, factory premolded, one-piece.

PART 3 EXECUTION

3.1 PREPARATION

Do not insulate materials until system tests have been completed and surfaces to be insulated have been cleaned of dirt, rust, and scale and dried. Insulate return ducts, outside air intakes and supply ducts to the room outlets, flexible runouts, plenums, casings, mixing boxes, filter boxes, coils, fans, and the portion of air terminals not in the conditioned spaces. Ensure full range of motion of equipment actuators. Modify insulation to avoid obstruction with valve handles, safety reliefs, and other such items. Allow adequate space for pipe expansion. Install insulation with jackets drawn tight and cement down on longitudinal and end laps. Do not use scrap pieces where a full length section will fit. Insulation shall be continuous through sleeves, wall and ceiling openings, except at fire dampers in duct systems. Extend surface finishes to protect surfaces, ends, and raw edges of insulation. Apply coatings and adhesives at the manufacturer's recommended coverage per gallon. Individually insulate piping and ductwork. Provide a moisture and vapor seal where insulation terminates against metal hangers, anchors and other projections through the insulation on surfaces for which a vapor seal is specified. Keep insulation dry during application of finish. Bevel and seal the edges of exposed insulation. Unless otherwise indicated, do not insulate the following:

- a. Factory preinsulated flexible ductwork;
- b. Vertical portion of interior roof drain pipelines, chrome plated pipes, and fire protection pipes;
- c. Vibration isolating connections;

- d. Adjacent insulation;
- e. ASME stamps;
- f. Fan name plates; and
- g. Access plates in fan housings.

3.2 PIPING INSULATION

3.2.1 Mineral Fiber Pipe Insulation

Place sections of insulation around the pipe and joints tightly butted into place. The jacket laps shall be drawn tight and smooth. Secure jacket with fire resistant adhesive factory applied self sealing lap, or stainless steel outward clinching staples spaced not over 4 inches on centers and 1/2 inch minimum from edge of lap. Cover circumferential joints with butt strips, not less than 3 inches wide, of material identical to the jacket material. Overlap longitudinal laps of jacket material not less than 1 1/2 inches. Adhesive used to secure the butt strip shall be the same as used to secure the jacket laps. Apply staples to both edges of the butt strips. Patch damaged jacket material by wrapping a strip of jacket material around the pipe and cementing, stapling, and coating as specified for butt strips. Extend the patch not less than 1 1/2 inches past the break in both directions. At penetrations by pressure gages and thermometers, fill the voids with the vapor barrier coating for outside service. Seal with a brush coat of the same coating. Where penetrating roofs, insulate piping to a point flush with the top of the flashing and seal with the vapor barrier coating. Butt tightly the exterior insulation to the top of the flashing and interior insulation. Extend the exterior metal jacket 2 inches down beyond the end of the insulation. Seal the flashing and counterflashing underneath with the vapor barrier coating.

3.2.2 Flexible Unicellular Insulation

Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees, and valve insulation. Where pipes penetrate fire walls, provide mineral-fiber insulation inserts and sheet-metal sleeves. Insulate flanges, unions, valves, and fittings in accordance with manufacturer's published instructions. Finish all unicellular insulation as follows:

- (1) Coat entire surface of insulation with MIL-A-3316
- (2) While the adhesive is tacky, apply a layer of MIL-C-20079 glass cloth. Stretch tightly and overlap all joints by a minimum of 2-inches. Glass cloth at elbows and fittings shall be mitered.
- (3) Apply a final coat of MIL-A-3316 adhesive.

3.2.3 Calcium Silicate Pipe Insulation

Secure insulation with stainless steel metal bands on 12-inch maximum centers. Apply a skim coat of hydraulic setting cement directly to the insulation. When dry, apply a flooding coat of adhesive over the hydraulic setting cement. Press a layer of MIL-C-20079 glass cloth or tape into adhesive and seal laps and edges with adhesive. Coat cloth with adhesive cut at a ratio of one part water to five parts adhesive in color

other than white for the purpose of visual inspection to ensure sizing of entire surface.

3.2.4 Cellular Glass, Cellular Phenolic, and Polyisocyanurate

Secure outer most layer of insulation with metal bands 12-inch on center. If a factory installed all service jacket is used, the metal bands shall be applied to the outside of the all service jacket. If two or more layers are applied, the inner layers may be secured with fiber reinforced tape. For cold or chilled piping all joints both longitudinal and circumferential shall be sealed. Use the manufacturer's recommended cement or sealant. Apply all-purpose jacket, vapor barrier if required by Table I, and metal jacket if outside. Elbows shall be four piece miter if field fabricated. Pre-manufactured elbows can be held in place with metal bands. All elbows shall be finished as follows: Apply a skim coat of hydraulic setting cement directly to the insulation. When dry, apply a flooding coat of adhesive over the hydraulic setting cement. Press a layer of MIL-C-20079 glass cloth or tape into adhesive and seal laps and edges with adhesive. Coat cloth with adhesive cut at a ratio of one part water to five parts adhesive in color other than white for the purpose of visual inspection to ensure sizing of entire surface. Insulate flexible connection at pumps and other equipment with unicellular plastic insulation, unless otherwise indicated. Factory-fabricated removable and reusable insulated covers shall be provided for all valves, circuit setters, unions and flow control devices. The insulation cover shall be reusable without the need for special material or tools. Insulation shall be two piece molded cellular to fit the valve or device. Flexible unicellular insulation may be used in lieu of molded cellular insulation.

3.2.5 Expanded Cellular Polystyrene

Secure outer most layer of insulation with metal bands 9 inch on center. If a factory installed all service jacket is used, the metal bands shall be applied to the outside of the all service jacket. If two or more layers are applied, the inner layers may be secured with fiber reinforced tape. For cold or chilled piping all joints both longitudinal and circumferential shall be sealed. use the manufacturer's recommended cement or sealant. Apply all-purpose jacket, vapor barrier if required by Table 1, and metal jacket if outside. Elbows shall be four piece miter if field fabricated. Pre-manufactured elbows can be held in place with metal bands. All elbows shall be finished according to manufacturer's recommended method. Insulate flexible connection at pumps and other equipment with unicellular plastic insulation, unless otherwise indicated. Factory-fabricated removable and reusable insulated covers shall be provided for all valves, circuit setters, unions and flow control devices. The insulation cover shall be reusable without the need for special material or tools. Insulation shall be two piece molded cellular to fit the valve or device. Flexible unicellular insulation may be used in lieu of molded cellular insulation.

3.2.6 Hangers and Anchors

Pipe insulation shall be continuous through pipe hangers. Where pipe is supported by the insulation, provide galvanized steel shields protection saddles. Band and secure insulation protection shields without damaging pipe insulation. Where shields are used on pipes 2 inches and larger, provide insulation inserts at points of hangers and supports. Insulation inserts shall be of calcium silicate, cellular glass (minimum 8 pcf), molded glass fiber (minimum 8 pcf), or other approved material of the same

thickness as adjacent insulation. Inserts shall have sufficient compressive strength to adequately support the pipe without compressing the inserts to a thickness less than the adjacent insulation. Insulation inserts shall cover the bottom half of the pipe circumference 180 degrees and be not less in length than the protection shield. Vapor-barrier facing of the insert shall be of the same material as the facing on the adjacent insulation. Seal inserts into the insulation with vapor barrier coating, Type II or for exterior work, manufacturer's recommended weatherproof coating, as applicable. Where protection saddles are used, fill all voids with the same insulation material as used on the adjacent pipe. Where anchors are secured to chilled piping that is to be insulated, insulate the anchors the same as the piping for a distance not less than four times the insulation thickness to prevent condensation. Vapor seal insulation around anchors.

3.2.7 Sleeves and Wall Chases

Where penetrating interior walls, extend a metal jacket 2 inches out on either side of the wall and secure on each end with a band. Where penetrating floors, extend a metal jacket from a point below the back-up material to a point 10 inches above the floor with one band at the floor and one not more than one inch from end of metal jacket. Where penetrating exterior walls, extend the metal jackets through the sleeve to a point 2 inches beyond the interior surface of the wall.

3.2.8 Flanges, Unions, Valves and Fittings for Hot Piping

Flanges, Unions, Valves, and Fittings Insulation (Except Flexible Unicellular) for Hot Piping: Factory fabricated removable and reusable insulation covers may be used. For inside domestic hot water, heating hot water, A/C condensate drains, high temperature hot water, steam and condensate return systems; exposed hot water piping and drains in handicap areas, place factory premolded, precut or field-fabricated segmented insulation of the same thickness and conductivity as the adjoining pipe insulation around the flange, union, valve, and fitting abutting the adjoining pipe insulation. If nesting size insulation is used, overlap 2 inches or one pipe diameter, whichever is larger. Use insulating cement to fill voids. Elbows insulated using segments shall have not less than three segments per elbow. Place and joint the segments with manufacturer's recommended water-vapor resistant, fire retardant, and adhesive appropriate for the temperature limit of the service. Upon completion of installation of insulation, apply two coats lagging adhesive with glass tape embedded between coats. Overlap tape seams one inch. Extend adhesive onto adjoining insulation not less than two inches. The total dry film thickness shall be not less than 1/16 inch. Where unions are indicated not to be insulated, taper the insulation to the union at a 45 degree angle. Coat the insulation and all purpose jacket with two coats of lagging adhesive and with glass tape embedded between coats. The total dry film thickness shall be not less than 1/16 inch. At the option of the Contractor, factory premolded one-piece PVC fitting covers may be provided in lieu of two coats of adhesive with tape embedded between coats. Factory premolded field-fabricated segment or blanket insert insulation shall be provided under the fitting covers. Install factory premolded one-piece PVC fitting covers over the insulation and secure by stapling, taping with PVC vapor barrier tape, or with metal or plastic tacks made for securing PVC fitting covers. Do not provide PVC fitting covers where exposed to the weather. Provide PVC fitting covers only in ambient temperatures below 150 degrees F.

3.2.9 Piping Exposed to Weather

3.2.9.1 Metal Jackets

Install over the insulation. Metal jackets shall have side and end lap at least 2 inches wide with the cut edge of the side lap turned inside one inch to provide a smooth edge. Overlap the jacket not less than 2 inches at longitudinal and circumferential joints and secure with metal bands at not more than 9-inch centers or with screws at not more than 5-inch centers. Overlap longitudinal joints down to shed water. Seal circumferential joints with a coating recommended by the insulation manufacturer for weatherproofing.

3.2.9.2 Flanges, Unions, Valves, Fittings, and Accessories

Insulate and finish as specified for the applicable service. Apply two coats of an emulsion type weatherproof mastic for hot service and vapor barrier mastic for cold service recommended by the insulation manufacturer. Embed glass tape in the first coat. Overlap tape not less than one inch and the adjoining metal jacket not less than 2 inches. Factory preformed metal jackets may be provided in lieu of the above for hot service.

3.3 DUCTS PLENUMS AND CASINGS (HVAC) INSULATION

3.3.1 Rigid Insulation

Secure rigid insulation by impaling over pins or anchors located not more than 3 inches from joint edges of boards, spaced not more than 12 inches on centers and secure with washers and clips. Spot weld anchor pins or attach with a waterproof adhesive especially designed for use on metal surfaces. Apply insulation with joints tightly butted. Neatly bevel insulation around name plates and access plates and doors. Each pin or anchor shall be capable of supporting a 20-pound load. Cut off protruding ends of pins, after clips are sealed with coating compound for inside work or manufacturer's recommended weatherproof coating for outside work, and reinforced with open weave glass membrane.

3.3.2 Flexible Blanket Insulation

Apply insulation with all joints tightly butted. Secure insulation to ductwork with adhesive in 6-inch wide strips on 12-inch centers. Staple laps of jacket with outward clinching staples. Sealing shall be in accordance with paragraph 3.3.3 below. For ductwork over 24 inches on horizontal duct runs, provide pins, washers and clips. Provide pins on sides of vertical ductwork being insulated. Space pins and clips on 18-inch centers and not more than 18 inches from duct corners. Carry insulation over standing seams and trapeze-type hangers. Install speed washers with pins and pin trimmed to washer. Sagging of flexible duct insulation will not be permitted. Cut off protruding ends of pins after clips are secured and sealed with coating compound for inside work. For warm air ducts, overlap insulation not less than 2 inches at joints and secure the laps with outward clinch staples on 4-inch centers. In cold air ducts, vapor seal all joints and staple as specified.

3.3.3 Insulation Finishes and Joint Sealing

Fill all breaks, punctures, and voids with vapor barrier coating compound for inside work or manufacturer's recommended weatherproof coating for

outside service. Vapor seal all joints by embedding a single layer of 3-inch wide open weave glass membrane, 20 by 20 mesh maximum size between two 1/16-inch wet film thickness coats of vapor barrier coating compound. Draw glass fabric smooth and tight with a 1 1/2-inch overlap. At jacket penetrations such as hangers, thermometers, and damper operating rods, fill voids in the insulation with vapor barrier coating. Brush a coat of vapor barrier coating where required on HVAC ducts. Provide vapor barrier jacket continuous across seams, reinforcing, and projections. Where height of projections is greater than insulation thickness, carry insulation and jacket over the projection. For joints for heating only systems, provide insulation with two coats of fire resistant adhesive with glass fabric mesh embedded between coats.

3.3.4 Access Plates and Doors

On acoustically lined ducts, plenums, and casings, provide insulation on access plates and doors. On externally insulated ducts, plenums, and casings, provide insulation-filled hollow steel panels and doors for access openings. Bevel insulation around access plates and doors.

3.4 EQUIPMENT INSULATION

3.4.1 General Procedures

Apply equipment insulation suitable for temperature and service in rigid block or semirigid board or flexible form to fit as closely as possible to equipment. Groove or score insulation where necessary to fit the contours of equipment. Stagger end joints where possible. Bevel the edges of the insulation for cylindrical surfaces to provide tight joints. Join sections of cellular glass insulation with bedding compound. After the cellular glass insulation is in place on areas to be insulated, except where metal-encased, fill joints, seams, chipped edges, or depressions with bedding compound to form a smooth surface. Fill mineral fiber joints with insulating cement. Bevel insulation around name plates, ASME and access plates. For insulation on equipment that must be opened periodically for inspection, cleaning, or repair, construct insulation to be removable and replaceable without damage. Protect exposed insulation corners with corner angles under wires and bands.

3.4.2 Cold Equipment (Except Pumps)

Secure insulation with 16-gage, galvanized steel or copper clad wire or with 3/4-inch wide 20-gage stainless steel bands spaced on 12-inch centers. Seal joints with joint sealer. Cover non-removable irregular surfaces such as corner angles with a smoothing coat of insulating cement. Provide removable heat exchanger head covers with a male-female shiplap type joint. Apply two coats of vapor barrier coating with a layer of glass cloth embedded between coats. The dry film thickness of the finish shall be 1/32-inch minimum.

3.4.3 Pumps

Insulate pumps used for hot service with 2-inch thick rigid mineral fiber insulation and pumps used for chilled water and brine service with 2-inch thick flexible unicellular sheets as follows: Insulate pumps by forming a box around the pump housing, drive shaft, and piping. Apply insulation to inside surfaces of 20-gage galvanized or stainless steel sheet-metal boxes having openings for drive shaft and pipes. Construct the box by forming the bottom and sides using joints which do not leave raw ends of

insulation exposed. Band bottom and sides to form a rigid housing that does not rest on the pump. Between top cover and sides, fit joints tightly forming a female shiplap joint on the side pieces and a male joint on the top cover to make the top cover removable. Secure insulation to the box with adhesive. Allow clearance for draining and adjustment of pump shaft seal.

3.5 PAINTING AND IDENTIFICATION

Paint in accordance with Section 09 90 00, "Paints and Coatings." Piping identification shall be as specified in other sections.

3.6 FIELD INSPECTION

Visually inspect to ensure that materials provided conform to specifications. Inspect installations progressively for compliance with requirements.

TABLE IPiping Insulation Wall Thickness

<u>Service</u> <u>Vapor</u>	<u>Material</u>	<u>Tube And Pipe Size (Inches)</u>							
		<u>1/4-1</u>	<u>1/4</u>	<u>1 1/2-3</u>	<u>3 1/2-5</u>	<u>6-& Larger</u>			
<u>Barrier</u>									
<u>Required</u>									
Chilled Water	Cellular Glass	1.5	(2.0)	1.5	(2.0)	2.0	(2.5)	2.0	(2.5) Yes
	Polyisocyanurate	1	(1)	1	(1.0)	1.5	(2.0)	1.5	
(2.0) Yes	Polystyrene			1	(1.5)	1	(1.5)	1.5	(2) 1.5
(2) Yes									
Refrigerant	Flexible	3/4	(1.5)	3/4	(1.5)	1.5	(2.0)	1.5	(2.0) Yes
Suction Pipe	Unicellular								
Domestic Cold	Polyisocyanurate	1		1		1		1	Yes
Water, Drains	Cellular Glass	1.5		1.5		1.5		1.5	Yes
and Horizontal	Polystyrene	1		1		1		1	Yes
Roof Drains									
Domestic Hot	Polyisocyanurate	1		1		1.5		1.5	No
Water	Calcium Silicate	1.5		1.5		1.5		1.5	No
	Mineral Fiber	1		1		1.5		1.5	No
	Cellular Glass	1.5		1.5		1.5		1.5	No
	Cellular Phenolic	1		1		1		1	No
	Polystyrene	1		1		1.5		1.5	Yes
Heating Hot	Polyisocyanurate	1	(1.5)	1	(1.5)	1.5	(2.0)	1.5	(2.0) No
Water &	Calcium Silicate	1.5	(2.5)	2	(2.5)	2	(2.5)	2.5	(3.0) No
Pipes (150	Mineral Fiber	1.5	(2.0)	1.5	(2.5)	2	(2.5)	2	(2.5) No
to 200	Cellular Glass	1.5	(2.5)	1.5	(2.5)	2	(2.5)	2.5	(3.0) No
Degrees F)	Cellular Phenolic	1	(1.25)	1	(1.25)	1	(1.25)	1.5	1.5) No

TABLE I

Piping Insulation Wall Thickness

		<u>Tube And Pipe Size (Inches)</u>			
<u>Service</u>	<u>Material</u>	<u>1/4-1 1/4</u>	<u>1 1/2-3</u>	<u>3 1/2-5</u>	<u>6-& Larger</u>
<u>Vapor</u>					
<u>Barrier</u>					
<u>Required</u>					

NOTE: Thickness in parenthesis are for:

- (1) Cold piping - crawl spaces, mechanical rooms, and outside locations
- (2) Hot Piping - outside locations, not including tunnels and crawl spaces.
- (3) NP - Not permitted.

=====

TABLE IIInsulation For Equipment

<u>Material</u>	<u>Spec</u>	<u>Type</u>	<u>Class</u>	<u>Vapor Barrier Required</u>
Flexible Mineral Fiber,	ASTM C 553	I	B-3	Yes*/No
Rigid Mineral Fiber,	ASTM C 612		2	Yes*/No
or Cellular Glass	ASTM C 552	I		No

*Yes for chilled water and brine service and no for other services.

<u>Equipment</u>	<u>Recommended Wall Thickness</u>	<u>Vapor Barrier Required</u>
Expansion Tanks	2"	For Chilled Water Systems
Air Separators	2"	For Chilled Water Systems
All Pumps	2"	For Chilled Water Systems
Drain Pans	2"	For Chilled Water Systems

*Exact insulation thickness may be determined by proposed condition of use.

20-0075 Repair BEQ FC530

-- End of Section --

20-0075 Repair BEQ FC530

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SECTION 23 09 23.13

BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC
02/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)

AMCA 500-D (2012) Laboratory Methods of Testing
Dampers for Rating

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

ASHRAE 135 (2012; Addenda AR 2013; Errata 1 2013; INT
1-9 2013; Errata 2 2013; INT 10-12 2014;
Errata 3-4 2014; Addenda AI-AY 2014; INT
13-17 2015; Errata 5 2015) BACnet-A Data
Communication Protocol for Building
Automation and Control Networks

ASHRAE 135.1 (Errata 1 2015; INT 1 2013; Addenda O
2014) Method of Test for Conformance to
BACnet

ARCNET TRADE ASSOCIATION (ATA)

ATA 878.1 (1999) Local Area Network: Token Bus

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5 (2013) Pipe Flanges and Flanged Fittings:
NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B31.1 (2014; INT 1-47) Power Piping

ASTM INTERNATIONAL (ASTM)

ASTM A126 (2004; R 2014) Standard Specification for
Gray Iron Castings for Valves, Flanges,
and Pipe Fittings

ASTM B117 (2016) Standard Practice for Operating
Salt Spray (Fog) Apparatus

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-D (2014) Control Network Protocol
Specification

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE C62.41.1 (2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
- IEEE C62.41.2 (2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
- IEEE C62.45 (2002; R 2008) Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000v and less)AC Power Circuits

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

- ISO 8802-3 (2000) Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD)Access Method and Physical Layer Specifications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
- NFPA 72 (2019; TIA 19-1; ERTA 2019) National Fire Alarm and Signaling Code
- NFPA 90A (2015) Standard for the Installation of Air Conditioning and Ventilating Systems

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

- SMACNA 1966 (2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

UNDERWRITERS LABORATORIES (UL)

- UL 1449 (2014; Reprint Jul 2017) UL Standard for Safety Surge Protective Devices
- UL 506 (2008; Reprint Oct 2013) Specialty Transformers
- UL 508A (2013; Reprint Jan 2014) Industrial Control Panels
- UL 916 (2007; Reprint Aug 2014) Standard for Energy Management Equipment

1.2 DEFINITIONS

1.2.1 ANSI/ASHRAE Standard 135

ANSI/ASHRAE Standard 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks, referred to as "BACnet". ASHRAE developed BACnet to provide a method for diverse building automation devices to communicate and share data over a network.

1.2.2 ARCNET

ATA 878.1 - Attached Resource Computer Network. ARCNET is a deterministic LAN technology; meaning it's possible to determine the maximum delay before a device is able to transmit a message.

1.2.3 BACnet

Building Automation and Control Network; the common name for the communication standard ASHRAE 135. The standard defines methods and protocol for cooperating building automation devices to communicate over a variety of LAN technologies.

1.2.4 BACnet/IP

An extension of BACnet, Annex J, defines this mechanism using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number. See also "BACnet Broadcast Management Device".

1.2.5 BACnet Internetwork

Two or more BACnet networks, possibly using different LAN technologies, connected with routers. In a BACnet internetwork, there exists only one message path between devices.

1.2.6 BACnet Network

One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

1.2.7 BACnet Segment

One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

1.2.8 BBMD

BACnet Broadcast Management Device (BBMD). A communications device, typically combined with a BACnet router. A BBMD forwards BACnet broadcast messages to BACnet/IP devices and other BBMDs connected to the same BACnet/IP network. Every IP subnetwork that is part of a BACnet/IP network must have only one BBMD. See also "BACnet/IP".

1.2.9 BAS

Building Automation Systems, including DDC (Direct Digital Controls) used for facility automation and energy management.

1.2.10 BAS Owner

The regional or local user responsible for managing all aspects of the BAS operation, including: network connections, workstation management, technical support, control parameters, and daily operation. The BAS Owner for this project is Camp Lejeune Public Works.

1.2.11 BIBBs

BACnet Interoperability Building Blocks. A collection of BACnet services used to describe supported tasks. BIBBs are often described in terms of "A" (client) and "B" (server) devices. The "A" device uses data provided by the "B" device, or requests an action from the "B" device.

1.2.12 BI

BACnet International, formerly two organizations: the BACnet Manufacturers Association (BMA) and the BACnet Interest Group - North America (BIG-NA).

1.2.13 BI/BTL

BACnet International/BACnet Testing Laboratories (Formerly BMA/BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

1.2.14 Bridge

Network hardware that connects two or more network (or BACnet internetwork) segments at the physical and data link layers. A bridge may also filter messages.

1.2.15 Broadcast

A message sent to all devices on a network segment.

1.2.16 Device

Any control system component, usually a digital controller, that contains a BACnet Device Object and uses BACnet to communicate with other devices. See also "Digital Controller".

1.2.17 Device Object

Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

1.2.18 Device Profile

A collection of BIBBs determining minimum BACnet capabilities of a device, defined in ASHRAE Standard 135-2004, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing BIBBs supported.

1.2.19 Digital Controller

An electronic controller, usually with internal programming logic and digital and analog input/output capability, which performs control functions. In most cases, synonymous with a BACnet device described in this specification. See also "Device".

1.2.19.1 Terminal Device Controllers

Terminal device controllers typically are controllers with less control features, may have integrated actuators, and may be mounted directly on equipment (with enclosures).

1.2.19.2 Field Controllers

Field controllers typically have a greater capability for input/output and customization, do not have integral actuators, are mounted in an enclosure not on the equipment and are used for equipment such as VAV air handlers.

1.2.19.3 Plant Controllers

Plant controllers are typically used to control various equipment in mechanical rooms such as pumps, heat exchangers, and chillers.

1.2.19.4 Supervisory Building Controller (SBC)

The Supervisory Building Controller is used to coordinate all equipment in a building, input scheduling, and is used as a connection point for transferring configuration files to the other controllers. The SBC shall communicate with other controllers and equipment through a BACnet MS/TP bus. Depending on approvals and capabilities, the SBC may be used as a point of connection between the Camp Lejeune EMCS network (IP) and the building level control network (BACnet MS/TP).

1.2.20 Direct Digital Control (DDC)

Digital controllers performing control logic. Usually the controller directly senses physical values, makes control decisions with internal programs, and outputs control signals to directly operate switches, valves, dampers, and motor controllers.

1.2.21 DDC System

A network of digital controllers, communication architecture, and user interfaces. A DDC system may include programming, sensors, actuators, switches, relays, factory controls, operator workstations, and various other devices, components, and attributes.

1.2.22 Energy Management & Control System (EMCS)

The EMCS at Camp Lejeune is an enterprise system that actively receives energy and building condition information from multiple sources and provides load shedding, electric metering, alarming, trending, scheduling, set point adjustment and device status of all supervisory building controllers for maintenance personnel. The EMCS receives real time electrical utility pricing data and automatically manages to Camp Lejeune's energy target. The existing EMCS consists of two servers, 1) Johnson Controls Incorporated (JCI) Metasys Extended Architecture (ADX server), and 2) Niagara FX N4 supervisor (JCI FX web supervisor). Both

of the systems communicate over the MCEN and either may be used to fulfill the requirements of this specification.

1.2.23 Ethernet

A family of local-area-network technologies providing high-speed networking features over various media.

1.2.24 Firmware

Software programmed into read only memory (ROM), flash memory, electrically erasable programmable read only memory (EEPROM), or erasable programmable read only memory (EPROM) chips.

1.2.25 Gateway

Communication hardware and software connecting two or more different protocols, similar to human language translators. The Gateway translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a Gateway has BACnet on one side and non-BACnet protocols on the other side.

1.2.26 Global ID

An identification number assigned to each Supervisory Building Controller. The Global ID includes assigned MSTP Trunk Instance Numbers and a range of BACnet Instance Numbers to be used for the Field Controllers. The Global ID is assigned by Public Works.

1.2.27 Half Router

A device that participates as one partner in a BACnet point-to-point (PTP) connection. Two half-routers in an active PTP connection combine to form a single router.

1.2.28 Hub

A common connection point for devices on a network.

1.2.29 Internet Protocol (IP, TCP/IP, UDP/IP)

A communication method, the most common use is the World Wide Web. At the lowest level, it is based on Internet Protocol (IP), a method for conveying and routing packets of information over various LAN media. Two common protocols using IP are User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). UDP conveys information to well-known "sockets" without confirmation of receipt. TCP establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

1.2.30 Input/Output (I/O)

Physical inputs and outputs to and from a device, although the term sometimes describes software, or "virtual" I/O. See also "Points".

1.2.31 I/O Expansion Unit

An I/O expansion unit provides additional point capacity to a digital controller.

1.2.32 IP subnet

Internet protocol (IP) identifies individual devices with a 32-bit number divided into four groups from 0 to 255. Devices are often grouped and share some portion of this number. For example, one device has IP address 209.185.47.68 and another device has IP address 209.185.47.82. These two devices share Class C subnet 209.185.47.00

1.2.33 Local-Area Network (LAN)

A communication network that spans a limited geographic area and uses the same basic communication technology throughout.

1.2.34 LonTalk

CEA-709.1-D. A communication protocol developed by Echelon Corp. LonTalk is not permitted.

1.2.35 MAC Address

Media Access Control address. The physical node address that identifies a device on a Local Area Network.

1.2.36 Master-Slave/Token-Passing (MS/TP)

ISO 8802-3. One of the LAN options for BACnet. MSTP uses twisted-pair wiring for relatively low speed and low cost communication (up to 4,000 ft at 76.8K bps).

1.2.37 Native BACnet Device

A device that uses BACnet as its primary, if not only, method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

1.2.38 Network

Communication technology for data communications. BACnet approved network types are BACnet over Internet Protocol (IP), Point to Point (PTP) Ethernet, ARCNET, MS/TP, and LonTalk®. In general, networks within the building, all controllers and equipment will be BACnet MS/TP, unless noted otherwise.

1.2.39 Network Number

A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

1.2.40 Object

The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

1.2.41 Object Identifier

An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

1.2.42 Object Properties

Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

1.2.43 Peer-to-Peer

Peer-to-peer refers to devices where any device can initiate and respond to communication with other devices. Peer-to-Peer configurations must be reviewed and approved by Camp Lejeune Public Works Department.

1.2.44 Performance Verification Test (PVT)

The procedure for determining if the installed BAS meets design criteria prior to final acceptance. The PVT is performed after installation, testing, and balancing of mechanical systems. Typically the PVT is performed by the Contractor in the presence of the Government.

1.2.45 PID

Proportional, integral, and derivative control; three parameters used to control modulating equipment to maintain a setpoint. Derivative control is often not required for HVAC systems (leaving "PI" control).

1.2.46 PICS

Protocol Implementation Conformance Statement (PICS), describing the BACnet capabilities of a device. See BACnet, Annex A for the standard format and content of a PICS statement.

1.2.47 Points

Physical and virtual inputs and outputs. See also "Input/Output".

1.2.48 PTP

Point-to-Point protocol connects individual BACnet devices or networks using serial connections like modem-to-modem links.

1.2.49 Repeater

A network component that connects two or more physical segments at the physical layer.

1.2.50 Router

A BACnet router is a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN. If a router is connected directly to the MCEN, it must be listed on the approved DIACAP equipment list and must be Marine Corps DADMS listed and approved.

1.2.51 Stand-Alone Control

Refers to devices performing equipment-specific and small system control without communication to other devices or computers for physical I/O, excluding outside air and other common shared conditions. Devices are located near controlled equipment, with physical input and output points limited to 64 or less per device, except for complex individual equipment or systems. Failure of any single device or communications will not cause other network devices to fail. Internal time clocks and onboard scheduling are required to allow for stand-alone control. BACnet "Smart" actuators (B-SA profile) and sensors (B-SS profile) communicating on a network with a parent device are exempt from stand-alone requirements. Provide stand-alone control routines to provide for energy saving sequences such as free cooling. Provide stand-alone control routines that operate without connection to the BACnet/IP and MS/TP networks during a loss of communication.

1.2.52 Supervisory Building Controller

Supervisory Controller that is the main interface for the building control system.

1.3 SUBCONTRACTOR SPECIAL REQUIREMENTS

Perform all work in this section in accordance with the paragraph SUBCONTRACTOR SPECIAL REQUIREMENTS in Section 01 30 00 ADMINISTRATIVE REQUIREMENTS. The paragraph specifies that all contract requirements of this section shall be accomplished directly by a first tier subcontractor. No work required shall be accomplished by a second tier subcontractor.

1.4 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC DESCRIPTION

- a. Remove entire existing system and provide entire new BACnet DDC system(s) including associated equipment and accessories.
- b. All new devices are accessible using a Web browser interface and communicate using ASHRAE 135 BACnet communications without the use of gateways, unless gateways are shown on the design drawings and specifically requested by the Government. Where gateways are allowed, they must support ASHRAE 135, including all object properties and read-write services shown on Government approved interoperability schedules. Manufacturer's products, including design, materials, fabrication, assembly, inspection, and testing shall be in accordance with ASHRAE 135, ASME B31.1, and NFPA 70, except where indicated otherwise.

1.4.1 Design Requirements

1.4.1.1 Control System Drawings Title Sheet

Provide a title sheet for the control system drawing set. Include the project title, project location, contract number, the controls contractor preparing the drawings, an index of the control drawings in the set, and a legend of the symbols and abbreviations used throughout the control system drawings. The Title Block of each drawing must include the Drawing revision, i.e. Submittal, Revision 1, Revision 2, As-Built, etc., including the date.

1.4.1.2 List of I/O Points

Also known as a Point Schedule, provide for each input and output point physically connected to a digital controller: point name, point description, point type (Analog Output (AO), Analog Input (AI), Binary Output (BO), Binary Input (BI)), point sensor range, point actuator range, point address, BACnet object, associated BIBBS (where applicable), and point connection terminal number and cable type (18/2, 18/3, etc). Typical schedules for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. All points shall adhere to the Camp Lejeune Standard naming conventions.

1.4.1.3 Control System Components List

Provide a complete list of control system components installed on this project. Include for each controller and device: control system schematic name, control system schematic designation, device description, manufacturer, model, part number, firmware version, serial number, physical location (e.g. Building 4, room 112 overhead), and power requirements (i.e. AC/DC voltage and power draw). For sensors, include point name, sensor range, and operating limits. For valves, include body style, Cv, design flow rate, pressure drop, valve characteristic (linear or equal percentage), and pipe connection size. For actuators, include point name, spring or non-spring return, modulating or two-position action, normal (power fail) position, nominal control signal operating range (0-10 volts DC or 4-20 milliamps), and operating limits.

1.4.1.4 Control System Schematics

Provide control system schematics. Typical schematics for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. Include the following:

- a. Location of each input and output device, specify room # for remote devices.
- b. Flow diagram for each piece of HVAC equipment
- c. Name or symbol for each control system component, such as V-1 for a valve
- d. Setpoints, with differential or proportional band values
- e. Written sequence of operation for the HVAC equipment
- f. Valve and Damper Schedules, with normal (power fail) position
- g. Control cabinet general layout, include all devices, point count, cable type (18/2, 18/3, etc), 24VAC VA power requirement for all devices including those powered from the cabinet.

1.4.1.5 HVAC Equipment Control Ladder Diagrams

Provide HVAC equipment control ladder diagrams. Indicate required electrical interlocks. Ladder diagram schematics shall include 120 VAC and low voltage devices in each panel. Ladder diagram schematics shall also include all field devices (sensors, relays actuators, etc) and any connection point to controlled equipment or devices.

1.4.1.6 Component Wiring Diagrams

Provide a wiring diagram for each type of input device and output device. Indicate how each device is wired and powered; showing typical connections at the digital controller and power supply. Show for all field connected devices such as control relays, motor starters, actuators, sensors, and transmitters.

1.4.1.7 Terminal Strip Diagrams

Provide a diagram of each terminal strip. Indicate the terminal strip location, termination numbers, and associated point names.

1.4.1.8 BACnet Communication Architecture Schematic (Network Riser)

Provide a schematic showing the project's entire BACnet communication network, including control panel layout Internet Protocol (IP), Media Access Control (MAC), BACnet network, Device ID, field bus address, BBMDs, any devices using BACnet FDR, and Firmware version / Operating System, LAN devices including routers and bridges, gateways, controllers, workstations, and field interface devices. If applicable, show connections to existing networks and include the existing network in the riser diagram. Include surge protection device locations on the riser when the field controller communication trunk is leaving or entering a building.

1.5 SUBMITTALS

Submit detailed and annotated manufacturer's data, drawings, and specification sheets for each item listed, that clearly show compliance with the project specifications.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Include the following in the project's control system drawing set:

Control System Drawings Title Sheet

List of I/O Points

Control System Components List

Control System Schematics

HVAC Equipment Control Ladder Diagrams

Component Wiring Diagrams

Terminal Strip Diagrams

BACnet Communication Architecture Schematic (Network Riser)

Sequence of Operations

Control Panel Layout

SD-03 Product Data

Direct Digital Controllers

Include BACnet PICS for each controller/device type, including smart sensors (B-SS) and smart actuators (B-SA).

BACnet Gateways

Include BACnet and workstation display information; bi-directional communication ability; compliance with interoperability schedule; expansion capacity; handling of alarms, events, scheduling and trend data; and single device capability (not depending on multiple devices for exchanging information from either side of the gateway).

Notebook Computer Software

BACnet Operator Workstation

Include BACnet PICS for Operator Workstation software.

Notebook Computer

Sensors and Input Hardware

Output Hardware

Surge and Transient Protection

Duct smoke detectors

Variable Frequency (Motor) Drives

SD-05 Design Data

Performance Verification Testing Plan

SD-06 Test Reports

Performance Verification Testing Report

Bus Waveform Report

Pre-Performance Verification Testing Checklist

SD-07 Certificates

Contractor's Qualifications

Contractor's Training Certifications

SD-10 Operation and Maintenance Data

Comply with requirements for data packages in Section 01 78 23 OPERATION AND MAINTENANCE DATA, except as supplemented and modified in this specification.

BACnet Direct Digital Control Systems, Data Package 4

Controls System Operators Manuals, Data Package 4

VFD Service Manuals, Data Package 4

SD-11 Closeout Submittals

Training Documentation

1.6 QUALITY ASSURANCE

1.6.1 Standard Products

Provide material and equipment that are standard manufacturer's products currently in production and supported by a local service organization.

1.6.2 Delivery, Storage, and Handling

Handle, store, and protect equipment and materials to prevent damage before and during installation according to manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6.3 Operating Environment

Protect components from humidity and temperature variation, dust, and contaminants. If components are stored before installation, keep them within the manufacturer's limits.

1.6.4 Finish of New Equipment

New equipment finishing shall be factory provided. Manufacturer's standard factory finishing shall be proven to withstand 125 hours in a salt-spray fog test. Equipment located outdoors shall be proven to withstand 500 hours in a salt-spray fog test.

Salt-spray fog test shall be according to ASTM B117, with acceptance criteria as follows: immediately after completion of the test, the finish shall show no signs of degradation or loss of adhesion beyond 0.125 inch on either side of the scratch mark.

1.6.5 Verification of Dimensions

The contractor shall verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing work.

1.6.6 Contractor's Qualifications

Submit documentation certifying the controls Contractor performing the work has completed at least three DDC systems installations of a similar design to this project, and programmed similar sequences of operation for at least two years. Personnel performing the installation, programming, checkout, commissioning and training shall, at a minimum, have obtained all certifications required by the manufacturer for the tasks they are performing. Tasks include any activity required to execute and complete the contracted work. Certifications for each person shall be submitted prior to the beginning of the contracted work. Certifications shall be made available at any time upon the request from Camp Lejeune.

1.6.7 Modification of References

The advisory provisions in ASME B31.1, NFPA 70 and the manufacturer's recommendations are mandatory. Substitute "shall" for "should" wherever it appears and interpret all references to the "authority having jurisdiction" and "owner" to mean the Contracting Officer.

1.6.8 Project Sequence

The control system work for this project shall proceed in the following order:

- a. Preparatory meeting for controls work.
- b. Submit and receive approval on the Shop Drawings, Product Data, and Certificates specified under the paragraph SUBMITTALS>
- c. Submit and receive approval for Performance Verification Testing (PVT) Plan.
- d. Perform the control system installation work, including all field check-outs and tuning.
- e. Provide support to TAB personnel as specified under the paragraph TEST AND BALANCE SUPPORT.
- f. Submit and receive approval of the Controls System Operators Manual specified under the paragraph CONTROLS SYSTEM OPERATORS MANUALS.
- g. Perform the Performance Verification Testing.
- h. Submit and receive approval on the PVT Report. Submit As-Built Control Drawings
- i. PVT Report Acceptance test for Season 1.
- j. Submit and receive approval on the Training Documentation specified under the paragraph INSTRUCTION TO GOVERNMENT PERSONNEL and VFD Service Support. Submit at least 30 days before training.
- k. Deliver the final Controls System Operators Manuals and VFD Service Manuals.
- l. Conduct the Phase I Training and VFD on-site/hands-on training.
- m. Conduct the Phase II Training.
- n. Submit and receive approval of Closeout Submittals.
- o. PVT Report Acceptance Test for Season 2.

PART 2 PRODUCTS

2.1 DDC SYSTEM

- a. Provide a networked DDC system for stand-alone control in compliance with the latest revision of the ASHRAE 135 BACnet standard. Include

all programming, objects, and services required to meet the sequence of control. Provide BACnet MS/TP communications between the DDC system and native BACnet devices furnished with HVAC equipment and plant equipment including boilers, chillers, and variable frequency drives. Devices provided shall be certified in the BACnet Testing Laboratories (BTL) Product Listing and in accordance with ASHRAE 135.1 Method of Test for Conformance to BACnet. Controls provided integral to equipment shall be part of the DDC system and shall fully comply with this specification. Coordinate integration of integral controls into the system as a whole. BACnet over IP is not permitted within the DDC system.

- b. Assist the Government in interfacing the new DDC system with the site's existing server and operator workstation and software. Create graphics, scheduling, alarming, and trending.

2.1.1.1 Supervisory Building Controller (SBC)

ASHRAE 135 building controller that is the main interface for the building control system. Provide either a Johnson Controls Incorporated NAE or NCE; OR a JACE based on the Niagara N4 platform. The JACE (JAVA Application Control Engine) shall be minimally based on a Tridium 8000 with expanded memory and embedded "Niagara Workbench or Workplace" software.

Any device implementing the Niagara Framework is a Niagara Framework Supervisory Gateway and must meet these requirements. In addition to the general requirements for all DDC Hardware, Niagara Framework Supervisory Gateway Hardware must:

- a. Be direct digital control hardware.
 - b. Have an unrestricted interoperability license and its Niagara Compatibility Statement (NiCS) must follow the Tridium Open NiCS Specification.
 - c. Manage communications between a field control network and the Niagara Framework Monitoring and Control Software, and between itself and other Niagara Framework Supervisory Gateways. Niagara Framework Supervisory Gateway Hardware must use Fox protocol for communication with other Niagara Framework Components, regardless of the manufacturer of the other components.
 - d. Be fully programmable using the Niagara Framework Engineering Tool and must support the following:
 - (1) Time synchronization, Calendar, and Scheduling using Niagara Scheduling Objects
 - (2) Alarm generation and routing using the Niagara Alarm Service
 - (3) Trending using the Niagara History Service and Niagara Trend Log Objects
 - (4) Integration of field control networks using the Niagara Framework Engineering Tool
 - (5) Configuration of integrated field control system using the Niagara Framework Engineering Tool when supported by the field control system
 - e. Meet the following minimum hardware requirements:
 - (1) Two 10/100/1000 Mbps Ethernet Port(s)
 - (2) One or more MS/TP ports.
 - (3) Central Processing Unit of 1000 Mhz or higher.
 - (4) Embedded operating system.
 - f. Provide access to field control network data and supervisory functions via web interface and support a minimum of 16 simultaneous users.
- Note: implementation of this capability may not be required on all

projects.

g. Submit a backup of each Niagara Framework Supervisory Gateway. The backup must be sufficient to restore a Niagara Framework Supervisory Gateway to the final as-built condition such that a new Niagara Framework Supervisory Gateway loaded with the backup is indistinguishable in functionality from the original.

2.1.1.1 Niagara Framework Engineering Tool

The Niagara Framework Engineering Tool must be Niagara Workbench or an equivalent Niagara Framework engineering tool software and must:

- a. Have an unrestricted interoperability license and its Niagara Compatibility Statement (NiCS) must follow the Tridium Open NiCS Specification.
- b. Be capable of performing network configuration for Niagara Framework Supervisory Gateways and Niagara Framework Monitoring and Control Software.
- c. Be capable of programming and configuring of Niagara Framework Supervisory Gateways and Niagara Framework Monitoring and Control Software.
- d. Be capable of discovery of Niagara Framework Supervisory Gateways and all points mapped into each Niagara Framework Supervisory Gateway and making these points accessible to Niagara Framework Monitoring and Control Software.

2.1.2 EMCS Interface

The Energy Management & Control System (ECMS) at Camp Lejeune is comprised of two separate systems. Both of the systems communicate over the basewide Marine Corps Enterprise Network (MCEN). One uses the Johnson Controls Network Automation Engine (NAE) or Network Control Engine (NCE) to the ADX server. The second system uses a Niagara FX N4 web supervisor with a JACE in the building communicating using Fox protocol. Because of IT security and permissions, only these systems and equipment are permitted as part of the EMCS.

2.1.2.1 Supervisory Building Controller

Provide either a Johnson Controls NAE, NCE, or a JACE. This will serve as both the Supervisory Building Controller and the connection point between the buildings DDC and the EMCS. Provide a five year service license on all Supervisory Controllers. Provide a reserve of 10% of additional points and additional devices on the Supervisory Controller license at the final project acceptance. The contractor shall assign Camp Lejeune Public Works Department as the owner and manager of all licenses including 3rd party drivers.

2.1.2.2 Fortinet Firewall

In addition to the Supervisory controller, provide a Fortinet FortiGate Rugged Series 60D. Manufacturer: Fortinet Model: FGR-60D

2.1.3 Direct Digital Controllers

Direct digital controllers shall be UL 916 rated.

2.1.3.1 I/O Point Limitation

The total number of I/O hardware points used by a single stand-alone

digital controller, including I/O expansion units, shall not exceed 64, except for complex individual equipment or systems. Place I/O expansion units in the same cabinet as the digital controller. The field controller must have one spare Configurable Output and one spare Universal Input available per system upon project completion, i.e. AHU, ERU, DOAS, HW System, CHW System and other building primary systems. VAV controllers and programmable thermostats are excluded

2.1.3.2 Environmental Limits

Controllers shall be suitable for, or placed in protective enclosures suitable for the environment (temperature, humidity, dust, and vibration) where they are located.

2.1.3.3 Stand-Alone Controllers

Provide stand-alone direct digital controllers with internal time clocks. Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of any building communication failure. All I/O points specified for a piece of equipment shall be integral to its controller and serial connected expansion modules. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.

2.1.3.4 Internal Clock

Provide internal clocks and scheduling for all Direct Digital Controllers. Provide controllers with BTL listed profiles for all BACnet Building Controllers (B-BC) and BACnet Advanced Application Controllers (B-AAC) using BACnet time synchronization services. This includes but is not limited to VAV Controllers, Fan Coil controllers, Heat Pump controllers and any terminal controllers. BACnet Application specific controllers (B-ASC) will only be accepted for dedicated small exhaust system control such as restroom and mechanical room exhaust fans. Automatically synchronize system clocks daily from an operator-designated controller. The system shall automatically adjust for daylight saving time.

2.1.3.5 Memory

Provide sufficient memory for each controller to support the required control, communication, trends, alarms, and messages. Protect programs residing in memory with EEPROM, flash memory, or by an uninterruptible power source (battery or uninterruptible power supply). The backup power source shall have capacity to maintain the memory during a 72-hour continuous power outage. Rechargeable power sources shall be constantly charged while the controller is operating under normal line power. Batteries shall be replaceable without soldering. Trend and alarm history collected during normal operation shall not be lost during power outages less than 72 hours long.

2.1.3.6 Immunity to Power Fluctuations

Controllers shall operate at 90 percent to 110 percent nominal voltage rating.

2.1.3.7 Transformer

The controller power supply shall be fused or current limiting and rated

at 125 percent power consumption. Each transformer must singularly serve the connected load, i.e. do not wire transformers in parallel on the load side.

2.1.3.8 Wiring Terminations

Use screw terminal wiring terminations for all field-installed controllers. Provide field-removable modular terminal strip or a termination card connected by a ribbon cable for all controllers other than terminal units.

2.1.3.9 Input and Output Interface

Provide hard-wired input and output interface for all controllers as follows:

- a. Protection: Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with sources up to 24 volts AC or DC for any duration shall cause no controller damage.
- b. Binary Inputs: Binary inputs shall monitor on and off contacts from a "dry" remote device without external power, and external 5-24 VDC voltage inputs.
- c. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to binary input requirements and accumulate pulses at a resolution suitable to the application.
- d. Analog Inputs: Analog inputs shall monitor low-voltage (0-10 VDC), current (4-20 mA), or resistance (thermistor or RTD) signals.
- e. Binary Outputs: Binary outputs shall send a pulsed 24 VDC low-voltage signal for modulation control, or provide a maintained open-closed position for on-off control. Where appropriate, provide a method to select normally open or normally closed operation.
- f. Analog Outputs: Analog outputs shall send modulating 0-10 VDC or 4-20 mA signals to control output devices.
- g. Tri-State Outputs: Tri-State outputs shall provide three-point floating control of terminal unit electronic actuators.

2.1.3.10 Digital Controller BACnet Internetwork

Provide intermediate gateways, only when requested by the Government and shown on the contract drawings, to connect existing non-BACnet devices to the BACnet internetwork. Controller and operator interface communication shall conform to ASHRAE 135, BACnet. If a controller becomes non-responsive, the remaining controllers shall continue operating and not be affected by the failed controller.

2.1.3.11 Communications Ports

- a. Direct-Connect Interface Ports: Provide at least one extra communication port at each local BACnet network for direct connecting a notebook computer or BACnet hand-held terminal so all network BACnet objects and properties may be viewed and edited by the operator.

- b. BACnet routers supporting ARCnet shall also be capable of supporting MS/TP.

2.1.3.12 BACnet Gateways

Provide BACnet communication ports, whenever available as a plant equipment OEM standard option, for DDC integration via a single communication cable. Typical BACnet controlled plant equipment includes, but is not limited to, boilers, chillers, and variable frequency motor drives.

Provide gateways to connect BACnet to legacy systems, existing non-BACnet devices, and existing non-BACnet DDC controlled plant equipment, only when specifically requested and approved by the Government, and shown on the Government approved BACnet Communication Architecture Schematic. Provide with each gateway an interoperability schedule, showing each point or event on the legacy side that the BACnet "client" will read, and each parameter that the BACnet network will write to. Describe this interoperability in terms of BACnet services, or Interoperability Building Blocks (BIBBS), defined in ASHRAE 135 Annex K. Provide two-year minimum warranty for each gateway, including parts and labor.

The following minimum capabilities are required:

- a. Gateways shall be able to read and view all readable object properties listed in the interoperability schedule on the non-BACnet network to the BACnet network and vice versa where applicable.
- b. Gateways shall be able to write to all writeable object properties listed in the interoperability schedule on the non-BACnet network from the BACnet network and vice versa where applicable.
- c. Gateways shall provide single-pass (only one protocol to BACnet without intermediary protocols) translation from the non-BACnet protocol to BACnet and vice versa.
- d. Gateways shall meet the requirements of Data Sharing Read Property (DS-RP-B), Data Sharing Write Property (DS-WP-B), Device Management Dynamic Device Binding-B (DM-DDB-B), and Device Management Communication Control (DM-DCC-B) BIBBs, in accordance with ASHRAE 135.
- e. Gateways shall include all hardware, software, software licenses, and configuration tools for operator-to-gateway communications. Provide backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

2.1.3.13 Digital Controller Cabinet

Provide each digital controller including gateways, in a factory fabricated locked cabinet enclosure.

Cabinets located indoors shall protect against dust and have a minimum NEMA 1 rating, except where indicated otherwise. Cabinets located outdoors or in damp environments shall protect against all outdoor conditions and have a minimum NEMA 4 rating. Mechanical rooms that contain steam service or equipment including new steam boiler rooms are considered damp environments. Outdoor control panels and controllers must be able to withstand extreme ambient conditions, without malfunction or

failure, whether or not the controlled equipment is running. If necessary, provide a thermostatically controlled panel heater in freezing locations, and an internal ventilating fan in locations exposed to direct sunlight. Cabinets shall have a hinged lockable door and an offset removable metal back plate, except controllers integral with terminal units, like those mounted on VAV boxes. Provide like-keyed locks for all hinged panels provided and a set of two keys at each panel, with one key inserted in the lock. All devices must be mounted only to the cabinet backplane with adequate space allowed for serviceability and proper heat dissipation from devices. The Supervisory controller cabinet door position (closed/open) shall be monitored with a door switch and BACnet programmable relay such as the Functional Devices RIBTW2401B-BC. An "open" door status shall initiate an alarm to the EMCS Server.

2.1.3.14 Main Power Switch and Receptacle

Provide each control cabinet with a main external power on/off switch located inside the cabinet. Also provide each cabinet with a separate 120 VAC duplex convenience receptacle.

2.1.4 DDC Software

2.1.4.1 Programming

Provide programming to execute the sequence of operation indicated. Provide all programming and tools to configure and program all controllers. All software shall be licensed to Marine Corps Base, Camp Lejeune Complex for unrestricted use on Camp Lejeune Complex and reproduction for use on Camp Lejeune Complex. Software keys and "dongles" are not permitted. Provide programming routines in simple, easy-to-follow logic with detailed text comments describing what the logic does and how it corresponds to the project's written sequence of operation. All logic programming and control functions shall be closed loop, command and feedback for fault detection and alarming when status != command.

- a. Graphic-based programming shall use a library of function blocks made from pre-programmed code designed for BAS control. Function blocks shall be assembled with interconnecting lines, depicting the control sequence in a flowchart. If providing a computer with device programming tools as part of the project, graphic programs shall be viewable in real time showing present values and logical results from each function block.
- b. Menu-based programming shall be done by entering parameters, definitions, conditions, requirements, and constraints.
- c. For line-by-line and text-based programming, declare variable types (variable types include but are not limited to the following: local, global, real, and integer) at the beginning of the program. Use descriptive comments frequently to describe the programming.
- d. If providing a computer with device programming tools as part of the project, provide a means for detecting program errors and testing software strategies with a simulation tool. Simulation may be inherent within the programming software suite, or provided by physical controllers mounted in a NEMA 1 test enclosure. The test enclosure shall contain one dedicated controller of each type provided under this contract, complete with power supply and relevant accessories.

2.1.4.2 Parameter Modification

All writeable object properties, and all other programming parameters needed to comply with the project specification shall be adjustable for devices at any network level, including those accessible with web-browser communication, and regardless of programming methods used to create the applications.

2.1.4.3 Short Cycling Prevention

Provide setpoint differentials and minimum on/off times to prevent equipment short cycling.

2.1.4.4 Equipment Status Delay

Provide an adjustable delay from when equipment is commanded on or off and when the control program looks to the status input for confirmation.

2.1.4.5 Run Time Accumulation

Use the Elapsed Time Property to provide re-settable run time accumulation for each Binary Output Object connected to mechanical loads greater than 1 HP, electrical loads greater than 10 KW, or wherever else specified.

2.1.4.6 Timed Local Override

Provide an adjustable override time for each push of a timed local override button.

2.1.4.7 Time Synchronization

Provide time synchronization, including adjustments for leap years, daylight saving time, and operator time adjustments.

2.1.4.8 Scheduling

Provide operating schedules as indicated, with equipment assigned to groups. Changing the schedule of a group shall change the operating schedule of all equipment in the group. Groups shall be capable of operator creation, modification, and deletion. Provide capability to view and modify schedules in a seven-day week format. Provide capability to enter holiday and override schedules one full year at a time.

2.1.4.9 Object Property Override

Allow writeable object property values to accept overrides to any valid value. Where specified or required for the sequence of control, the Out-Of-Service property of Objects shall be modifiable using BACnet's write property service. When documented, exceptions to these requirement are allowed for life, machine, and process safeties.

2.1.4.10 Alarms and Events

Alarms and events shall be capable of having programmed time delays and high-low limits. When a web server is connected to the BACnet internetwork, alarms/events shall report to web server as defined by an authorized operator. Otherwise alarms/events shall be stored within a device on the BACnet network until connected to a user interface device

and retrieved. Provide alarms/events in agreement with the point schedule, sequence of operation, and the BAS Owner. At a minimum, provide programming to initiate alarms/events any time a piece of equipment fails to operate, a control point is outside normal range or condition shown on schedules, communication to a device is lost, a device has failed, or a controller has lost its memory.

2.1.4.11 Trending

Provide BACnet trending all object present values, set points, and other parameters indicated for trending on project schedules or at the request of Camp Lejeune or commissioning agents. Trends may be associated into groups, and a trend report may be set up for each group. Trends are stored within a device on the BACnet network, with operator selectable trend intervals from 10 seconds up to 60 minutes. The minimum number of consecutive trend values stored at one time shall be 100 per variable. When trend memory is full, the most recent data shall overwrite the oldest data.

The BACnet system shall allow for Change-Of-Value (COV) subscription based trending at user defined thresholds.

The B-BC shall upload trends automatically upon reaching 3/4 of the device buffer limit (via Notification_Threshold property), by operator request, or by time schedule for archiving. Archived and real-time trend data shall be available for viewing numerically and graphically for at the workstation and connected notebook computers.

Additionally, provide daily trend on geothermal well field supply and return temperatures. Allocate sufficient memory to store 24 months data.

2.1.4.12 Device Diagnostics

Each controller shall have diagnostic LEDs for power, communication, and device fault condition. The DDC system shall recognize and report a non-responsive controller.

2.1.4.13 Power Loss

Upon restoration of power, the DDC system shall perform an orderly restart and restoration of control.

2.1.5 Notebook Computer

Provide a notebook computer, complete with the project's installed DDC software, applications database, final archived field controller programs and Supervisory controller database, and graphics to fully troubleshoot and program the project's devices. Provide the notebook computer with ballistic nylon carrying case with shoulder strap with all necessary cables and interface hardware needed for setup and direct communication with the controllers and control system components. Direct communication shall not be through the Supervisory controller.

At a minimum the notebook computer shall include: Common Access Card Reader, Windows based operating system, minimum 2.7 GHz processor with 3 MB Cache, discrete switchable graphics card with minimum 1 GB dedicated memory, 1 Terabyte hard drive, 32 GB DDR3 RAM, 2 USB 3.0 ports, 10/100/1000 network interface card, 802.11 b/g/n WLAN, 17-inch display, keyboard with numeric keypad, 6-hour battery with charger, internal or

external 8X DVD+/-R/RW drive with double layer support with DVD creator software, and Microsoft Office Home and Business bundled software. Provide all original licenses, installation media, documentation, and recovery CDs capable of restoring the original configuration. Provide a means to connect the notebook computer directly to the installed field bus. Provide the manufacturer's 3-year accidental damage protection with 3-day on site response for 2 year warranty with the Government listed as the warranty owner.

2.1.6 Notebook Computer Software

2.1.6.1 Password Protection

System shall support role based access. At a minimum OS administrator, auditor, DDC operator and user roles must be defined. The system must be capable of enforcing role based access by location (e.g., Bob may alter operating parameters for Building 1 but not Building 2. Building 2 is Alice's responsibility).

Workstation shall be capable of DoD Common Access Card (CAC) login in addition to traditional username and password.

The lowest level only allow viewing graphics. The second level allows viewing graphics and changing space temperature setpoints. The third level allows the previous level's capability, plus changing operating schedules. The fourth level allows access to all functions except passwords. The highest level provides all administrator rights and allows full access to all programming, including setting new passwords and access levels. Provide the BAS Owner with the highest level password access. Provide automatic log out if no keyboard or mouse activity is detected after a user-defined time delay.

2.1.6.2 Notebook Computer DDC Software

Provide the workstation software with the manufacturer's installation CDs and licenses. Configure the software according to the DDC system manufacturer's specifications, cybersecurity requirements, and in agreement with BACnet Operator Workstation (B-OWS) device standards found in ASHRAE 135, Annex L.

The workstation software shall permit complete monitoring, modification, archiving, programming and troubleshooting interface with the DDC system including supervisory controller and field controllers. Software shall include, but not limited to, Niagara Workbench, JCI SCT, CCT/PCT or any controls manufacturer Supervisory controller and field controller programming software used to program the system. The operator interface with the software shall be menu-driven with appropriate displays and menu commands to manipulate the DDC system's objects, point data, operating schedules, control routines, system configuration, trends, alarms, messages, graphics, and reports. Trends shall be capable of graphic display in real time, with variables plotted as functions of time. Each alarmed point shall be capable of displaying its alarm history, showing when it went into alarm, if and when it was acknowledged, and when it went out of alarm. The modification of DDC system parameters and object properties shall be accomplished with "fill in the blank" and/or "point and drag" methods. Modifications shall download to the appropriate controllers at the operator's request.

2.1.6.3 Web-Based User Interface (UI) and Graphics

Provide web-based graphics fully compatible with Internet Explorer 9+, Safari, Firefox, and Google Chrome. Web-based user interface shall be browser agnostic and shall not rely on proprietary client side scripting to function.

Graphic displays shall have full-screen resolution when viewed on the workstation and notebook computers. Dynamic data on graphics pages shall refresh within 10 seconds using an Internet connection, or 30 seconds using a dial-up modem connection. Web-based user interface shall not rely on additional third-party browser "plug-in" software like Adobe Flash. Java client side applets may be used if appropriately signed. If Java client side runtimes are used they shall not require deprecated or otherwise unsupported Java runtime environments.

The graphics shall show the present value and object name for each of the project's I/O points on at least one graphic page. Arrange point values and names on the graphic displays in their appropriate physical locations with respect to the floor plan or equipment graphic displayed. Graphics shall allow the operator to monitor current status, view zone and equipment summaries, use point-and-click navigation between graphic pages, and edit setpoints and parameters directly from the screens. Items in alarm shall be displayed using a different color or other obvious visual indicator.

Provide graphics with the following:

- a. **Graphic Types:** Provide at least one graphic display for each piece of HVAC equipment, building floor, and controlled zone. Indicate dynamic point values, operating statuses, alarm conditions, and control setpoints on each display. Provide summary pages where appropriate.
 - (1) **Building Elevation:** For buildings more than one story, provide an elevation view of the building with links to each of the building's floor plans. Simulate the building's architecture and include the building number and floor numbers. If possible, use an actual photograph of the building.
 - (2) **Building Floor Plans:** Provide a floor plan graphic for each of the building's floors and roof with dynamic display of space temperature and other important data. If used, indicate and provide links to sub-plan areas. If possible, use the project's electronic drawing files for the graphic backgrounds. Provide clear names for important areas, such as "Main Conference Room." Include room names and numbers where applicable. Include features such as stairwells, elevators, and main entrances. Where applicable, include the mechanical room, HVAC equipment, and control component locations, with corresponding links to the equipment graphics.
 - (3) **Sub-plan Areas:** Where a building's floor plan is too large to adequately display on the screen, sub-divide the plan into distinct areas, and provide a separate graphic display for each area. Provide same level of detail requested in building floor plan section above.
 - (4) **HVAC Equipment:** Provide a graphic display for each piece of HVAC equipment, such as a fan coil unit, VAV terminal, or air handling unit. Equipment shall be represented by a two or

three-dimensional drawing. Where multiple pieces of equipment combine to form a system, such as a central chiller plant or central heating plant, provide one graphic to depict the entire plant. Indicate the equipment, piping, ductwork, dampers, and control valves in the installed location. Include labels for equipment, piping, ductwork, dampers, and control valves. Show the direction of air and water flow. Include dynamic display of applicable object data with clear names in appropriate locations.

- (5) Sequence of Operation: Provide a graphic screen displaying the written out full sequence of operation for each piece of HVAC equipment. Provide a link to the sequence of operation displays on their respective equipment graphics. Include dynamic real-time data within the text for setpoints and variables.

- b. Graphic Title: Provide a prominent, descriptive title on each graphic page.
- c. Dynamic Update: When the workstation is on-line, all graphic I/O object values shall update with change-of-value services, or by operator selected discrete intervals.
- d. Graphic Linking: Provide forward and backward linking between floor plans, sub-plans, and equipment.
- e. Graphic Editing: Provide installed software to create, modify, and delete the DDC graphics. Include the ability to store graphic symbols in a symbol directory and import these symbols into the graphics.
- f. Dynamic Point Editing: Provide full editing capability for deleting, adding, and modifying dynamic points on the graphics.

2.2 SENSORS AND INPUT HARDWARE

Coordinate sensor types with the BAS Owner to keep them consistent with existing installations.

2.2.1 Field-Installed Temperature Sensors

Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless absolutely necessary.

2.2.1.1 Thermistors

Precision thermistors may be used in applications below 200 degrees F. Sensor accuracy over the application range shall be 0.36 degree F or less between 32 to 150 degrees F. Stability error of the thermistor over five years shall not exceed 0.25 degrees F cumulative. A/D conversion resolution error shall be kept to 0.1 degrees F. Total error for a thermistor circuit shall not exceed 0.5 degrees F.

2.2.1.2 Resistance Temperature Detectors (RTDs)

Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (10k ohms) at 32 degrees F. Temperature sensor stability error over five years shall not exceed 0.25 degrees F cumulative. Direct connection of RTDs to digital controllers without

transmitters is preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25 degrees F. The total error for a RTD circuit shall not exceed 0.5 degrees F.

2.2.1.3 Temperature Sensor Details

- a. Room Type: Provide the sensing element components within a decorative protective cover suitable for surrounding decor. Provide room temperature sensors with timed override button, and setpoint adjustment lever +/-2 degrees F.
- b. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.
- c. Duct Averaging Type: Continuous averaging sensors shall be one foot in length for each 4 square feet of duct cross-sectional area, and a minimum length of 6 feet.
- d. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior.
- e. Outside Air Type: Provide the sensing element on the building's north side with a protective weather shade that positions the sensor approximately 3 inches off the wall surface, does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain.

2.2.2 Supervisory Controller MCEN Network Homerun

See CLGS 27 10 00.

2.2.3 Transmitters

Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated, and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 degrees F a year.

2.2.3.1 Relative Humidity Transmitters

Provide transmitters with an accuracy equal to plus or minus 3 percent from 0 to 90 percent scale, and less than one percent drift per year. Sensing elements shall be the polymer type.

2.2.3.2 Pressure Transmitters

Provide transmitters integral with the pressure transducer.

2.2.4 Current Transducers

Provide current transducers to monitor motor amperage, unless current switches are shown on design drawings or point tables.

2.2.5 Motor Run Status

Unless otherwise noted, provide current switches to indicate run status of pumps and fans. Sensitivity of the switch on belt driven equipment should distinguish between loaded motor and unloaded motor such as a fan with a broken belt.

2.2.6 Air Quality Sensors

Provide power supply for each sensor.

2.2.6.1 CO2 Sensors

Provide photo-acoustic type CO2 sensors with integral transducers and linear output. The devices shall read CO2 concentrations between 0 and 2000 ppm with full scale accuracy of at least plus or minus 100 ppm.

2.2.6.2 Air Quality Sensors

Provide full spectrum air quality sensors using a hot wire element based on the Taguchi principle. The sensor shall monitor a wide range of gaseous volatile organic components common in indoor air contaminants like paint fumes, solvents, cigarette smoke, and vehicle exhaust. The sensor shall automatically compensate for temperature and humidity, have span and calibration potentiometers, operate on 24 VDC power with output of 0-10 VDC, and have a service rating of 32 to 140 degrees F and 5 to 95 percent relative humidity.

2.2.7 Input Switches

2.2.7.1 Timed Local Overrides

Provide buttons or switches to override the DDC occupancy schedule programming for each major building zone during unoccupied periods, and to return HVAC equipment to the occupied mode. This requirement is waived for zones clearly intended for 24 hour continuous operation.

2.2.7.2 Emergency Shut Down Switches (ATFP)

Anti Terrorism Force Protection emergency shut down switches must be two action to prevent accidental initiation, such as a mushroom push button with a cover.

2.2.8 Freeze Protection Thermostats

Provide special purpose thermostats with flexible capillary elements 20 feet minimum length for coil face areas up to 40 square feet. Provide longer elements for larger coils at 1-foot of element for every 4 square feet of coil face area, or provide additional thermostats. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat

requires manual resetting before the HVAC equipment can restart.

2.2.9 Air Flow Measurement Stations

Air flow measurement stations shall have an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements shall be the RTD or thermistor type, traversing the ducted air in at least two directions. The air flow pressure drop across the station shall not exceed 0.08 inch water gage at a velocity of 2,000 fpm. The station shall be suitable for air flows up to 5,000 fpm, and a temperature range of 40 to 120 degrees F. The station's measurement accuracy over the range of 125 to 2,500 fpm shall be plus or minus 3 percent of the measured velocity. Station transmitters shall provide a linear, temperature-compensated 4 to 20 mA or 0 to 10 VDC output. The output shall be capable of being accurately converted to a corresponding air flow rate in cubic feet per minute. Transmitters shall be a 2-wire, loop powered device. The output error of the transmitter shall not exceed 0.5 percent of the measurement.

2.2.10 Air Flow Measurement for Terminal Devices

Air flow measurement for terminal devices such as variable air volume boxes, with or without fan power shall have an array of pressure sensing elements than sense total pressure and static pressure. The flow measurement shall be integral to the device controller and shall be by differential pressure sensor. The air flow shall measure flows down to 300 fpm with an accuracy of 5 percent of reading.

2.3 OUTPUT HARDWARE

2.3.1 Control Dampers

Provide factory manufactured galvanized steel dampers where indicated. Dampers shall be opposed blade for rectangular applications 10-inches and taller, and single blade for round dampers and rectangular dampers shorter than 10-inches. Control dampers shall comply with SMACNA 1966 except as modified or supplemented by this specification. Published damper leakage rates and respective pressure drops shall have been verified by tests in compliance with AMCA 500-D requirements.

Provide damper assembly frames constructed of minimum thickness galvanized steel channels with mitered and welded corners. Damper axles shall be 0.5 inches minimum diameter plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings.

Dampers shall be rated for not less than 2000 fpm air velocity. The pressure drop through each damper when full-open shall not exceed 0.04 inches water gage at 1000 fpm face velocity. Damper assemblies in ductwork shall be constructed to meet SMACNA Seal Class "A" construction requirements.

Provide the damper operating linkages outside of the air stream, including crank arms, connecting rods, and other hardware that transmits motion from the damper actuators to the dampers, shall be adjustable. Additionally, operating linkages shall be designed and constructed to have a 2 to 1 safety factor when loaded with the maximum required damper operating force. Linkages shall be brass, bronze, galvanized steel, or stainless steel.

Provide access doors or panels in hard ceilings and walls for access to all concealed damper operators and damper locking setscrews.

For field-installed control dampers, a single damper section shall have blades no longer than 48 inches and no higher than 72 inches. The maximum damper blade width shall be 12 inches. Larger sized dampers shall be built using a combination of sections.

Frames shall be at least 2 inches wide. Flat blades shall have edges folded for rigidity. Blades shall be provided with compressible gasket seals along the full length of the blades to prevent air leakage when closed.

The damper frames shall be provided with jamb seals to minimize air leakage. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F.

The leakage rate of each damper when full-closed shall be no more than 3 cfm per sq. foot of damper face area at 1.0 inches water gage static pressure.

2.3.2 Control Valves

2.3.2.1 Valve Assembly

Valve bodies shall be designed for 125 psig minimum working pressure or 150 percent of the operating pressure, whichever is greater. Valve stems shall be Type 316 stainless steel. Valve leakage ratings shall be 0.01 percent of rated Cv value. Class 125 copper alloy valve bodies and Class 150 steel or stainless steel valves shall meet the requirements of ASME B16.5. Cast iron valve components shall meet the requirements of ASTM A126 Class B or C.

2.3.2.2 Butterfly Valves

Butterfly valves shall be the threaded lug type suitable for dead-end service and for modulation to the fully-closed position, with stainless steel shafts supported by bearings, non-corrosive discs geometrically interlocked with or bolted to the shaft (no pins), and EPDM seats suitable for temperatures from minus 20 degrees F to plus 250 degrees F. Valves shall have a means of manual operation independent of the actuator.

2.3.2.3 Two-Way Valves

Two-way modulating valves shall have an equal percentage characteristic.

2.3.2.4 Three-Way Valves

Three-way valves shall have an equal percentage characteristic.

2.3.2.5 Valves for Chilled Water Service

- a. Bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends. Bodies for valves from 2 inches to 3 inches inclusive shall be of brass, bronze, or iron. Bodies for 2 inch valves shall have threaded connections. Bodies for valves from 2-1/2 to 3 inches shall have flanged connections.

- b. Internal valve trim shall be brass or bronze, except that valve stems shall be stainless steel.
- c. Unless indicated otherwise, provide modulating valves sized for 2 psi minimum and 4 psi maximum differential across the valve at the design flow rate.
- d. Valves 4 inches and larger shall be butterfly valves, unless indicated otherwise.

2.3.2.6 Valves for Hot Water Service

Valves for hot water service below 250 Degrees F:

- a. Bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends. Bodies for valves from 2 inches to 3 inches inclusive shall be of brass, bronze, or iron. Bodies for 2 inch valves shall have threaded connections. Bodies for valves from 2-1/2 to 3 inches shall have flanged connections.
- b. Internal trim (including seats, seat rings, modulation plugs, valve stems, and springs) of valves controlling water above 210 degrees F shall be Type 316 stainless steel.
- c. Internal trim for valves controlling water 210 degrees F or less shall be brass or bronze. Valve stems shall be Type 316 stainless steel.
- d. Non-metallic parts of hot water control valves shall be suitable for a minimum continuous operating temperature of 250 degrees F or 50 degrees F above the system design temperature, whichever is higher.
- e. Unless indicated otherwise, provide modulating valves sized for 2 psi minimum and 4 psi maximum differential across the valve at the design flow rate.
- f. Valves 4 inches and larger shall be butterfly valves, unless indicated otherwise.

2.3.3 Actuators

Provide direct-drive electric actuators for all control applications, except where indicated otherwise. All actuators shall include a feedback loop for detecting actuator faults. The actuator shall report actual position back to the control system. Binary actuators shall provide open/closed status, at a minimum. Modulating actuators and process shall provide position feedback expressed (directly or through span conversion) as percent open/closed. Actuator status shall be derived from actuator position; however, effect may be used in cases where direct feedback is not practical such as VAV coils and dampers.

Use airflow sensors as a feedback loop for damper actuators. Use differential temperature as a feedback mechanism for VAV coil valve actuation.

2.3.3.1 Electric Actuators

Each actuator shall deliver the torque required for continuous uniform motion and shall have internal end switches to limit the travel, or be capable of withstanding continuous stalling without damage. Actuators

shall function properly within 85 to 110 percent of rated line voltage. Provide actuators with hardened steel running shafts and gears of steel or copper alloy. Fiber or reinforced nylon gears may be used for torques less than 16 inch-pounds. Provide two-position actuators of single direction, spring return, or reversing type. Provide modulating actuators capable of stopping at any point in the cycle, and starting in either direction from any point. Actuators shall be equipped with a switch for reversing direction, and a button to disengage the clutch to allow manual adjustments. Provide the actuator with a hand crank for manual adjustments, as applicable. Thermal type actuators may only be used on terminal fan coil units, terminal VAV units, convectors, and unit heaters. Spring return actuators shall be provided on all control dampers and all control valves except terminal fan coil units, terminal VAV units, convectors, and unit heaters; unless indicated otherwise. Each actuator shall have distinct markings indicating the full-open and full-closed position, and the points in-between. Actuators mounted outdoors shall be outdoor rated and not require a weatherproof enclosure.

2.3.4 Output Switches

2.3.4.1 Control Relays

Field installed and DDC panel relays shall be double pole, double throw, UL listed, with contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

2.4 ELECTRICAL POWER AND CONTROL WIRING

2.4.1 Transformers

Transformers shall conform to UL 506. For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.

2.4.2 Surge and Transient Protection

Provide each control cabinet with surge and transient power protection. Surge protection is not required for small terminal unit controllers such as VAV controllers. Surge and transient protection shall consist of the following devices, installed externally to the controllers.

2.4.2.1 Power Line Surge Protection

Provide surge suppressors on the incoming power at each direct digital controller or grouped terminal controllers and shall be installed externally to the device or devices being protected. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following:

- a. The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.
- b. The device shall react within 5 nanoseconds and automatically reset.

- c. The voltage protection threshold, line to neutral, shall be no more than 211 volts.
- d. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.
- e. The primary suppression system components shall be pure silicon avalanche diodes.
- f. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.
- g. The device shall have an indication light to indicate the protection components are functioning.
- h. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.
- i. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.
- j. The device shall comply with IEEE C62.41.1 and IEEE C62.41.2, Class "B" requirements and be tested according to IEEE C62.45.
- k. The device shall be capable of operating between minus 20 degrees F and plus 122 degrees F.

2.4.2.2 MS/TP Communication Line Surge Protection

Provide surge and transient protection for DDC controllers and DDC network related devices connected to phone lines, network communication lines, lines from exterior equipment, and lines from other buildings including mechanical buildings in accordance with the following:

- a. The device shall provide continuous, non-interrupting protection.
- b. The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology.
- c. The device shall be installed at the distance recommended by its manufacturer.

Include the location of the surge protection devices on the control drawing network riser.

2.4.3 Wiring

Provide complete electrical wiring for the DDC System, including wiring to transformer primaries. Run all control wiring in rigid or flexible conduit, metallic tubing, or covered metal raceways, unless noted otherwise. Control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Circuits operating at more than 100 volts shall be in accordance with Section 26 20 00, INTERIOR DISTRIBUTION SYSTEM. Run all circuits over 100 volts in conduit, metallic tubing, covered metal raceways, or armored cable. Follow cable manufacturer's recommendations or requirements based on the cable usage, such as outdoors and/or underground.

2.4.3.1 Power Wiring

The following requirements are for field-installed wiring:

- a. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.
- b. Wiring for 120 V circuits shall be insulated copper 12 AWG minimum and rated for 600 VAC service.

2.4.3.2 Analog Signal and Binary Wiring

Provide in accordance with control manufacturer's recommendations and the following: Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape. All binary input and output wiring shall be 18 AWG.

2.4.3.3 MS/TP Communication Bus

- a. Provide system manufacturer's recommended or preferred cabling.
- b. Follow cable manufacturer's recommendations or requirements based on the cable usage, such as outdoors and/or underground.
- c. Splices in communication cable are not allowed. Segments of communication cable between field devices shall be solid lengths with no splices.

2.4.3.4 Conduit

Conduit for controls less than 100 volts shall be colored blue. Junction box cover plates for controls shall be blue. Fittings and boxes do not need to be blue.

2.5 FIRE PROTECTION DEVICES

2.5.1 Duct Smoke Detectors

Provide duct smoke detectors in HVAC ducts in accordance with NFPA 72 and NFPA 90A, except as indicated otherwise. Provide UL listed or FM approved detectors, designed specifically for duct installation.

Furnish detectors under Section 28 31 76.00 20 INTERIOR FIRE ALARM AND MASS NOTIFICATION SYSTEM and install under this section. Connect new detectors to the building fire alarm panel.

2.6 VARIABLE FREQUENCY (MOTOR) DRIVES

Provide variable frequency drives (VFDs) as indicated. VFDs shall convert 208 or 480 volt (plus or minus 10 percent), three phase, 60 hertz (plus or minus 2Hz), utility grade power to adjustable voltage/frequency, three phase, AC power for stepless motor control from 5 percent to 200 percent of base speed. VFDs shall be UL listed as delivered to the end user. The VFD shall meet the requirements specified in the most current National Electrical Code. Each VFD shall also meet the following:

- a. The VFD shall use sine coded Pulse Width Modulation (PWM) technology. PWM calculations shall be performed by the VFD microprocessor.
- b. The VFD shall be capable of automatic control by a remote 4-20 mA signal, by network command, or manually by the VFD control panel.

2.6.1 VFD Quality Assurance

VFDs shall be the manufacturer's current standard production unit with at least 10 identical units successfully operating in the field.

2.6.2 VFD Service Support

- a. Warranty: Provide the VFDs with a minimum 24-month full parts and labor warranty. The warranty shall start when the contract's HVAC system is accepted by the Government. Include warranty documentation, dates, and contact information with the VFD on-site service manuals.
- b. VFD Service Manuals: Provide the VFDs with all necessary installation, operation, maintenance, troubleshooting, service, and repair manuals in English including related factory technical bulletins. Provide the documents factory bound, in sturdy 3-ring binders, or hard bound covers. Provide a title sheet on the outside of each binder indicating the project title, project location, installing contractor, contract number, and the VFD manufacturer, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. The documentation provided shall be specifically applicable to this project, shall be annotated to reflect the actual project conditions, and shall provide a complete and concise depiction of the installed work. Provide a storage cabinet on or near the VFD large enough to hold all of the documentation. Have the cabinet's proposed installation site approved in advance by the Contracting Officer. Prominently label the cabinet "VFD OPERATION AND MAINTENANCE MANUALS." Clearly label each manual with the wording "MECHANICAL ROOM COPY - DO NOT REMOVE".
- c. Technical Support: Provide the VFDs with manufacturer's technical telephone support in English, readily available during normal working hours, and free of charge for the life of the equipment.
- d. Initial Start-Up: Provide the VFDs with factory-trained personnel for the on-site start-up of the HVAC equipment and associated VFD. The personnel shall be competent in the complete start-up, operation, and repair of the particular model VFD installed. The factory start-up representative shall perform the factory's complete recommended start-up procedures and check-out tests on the VFD. Include a copy of the start-up test documentation with the VFD on-site service manuals.
- e. Provide the VFDs with on-site/hands-on training for the user and maintenance personnel. Provide a capable and qualified instructor with minimum two years field experience with the operation and maintenance of similar VFDs. The training shall occur during normal working hours and last not less than 2 hours. Coordinate the training time with the Contracting Officer and the end user. The VFD service manuals shall be used during the training. The contractor shall ensure the manuals are on-site before the start of training. The training shall cover all operational aspects of the VFD.

2.6.3 VFD Features

VFDs shall have the following features:

- a. A local operator control keypad capable of:
 - (1) Remote/Local operator selection with password access.
 - (2) Run/Stop and manual speed commands.
 - (3) All programming functions.
 - (4) Scrolling through all display functions.
- b. Digital display capable of indicating:
 - (1) VFD status.
 - (2) Frequency.
 - (3) Motor RPM.
 - (4) Phase current.
 - (5) Fault diagnostics in descriptive text.
 - (6) All programmed parameters.
 - (7) Load power.
- c. Standard PI loop controller with input terminal for controlled variable and parameter settings.
- d. User interface terminals for remote control of VFD speed, speed feedback, and an isolated form C SPDT relay, which energizes on a drive fault condition.
- e. An isolated form C SPDT auxiliary relay which energizes on a run command.
- f. A metal NEMA 1 enclosure for indoors, NEMA 4 with heater for outdoors.
- g. An adjustable carrier frequency with 16 KHz minimum upper limit.
- h. A built in DC buss reactor with 3 percent minimum impedance to protect the VFDs DC buss capacitors and rectifier section diodes.

2.6.4 Programmable Parameters

VFDs shall include the following operator programmable parameters:

- a. Upper and lower limit frequency.
- b. Acceleration and Deceleration rate.
- c. Variable torque volts per Hertz curve.
- d. Starting voltage level.

- e. Starting frequency level.
- f. Display speed scaling.
- g. Enable/disable auto-restart feature.
- h. Enable/disable soft stall feature.
- i. Motor overload level.
- j. Motor stall level.
- k. Jump frequency and hysteresis band.
- l. PWM carrier frequency.

2.6.5 Protective Features

VFDs shall have the following protective features:

- a. An electronic adjustable inverse time current limit with consideration for additional heating of the motor at frequencies below 45Hz, for the protection of the motor.
- b. An electronic adjustable soft stall feature, allowing the VFD to lower the frequency to a point where the motor will not exceed the full-load amperage when an overload condition exists at the requested frequency. The VFD will automatically return to the requested frequency when load conditions permit.
- c. A separate electronic stall at 110 percent VFD rated current, and a separate hardware trip at 190 percent current.
- d. Ground fault protection that protects the output cables and motor from grounds during both starting and continuous running conditions.
- e. The ability to restart after the following faults:
 - (1) Overcurrent (drive or motor).
 - (2) Power outage.
 - (3) Phase loss.
 - (4) Over voltage/Under voltage.
- f. The ability shut down if inadvertently started into a rotating load without damaging the VFD or the motor.
- g. The ability to keep a log of a minimum of four previous fault conditions, indicating the fault type and time of occurrence in descriptive text.
- h. The ability to sustain 110 percent rated current for 60 seconds
- i. The ability to shutdown safely or protect against and record the following fault conditions:
 - (1) Over current (and an indication if the over current was during

acceleration, deceleration, or running).

- (2) Over current internal to the drive.
- (3) Motor overload at start-up.
- (4) Over voltage from utility power.
- (5) Motor running overload.
- (6) Over voltage during deceleration.
- (7) VFD over heat.
- (8) Load end ground fault.
- (9) Abnormal parameters or data in VFD EEPROM.

2.6.6 Minimum Operating Conditions

VFDs shall be designed and constructed to operate within the following service conditions:

- a. Ambient Temperature Range, 0 to 120 degrees F.
- b. Non-condensing relative humidity to 90 percent.

2.6.7 Additional Features

Provide VFDs with the following additional features:

- a. BACnet communication interface port

PART 3 EXECUTION

3.1 INSTALLATION

Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems. All material and equipment shall be installed in accordance with the manufacturer's recommendations for the intended purpose. Maintain a copy of the manufacturer's recommendations on the Construction Site. Use the more stringent methods when manufacturer's recommendations, and plans & specification requirements differ. Use the "Preferred" method when alternative methods are given. The word "should" will be considered to mean "shall". Bring any conflicts between manufacturer's recommendations and plans & specification requirements to the Government's attention. All equipment shall be installed level and plumb.

3.1.1 Pre-Installation Meeting

Prior to starting the installation, meet with the Contracting Officer's Technical Representative (COTR) and the BAS owner to develop a mutual understanding relative to the details of the DDC system requirements. Requirements to be discussed include required submittals, work schedule, and field quality control.

3.1.2 Demolition

Remove and/or demolish all existing controls, cabling, conductors, conduit, controllers, power circuits and cabinets that are no longer needed after new work is installed. Any existing systems to remain, must remain functional and operate properly after all demolition is complete.

3.1.3 BACnet Naming and Addressing

Coordinate with the EMCS Owner and provide unique naming and addressing consistent with existing buildings already loaded on the EMCS server. All DDC controllers shall have a Camp Lejeune unique instance number and all Supervisory Building Controllers shall have a Camp Lejeune unique name. Names are managed by the Government.

a. MAC Address

Every BACnet device shall have an assigned and documented MAC Address unique to its network. For Ethernet networks, document the MAC Address assigned at its creation. For MS/TP networks, assign addresses from 0-127. Do not use the controls manufacturer reserved addresses for field controllers. This is typically 0-3. Also the BACnet Instance ID for MAC Address 127, Trunk 1, is reserved for the Supervisory controller. Supervisory Controller Global ID and instance numbers are to be obtained from Camp Lejeune Public Works Operations to ensure duplicates do not occur. Point of Contact:

Public Works Division/EMCS
1005 Michael Road / Building 1005
MCB Camp Lejeune, NC 28547
(910) 450-7846

For MS/TP, assign from 01 to 127 unless reserved by the manufacturer.

b. Network Numbering

Assign unique numbers to each new network installed on the BACnet internetwork. Provide ability for changing the network number; either by device switches, network computer, or field operator interface. The BACnet internetwork (all possible connected networks) can contain up to 65,534 possible unique networks.

c. Device Object Identifier Property Number

Assign unique Device "Object_Identifier" property numbers or device instances for each device on the BACnet internetwork. Provide for future modification of the device instance number; either by device switches, network computer, or field interface. Instance numbers must be field assignable. BACnet allows up to 4,194,302 possible unique devices per internetwork.

d. Device Object Name Property Text

Each object on the Camp Lejeune EMCS has a unique point name, which is made up of the object or short name stored in the controller and the equipment identifier, which is stored in the supervisory building controller (SBC). The long point name combines this object name with the name stored in the SBC that describes the controller or location

of the object. The device object name property field shall support 32 minimum printable characters. The point name follows the general convention:

Building.Equipment.Object Name

Example: HP512.AHU-3.DA-T. See Attachments one through three for equipment names, object names, object groupings, and area names.

e. Object Name Property Text (Other than Device Objects)

The object name identifies the specific point. Only object names on the approved Camp Lejeune list shall be used. From the example above, the point name is: "DA-T". See Attachment for the approved Camp Lejeune list. The object name property field shall support 32 minimum printable characters.

f. Object Description

The controller shall also store an alpha numeric description of the object name. The controller shall support a minimum of 30 printable characters. From the example above the object description is: "Discharge Air Temperature".

g. List of Attachments

Attachment 1 - Equipment Names
Attachment 2 - Object Names
Attachment 3 - Object Grouping
Attachment 4 - Niagara BAS Alarms Policy
Attachment 5 - Trend (History)

3.1.4 Minimum BACnet Object Requirements

a. Use of Standard BACnet Objects in accordance with existing Camp Lejeune Standards

For the following points and parameters, use standard BACnet objects, where all relevant object properties can be read using BACnet's Read Property Service, and all relevant object properties can be modified using BACnet's Write Property Service:

all device physical inputs and outputs, all set points, all PID tuning parameters, all calculated pressures, flow rates, and consumption values, all alarms, all trends, all schedules, and all equipment and lighting circuit operating status.

b. BACnet Object Description Property

The Object Description property shall support 32 minimum printable characters. For each object, complete the description property field using a brief, narrative, plain English description specific to the object and project application. For example: "HW Pump 1 Proof." Document compliance, length restrictions, and whether the description is writeable in the device PICS.

c. Analog Input, Output, and Value Objects

Support and provide Description and Device_Type text strings matching signal type and engineering units shown on the points list.

d. Binary Input, Output, and Value Objects

Support and provide Inactive_Text and Active_Text property descriptions matching conditions shown on the points list.

e. Calendar Object

For devices with scheduling capability, provide at least one Calendar Object with ten-entry capacity. All operators may view Calendar Objects; authorized operators may make modifications from a workstation. Enable the writeable Date List property and support all calendar entry data types.

f. Schedule Object

Use Schedule Objects for all building system scheduling. All operators may view schedule entries; authorized operators may modify schedules from a workstation.

g. Loop Object or Equal

Use Loop Objects or equivalent BACnet objects in each applicable field device for PID control. Regardless of program method or object used, allow authorized operators to adjust the Update Interval, Setpoint, Proportional Constant, Integral Constant, and Derivative Constant using BACnet read/write services.

h. Setpoints

All setpoints must be BACnet exposed for auto discovery purposes if needed.

3.1.5 Minimum BACnet Service Requirements

a. Command Priorities

Use commandable BACnet objects to control machinery and systems, providing the priority levels listed below. If the sequence of operation requires a different priority, obtain approval from the Contracting Officer.

<u>Priority Level</u>	<u>Application</u>
1	Manual-Life Safety
2	Automatic-Life Safety
3	(User Defined)
4	(User Defined)
5	Critical Equipment Control
6	Minimum On/Off
7	(User Defined)
8	Manual Operator

<u>Priority Level</u>	<u>Application</u>
9	(User Defined)
10	(User Defined)
11	Load Shedding
12	(User Defined)
13	(User Defined)
14	(User Defined)
15	(User Defined)
16	(User Defined)

b. Alarming

- (1) Alarm Priorities - Coordinate alarm and event notification with the BAS Owner.
- (2) Notification Class - Enable writeable Priority, Ack Required, and Recipient List properties of Notification Class objects.
- (3) Event Notification Message Texts - Use condition specific narrative text and numerical references for alarm and event notification.

c. Updating Displayed Property Values

Allow workstations to display property values at discrete polled intervals, or based on receipt of confirmed and unconfirmed Change of Value notifications. The COV increment shall be adjustable by an operator using BACnet services, and polled intervals shall be adjustable at the operator workstation.

3.1.6 Local Area Networks

Obtain Government approval before connecting new networks with existing networks. Network numbers and device instance numbers shall remain unique when joining networks. Do not change existing network addressing without Government approval. See also "BACnet Naming and Addressing".

3.1.7 BACnet Routers and Protocol Gateways

Provide the quantity of BACnet routers necessary for communications shown on the BACnet Communication Architecture schematic. Provide BACnet routers with BACnet Broadcast Message Device (BBMD) capability on each BACnet internetwork communicating across an IP network. Configure BBMD tables to enable unicast forwarding of broadcast messaging across Layer-3 IP subnets.

3.1.8 Plant Controllers

Equipment such as VFD's, chillers, and boilers shall have hardwired enable(start/stop), and status points from the plant controller, VFD's shall also have a hardwired speed command. Additionally, this equipment shall have a BACnet interface for monitoring.

3.1.9 Wiring Criteria

- a. Run circuits operating at more than 100 volts in rigid or flexible conduit, metallic tubing, covered metal raceways, or armored cable.
- b. Run all control wiring in blue rigid or flexible conduit, blue metallic tubing, or covered metal raceways, unless noted otherwise. All control wiring located inside mechanical rooms shall be in conduit or metallic tubing. All conduit and junction box covers shall be blue in color."
- c. Do not run binary control circuit wiring in the same conduit as power wiring over 100 volts. Where analog signal wiring requires conduit, do not run in the same conduit with AC power circuits or control circuits operating at more than 100 volts.
- d. Provide circuit and wiring protection required by NFPA 70.
- e. Minimum conduit size is 3/4-inch, except 1/2-inch may be used from last junction box to the terminal device. Maximum conduit fill is 40% or the cable manufacturer's recommended amount whichever is less. Provide plastic end sleeves at all conduit terminations to protect wiring from burrs.
- f. Do not bury aluminum-sheathed cable or aluminum conduit in concrete.
- g. Input/output identification: Permanently label each field-installed wire, cable, and pneumatic tube at each end with descriptive text using a commercial wire marking system. Labels shall fully encircle the wire, cable, or tube. The single line text shall run parallel to the wire, cable, or tube and shall be repeated so as to be viewable without twirling or twisting the wire. Locate the markers within 2 inches of each termination. Label shall include type of network and destination of cable (ex. BACnet/AHU-1). Match the names and I/O number to the project's point list. Similarly label all power wiring serving control devices, including the word "power" and panel board and circuit number, or transformer location in the label. Number each pneumatic tube every six feet. Label all terminal blocks with alpha/numeric labels. All wiring and the methods shall be in accordance with UL 508A.
- h. Permanently display controller wiring diagram for each controller on the inside of the control cabinet door. Diagram shall be neatly lettered and taped or adhered with sticky back label.
- i. Conduit identification: All conduits shall be labeled within 36 inches from terminations, boxes, or bends. Labels shall be 3/8 inches black lettering on white background and indicate what system the conduit contains. Label shall be visible and legible from at least three sides with a minimum dimension of 1.9 inches x 4 inches. Conduit that includes power circuits shall be labeled with source panel and circuit, and destination cabinet or equipment.

- j. Each terminal device shall have its own terminal conduit run. Device boxes or devices or panels shall not be used as "pass thru" for wiring.
- k. Conduit to equipment and devices shall be run tight to walls, and ceilings. Avoid conduit on the floor, i.e. conduit shall not block access to or past equipment. Flex conduit is to be used only when EMT or rigid conduit is not able to satisfy the application such as a transition to a sensor or equipment. Flex conduit shall be limited to a maximum length of 3 ft.
- l. For controller power, provide new 120 VAC circuits, with ground if not defined on the electrical drawings. Provide each circuit with a dedicated breaker, and run wiring in its own conduit, separate from any control wiring. Connect the controller's ground wire to the electrical panel ground. Conduit grounds are not acceptable. Include a label on the 120 VAC circuit conduit at each control panel. The label is to include the source panel and circuit identification. The label size shall be a minimum of 1.9 inches by 4 inches, 3/8 inch black lettering on white background.
- m. Supervisory Building Controllers (SBC) shall be powered from a dedicated transformer for the SBC only. Each control cabinet shall have a dedicated 24 volt transformer. The 120 VAC power branch circuit shall be dedicated to the DDC control system. Factory provided transformers in equipment must be used as a source of power only for the control devices intended by the equipment manufacturer.
- n. Surge Protection: Install surge protection according to manufacturer's instructions. Multiple controllers fed from a common power supply may be protected by a common surge protector, properly sized for the total connected devices.
- o. All terminations in panels shall be made at a terminal block if not connected directly to a panel device, ie Field Controller, Supervisory Controller, relays, transmitters, etc. . No wire nuts are allowed in panels, VAV boxes, control panels, relay panels, or any other type of enclosure shall follow this requirement. High and low voltage wires must not land on the same terminal block unless they are separated and of a different color and/or clearly identified.
- p. Grounding: Ground controllers and cabinets to a good earth ground as specified in Section 2620 00 INTERIOR DISTRIBUTION SYSTEM. Conduit grounding is not acceptable; all grounding shall have a direct path to the building earth ground. Ground sensor drain wire shields at the controller end.
- q. The Contractor shall be responsible for correcting all associated MS/TP and SA bus wiring, auxiliary bus wiring, termination, end of line, and ground loop problems.
- r. Run wiring in panel enclosures in covered wire track.
- s. Control cabinets and wiring boxes must be clean of all debris.
- t. Low voltage cable must not be supported directly from "all thread" rod. If cabling/wiring is permitted to be run without conduit/raceway it must be supported using a retaining device such as a bridle ring or J hook, and where appropriate connected to the all thread rod using a

standoff device. Openly installed cabling/wiring must be approved by Camp Lejeune Public Works Department.

- u. For serviceability, allow a minimum of 2 inches of exposed wire or cable from any termination point, i.e. between Panduit and field controller terminations.

3.1.10 Accessibility

Install all equipment so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install digital controllers, data ports, and concealed actuators, valves, dampers, and like equipment in locations freely accessible through access doors. Install power surge protection such that it is replaceable without removing other components.

3.1.11 Digital Controllers

- a. Install as stand alone control devices (see definitions).
- b. Locate control cabinets at the locations shown on the drawings. If not shown on the drawings, install in the most accessible space, close to the controlled equipment. Controllers must be installed in a manufacturer's required/recommended enclosure for each type of controller.
- c. Provide a dedicated analog output to each output device, such as variable frequency driven pump motors in an alternating arrangement.
- d. Equipment such as VFD's must have hardwired enable(start/stop), speed command and status points from the controller. Software points are not allowable. Additionally, this equipment shall have a BACnet interface for monitoring

3.1.12 Hand-Off-Auto Switches

Wire safety controls such as smoke detectors, freeze protection thermostats, and emergency shut down switches to protect the equipment during both hand and auto operation.

3.1.13 Emergency Shut Down Switches (ATFP)

Quantity and location as shown on the drawings. Switches must be hardwired such that all fans and dampers that circulate air between rooms, or between inside and outside must shut down/close regardless of equipment HOA switch position. ATFP circuit must be energized to allow equipment to operate; i.e. activation of the emergency shut down switch will de-energize the circuit and open relays at the equipment. Additionally, activation of the switch must signal the DDC system to shut all air moving equipment off/closed and initiate an alarm. Reset of the DDC system must be manual.

3.1.13.1 Safety and Shutdown Circuit Monitoring

All safety or shutdown circuits, or any circuit that can disable a system, shall be monitored by the DDC system as separate inputs for each circuit. This shall include, but is not limited to, Low Temperature Limit, Duct Mounted Smoke Detector, Discharge Air High Pressure Limit, Boiler

Emergency Pushbutton, Carbon Monoxide, Gas Detection, ATFP, etc. Supervisory controller alarm reporting shall be configured for each individual circuit alarm.

3.1.14 Temperature Sensors

Install temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.

3.1.14.1 Room Temperature Sensors

Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of the sensor 54 inches above the floor to meet ADA requirements.

3.1.14.2 Duct Temperature Sensors

- a. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration air tight. Seal the duct insulation penetration vapor tight.
- b. Averaging Type (and coil freeze protection thermostats): Weave the capillary tube sensing element in a serpentine fashion perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports. Prevent contact between the capillary and the duct or air handler internals. Provide a duct access door at the sensor location. The access door shall be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit, maximum 18 by 18 inches. For sensors inside air handlers, the sensors shall be fully accessible through the air handler's access doors without removing any of the air handler's internals.

3.1.14.3 Immersion Temperature Sensors

Provide thermowells for sensors measuring piping, tank, or pressure vessel temperatures. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to sense flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of pipe area. Increase piping size as required to avoid restriction. Provide thermal conductivity material within the well to fully coat the inserted sensor.

3.1.14.4 Outside Air Temperature Sensors

Provide outside air temperature sensors in weatherproof enclosures on the north side of the building, away from exhaust hoods and other areas that may affect the reading. Provide a shield to shade the sensor from direct sunlight.

3.1.15 Energy Meters

Provide and locate energy meters as indicated. Connect each meter output to the DDC system, to measure both instantaneous and accumulated energy usage.

3.1.16 Damper Actuators

Where possible, mount actuators outside the air stream in accessible areas.

3.1.17 Pressure Sensors

Locate pressure sensors as indicated.

3.1.18 Pneumatic Tubing

Run tubing concealed in finished and unfinished areas. Run tubing in conduit, such as EMT. For tubing enclosed in concrete, provide rigid metal conduit. Run tubing parallel and perpendicular to building walls. Polyethylene tubing over 3 feet long must be run in conduit such as EMT. Caulking joints is not permitted. Do not run tubing and electrical power conductors or class 1, 2, or 3 cables, in the same conduit. All tubing must be terminated with an appropriate fitting designed for that purpose.

3.1.19 Component Identification Labeling

Using an electronic hand-held label maker with white tape and bold black block lettering, provide an identification label on the exterior of each new control panel, control device, actuator, and sensor. Also provide labels on the exterior of each new control actuator indicating the (full) open and (full) closed positions. For labels located outdoors, use exterior grade label tape, and provide labels on both the inside and outside of the panel door or device cover. Acceptable alternatives are white plastic labels with engraved bold black block lettering permanently attached to the control panel, control device, actuator, and sensor. Have the labels and wording approved by the BAS Owner prior to installation. Devices with field adjustable setpoints, such as Air Filter Status, Duct Pressure Safety Limit, etc., must have the field adjusted setpoint and date included on the label. Components mounted above a ceiling or service hatch must also have the component identification visible from below. Examples: A VAV controller, or exhaust fan relay, identification would be included on the ceiling grid, or service hatch, in the area of the controller."

3.1.20 Network and Telephone Communication Lines

When telephone lines or network connections by the Government are required, provide the Contracting Officer at least 120 days advance notice of need. Provide one inch conduit and two (2) green Cat 6 cables from the point of connection of the BAS to the point of connection to the MCEN (most likely in the telephone equipment room). Cables must be terminated and tested.

3.2 TEST AND BALANCE SUPPORT

The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel specified under Section 23 05 93 TESTING, ADJUSTING AND BALANCING or Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. This support shall include:

- a. On-site operation and manipulation of control systems during the testing and balancing.
- b. Control setpoint adjustments for balancing all relevant mechanical

systems, including VAV boxes.

- c. Tuning control loops with setpoints and adjustments determined by TAB personnel.

3.3 INTERFACE WITH EXISTING EMCS

Provide 16 hours of assistance to the Government with interfacing the BAS to the Base wide EMCS. The Government will make the final connection of the BAS to the MCEN. This 16 hours does not include completion or corrections to the installed BAS as defined in the contract documents. This 16 hours is for assisting the interface and for making revisions to the BAS that may be needed outside of the contract requirements. As-Build control drawings must be available for the EMCS operator performing the interfacing.

3.4 CONTROLS SYSTEM OPERATORS MANUALS

Provide three electronic and printed copies of a Controls System Operators Manual. The manual shall be specific to the project, written to actual project conditions, and provide a complete and concise depiction of the installed work. Provide information in detail to clearly explain all operation requirements for the control system.

Provide with each manual: CDs of the project's control system drawings, control programs, data bases, graphics, and all items listed below. Include gateway back-up data and configuration tools where applicable. Provide CDs in jewel case with printed and dated project-specific labels on both the CD and the case. For text and drawings, use Adobe Acrobat or MS Office file types. When approved by the Government, AutoCAD and Visio files are allowed. Give files descriptive English names and organize in folders.

Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the controls contractor name, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. Manuals shall include the following:

- a. A copy of the as-built control system (shop) drawings set, with all items specified under the paragraph SUBMITTALS. Indicate all field changes and modifications. As-Built Control Drawings shall be marked "As-Built" on the cover page and in the title block of each page. Revisions must be dated, may be hand or CAD annotated.
- b. A copy of the project's mechanical design drawings, including any official modifications and revisions.
- c. A copy of the project's approved Product Data submittals provided under the paragraph SUBMITTALS.
- d. A copy of the project's approved Performance Verification Testing Plan and Report.
- e. A copy of the project's approved final TAB Report.
- f. Printouts of all control system programs, including controller setup pages if used. Include plain-English narratives of application

programs, flowcharts, and source code.

- g. Printouts of all physical input and output object properties, including tuning values, alarm limits, calibration factors, and set points.
- h. A table entitled "AC Power Table" listing the electrical power source for each controller. Include the building electrical panel number, panel location, and circuit breaker number.
- i. The DDC manufacturer's hardware and software manuals in both print and CD format with printed project-specific labels. Include installation and technical manuals for all controller hardware, operator manuals for all controllers, programming manuals for all controllers, operator manuals for all workstation software, installation and technical manuals for the workstation and notebook, and programming manuals for the workstation and notebook software.
- j. A list of qualified control system service organizations for the work provided under this contract. Include their addresses and telephone numbers.
- k. A written statement entitled "Technical Support" stating the control system manufacturer or authorized representative will provide toll-free telephone technical support at no additional cost to the Government for a minimum of two years from project acceptance, will be furnished by experienced service technicians, and will be available during normal weekday working hours. Include the toll-free technical support telephone number.
- l. A written statement entitled "Software Upgrades" stating software and firmware patches and updates will be provided upon request at no additional cost to the Government for a minimum of two years from project acceptance. Include a table of all DDC system software and firmware provided under this contract, listing the original release dates, version numbers, part numbers, and serial numbers.
- m. Submit any and all updated field controller files, and BACnet Building Controller data base during the acceptance and warranty periods or as a result of a latent defect.

3.4.1 Storage Cabinets

In one project mechanical room, typically near the BACnet Building Controller provide a wall-mounted storage cabinet with hinged doors. In addition to the number of manuals specified above, provide an additional copy of the manuals in this mechanical room storage cabinet. Provide cabinets large enough to hold the entire set of Controls System Operators Manuals, and the HVAC operation and maintenance manuals provided under Division 15 MECHANICAL. Locate cabinets adjacent to DDC control panels where applicable. Have each cabinet's proposed installation site approved in advance by the Contracting Officer and the BAS Owner. Prominently label each cabinet with the wording "OPERATION AND MAINTENANCE MANUALS." Prominently label each binder with the wording "MECHANICAL ROOM COPY - DO NOT REMOVE."

3.5 PERFORMANCE VERIFICATION TESTING (PVT)

3.5.1 General

The PVT shall demonstrate compliance of the control system work with the contract requirements. The PVT shall be performed by the Contractor and may be witnessed by the Government. If the project is phased, provide separate testing for each phase. A Pre-PVT meeting to review the Pre-PVT Checklist is required to coordinate all aspects of the PVT and shall include the Contractor's QA representative, the Contractor's PVT administrator, the Contracting Officer's representative, and the BAS Owner.

3.5.2 Performance Verification Testing Plan

Submit a detailed PVT Plan of the proposed testing for Government approval. Develop the PVT Plan specifically for the control system in this contract. The PVT Plan shall be a clear list of test items arranged in a logical sequence. It shall include each and all sequences of all controllers. Include sequence tested, intended test procedure, required assisted personnel (such as the mechanical contractor), the expected response, and the pass/fail criteria for every component tested. Include pass/fail column for test, and space for comments, signature and date lines for Contractor's PVT administrator and Contractor's QA representative. The PVT plan shall include the prescriptive pre-PVT check list in addition to the Contractor generated controller specific testing sequences. The final part of the PVT Report shall be 72 hour trends. Propose criteria for the trends, ie, change of state, change of value with the trigger value, time in the PVT Plan.

3.5.3 PVT Sample Size

Test all controllers unless otherwise directed. Trends will be reported on all central plant equipment and primary air handling unit controllers, and 25% of terminal controllers such as VAV boxes and fan coil units. Additional trends shall be provided if requested by Camp Lejeune or a commissioning agent.

3.5.4 Pre-Performance Verification Testing Checklist

Submit the following as a part of the PVT Plan and the PVT Report. Each item shall include a column for the Contractor's initial/date. This form may be a general form applicable to all controllers and submitted only once in the PVT Plan. Each controller shall have an individual checklist with controller title and identified in the PVT Report.

- a. Verify all mechanical installation work is successfully completed and started up by the appropriate personnel.
- b. Verify all required control system components, wiring, and accessories are installed.
- c. Verify the installed control system architecture matches approved drawings.
- d. Verify all control circuits operate at the proper voltage and are free from grounds or faults.
- e. Verify all required surge protection is installed.

- f. Verify the A/C Power Table specified in the paragraph CONTROLS SYSTEM OPERATORS MANUALS is accurate.
- g. Verify all DDC network communications function properly, including uploading and downloading programming changes.
- h. Verify each digital controller's programming is backed up.
- i. Verify all wiring, components, and panels are properly labeled.
- j. Verify all required points are programmed into devices.
- k. Verify all valve and actuator zero and span adjustments are set properly. List each device and span for that device. label device with span setting and adjustment date.
- l. Verify all sensor readings are accurate and calibrated. List each sensor, sensor reading, and measured value. Label device with calibrated value and the calibration date.
- m. Verify each control valve and actuator goes to normal position upon loss of power. List each device and normal position.
- n. Verify each controller works properly in stand-alone mode by disconnecting the BACnet bus.

3.5.5 Conducting Performance Verification Testing

- a. Conduct PVT after approval of the PVT Plan. Notify the Contracting Officer of the planned PVT at least 15 days prior to testing. Provide an estimated time table required to perform the testing. Furnish personnel, equipment, instrumentation, and supplies necessary to perform all aspects of the PVT. Ensure that testing personnel are regularly employed in the testing and calibration of DDC systems. Using the project's as-built control system (shop) drawings, the project's mechanical design drawings, and the approved PVT Plan, conduct the PVT.
- b. During testing, identify any items that do not meet the contract requirements and if time permits, conduct immediate repairs and re-test. Otherwise, deficiencies shall be investigated, corrected, and re-tested later. Document each deficiency and corrective action taken.
- c. If re-testing is required, follow the procedures for the initial PVT. The Government may require re-testing of any control system components affected by the original failed test.

3.5.6 Controller Capability and Labeling

Test the following for each controller:

- a. Memory: Demonstrate that programmed data, parameters, and trend/ alarm history collected during normal operation is not lost during power failure.
- b. Direct Connect Interface: Demonstrate the ability to connect directly to each type of digital controller with a portable electronic device like a notebook computer or PDA. Show that maintenance personnel

interface tools perform as specified in the manufacturer's technical literature.

- c. Stand Alone Ability: Demonstrate controllers provide stable and reliable stand-alone operation using default values for values normally read over the network.
- d. Wiring and AC Power: Demonstrate the ability to disconnect any controller safely from its power source using the AC Power Table. Demonstrate the ability to match wiring labels easily with the control drawings. Demonstrate the ability to locate a controller's location using the BACnet Communication Architecture Schematic and floor plans.
- e. Nameplates and Tags: Show the nameplates and tags are accurate and permanently attached to control panel doors, devices, sensors, and actuators.

3.5.7 Workstation and Software Operation

For every user workstation or notebook provided:

- a. Show points lists agree with naming conventions.
- b. Show that graphics are complete.
- c. Show the UPS operates as specified.

3.5.8 BACnet Communications and Interoperability Areas

- a. Data Presentation: On each BACnet Operator Workstation, demonstrate graphic display capabilities.
- b. Reading of Any Property: Demonstrate the ability to read and display any used readable object property of any device on the network.
- c. Setpoint and Parameter Modifications: Show the ability to modify all setpoints and tuning parameters in the sequence of control or listed on project schedules. Modifications are made with BACnet messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.
- d. Peer-to-Peer Data Exchange: Show all BACnet devices are installed and configured to perform BACnet read/write services directly (without the need for operator or workstation intervention), to implement the project sequence of operation, and to share global data.
- e. Alarm and Event Management: Show that alarms/events are installed and prioritized according to the BAS Owner. Demonstrate time delays and other logic is set up to avoid nuisance tripping, e.g., no status alarms during unoccupied times or high supply air during cold morning start-up. Show that operators with sufficient privilege can read and write alarm/event parameters for all standard BACnet event types. Show that operators with sufficient privilege can change routing (BACnet notification classes) for each alarm/event including the destination, priority, day of week, time of day, and the type of transition involved (types of transition include but are not limited to the following: TO-OFF NORMAL and TO-NORMAL).
- f. Schedule Lists: Show that schedules are configured for start/stop,

mode change, occupant overrides, and night setback as defined in the sequence of operations.

- g. Schedule Display and Modification: Show the ability to display any schedule with start and stop times for the calendar year. Show that all calendar entries and schedules are modifiable from any connected workstation by an operator with sufficient privilege.
- h. Archival Storage of Data: Show that data archiving is handled by the operator workstation/server, and local trend archiving and display is accomplished with BACnet Trend Log objects.
- i. Modification of Trend Log Object Parameters: Show that an operator with sufficient privilege can change the logged data points, sampling rate, and trend duration.
- j. Device and Network Management: Show the following capabilities:
 - (1) Display of Device Status Information
 - (2) Display of BACnet Object Information
 - (3) Silencing Devices that are Transmitting Erroneous Data
 - (4) Time Synchronization
 - (5) Remote Device Reinitialization
 - (6) Backup and Restore Device Programming and Master Database(s)
 - (7) Configuration Management of Half-Routers, Routers and BBMDs

3.5.9 Execution of Sequence of Operation

Demonstrate that the HVAC system operates properly through the complete sequence of operation. Use read/write property services to globally read and modify parameters over the internetwork.

3.5.10 Control Loop Stability and Accuracy

For all control loops tested, give the Government trend graphs of the control variable over time, demonstrating that the control loop responds to a 20 percent sudden change of the control variable set point without excessive overshoot and undershoot. If the process does not allow a 20 percent set point change, use the largest change possible. Show that once the new set point is reached, it is stable and maintained. Control loop trend data shall be in real-time with the time between data points 30 seconds or less.

3.5.11 Performance Verification Testing Report

Upon successful completion of the PVT, submit a PVT Report to the Government and prior to the Government taking use and possession of the facility. Do not submit the report until all problems are corrected and successfully re-tested. The report shall include the annotated PVT Plan used during the PVT. Where problems were identified, explain each problem and the corrective action taken. Include a written certification that the installation and testing of the control system is complete and meets all of the contract's requirements.

3.5.12 Bus Waveform Report

Provide printed wave form of the MS/TP bus(es). Use an oscilloscope to test and record the wave form of each bus. This wave form is useful in identifying and troubleshooting bus problems such as inappropriate taps, grounds, end of line terminations and poor connections. Identify each graphic with bus name, location, date and time, and instrument used. Include the resistor sizes needed at each Bus End of Line (EOL). Include a list of the EOL devices.

3.5.13 Performance Verification Testing Acceptance Testing Season One

After acceptance of the PVT Report, demonstrate proper and stable operation of the DDC System. During the field acceptance testing, verify, in the presence of the COTR and BAS owner, random selections of sequences reported in the PVT Report. Equipment, controllers, devices, and sequences for field acceptance testing are to be selected by the COTR. As-built control drawings must be for use and verification at acceptance testing. Field acceptance testing includes verification of the PVT for the following equipment groups:

Group 1: All pumps, chillers, boilers, and air handling units.

Group 2: 25 percent of terminals such as VAV and fan coil units.

Group 3: 25 percent of supply fans, and exhaust fans.

If any of the acceptance testing is found to not operate correctly, terminate verification for the given group. Make the necessary corrections and prepare a revised PVT Report. Reschedule acceptance testing of the revised report with the COTR. After the PVT has been accepted, submit the revised controller files and BACnet Building Controller database.

3.5.14 Performance Verification Testing Acceptance Testing Season Two

A minimum of 3 months after initial acceptance of the DDC system and in the opposite season of heating and cooling, demonstrate proper and stable operation of the DDC system. During the field acceptance testing, verify, in the presence of the COTR and BAS owner, random selections of sequences reported in the PCT Report. Equipment, controllers, devices, and sequences for field acceptance testing are to be selected by the COTR. Field acceptance testing includes verification of the PVT for the following equipment groups:

Group 1: All pumps, chillers, boilers, return fans, computer room units, and air handling units (rooftop and central stations).

Group 2: 25 percent of terminals such as VAV and fan coil units.

Group 3: 25 percent of supply fans, and exhaust fans.

If any of the acceptance testing is found to not operate correctly, terminate verification for the given group. Make the necessary corrections and prepare a revised PVT Report. Reschedule acceptance testing of the revised report with the COTR. After the PVT has been accepted, submit the revised controller files and BACnet Building Controller database.

3.6 TRAINING REQUIREMENTS

Provide a qualified instructor (or instructors) with two years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed. Coordinate training times and location with the Contracting Officer and BAS Owner after receiving approval of the training course documentation. Training shall take place at the job site or a nearby Government-furnished location. A training day shall occur during normal working hours, last no longer than 8 hours and include a one-hour break for lunch and two additional 15-minute breaks. The project's approved Controls System Operators Manual shall be used as the training text. The Contractor shall ensure the manuals are submitted, approved, and available to hand out to the trainees before the start of training.

3.6.1 Training Documentation

Submit contractor's training certifications and training documentation for review 30 days minimum before training. Documentation shall include an agenda for each training day, objectives, a synopsis of each lesson, and the instructor's background and qualifications. The training documentation can be submitted at the same time as the project's Controls System Operators Manual.

3.6.2 Phase I Training - Fundamentals

The Phase I training session shall last one day and be conducted in a classroom environment with complete audio-visual aids provided by the contractor. Provide each trainee a printed 8.5 by 11 inch hard-copy of all visual aids used. Upon completion of the Phase I Training, each trainee should fully understand the project's DDC system fundamentals. As-Built control drawings must be used for training. The training session shall include the following:

- a. BACnet fundamentals (objects, services, addressing) and how/where they are used on this project
- b. This project's list of control system components
- c. This project's list of points and objects
- d. This project's device and network communication architecture
- e. This project's sequences of control, and:
- f. Alarm capabilities
- g. Trending capabilities
- h. Troubleshooting communication errors
- i. Troubleshooting hardware errors

3.6.3 Phase II Training - Operation

Provide Phase II Training shortly after completing Phase I Training. The Phase II training session shall last one day and be conducted at the DDC system workstation, at a notebook computer connected to the DDC system in

the field, and at other site locations as necessary. Upon completion of the Phase II Training, each trainee should fully understand the project's DDC system operation. The training session shall include the following:

- a. A walk-through tour of the mechanical system and the installed DDC components (components include but are not limited to the following: controllers, valves, dampers, surge protection, switches, thermostats, and sensors)
- b. A discussion of the components and functions at each DDC panel
- c. Logging-in and navigating at each operator interface type
- d. Using each operator interface to find, read, and write to specific controllers and objects
- e. Modifying and downloading control program changes
- f. Modifying setpoints
- g. Creating, editing, and viewing trends
- h. Creating, editing, and viewing alarms
- i. Creating, editing, and viewing operating schedules and schedule objects
- j. Backing-up and restoring programming and data bases
- k. Modifying graphic text, backgrounds, dynamic data displays, and links to other graphics
- l. Creating new graphics and adding new dynamic data displays and links
- m. Alarm and Event management
- n. Adding and removing network devices

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SECTION 23 52 43.00 20

LOW PRESSURE WATER HEATING BOILERS (UNDER 800,000 BTU/HR OUTPUT)
05/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.13/CSA 4.9 (2017; Errata 2018) Gas-Fired Low Pressure
Steam and Hot Water Boilers

ANSI/ASHRAE 103-2017 (2017) Method of Testing for Annual Fuel
Utilization Efficiency of Residential
Central Furnaces and Boilers

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP (2016) Energy Standard for Buildings
Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME BPVC SEC IV (2017) BPVC Section IV-Rules for
Construction of Heating Boilers

ASME BPVC SEC VIII D1 (2017) BPVC Section VIII-Rules for
Construction of Pressure Vessels Division 1

ASME CSD-1 (2016) Control and Safety Devices for
Automatically Fired Boilers

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M (2020) Standard Specification for Pipe,
Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless

HYDRONICS INSTITUTE DIVISION OF AHRI (HYI)

HYI-005 (2008) I=B=R Ratings for Boilers,
Baseboard Radiation and Finned Tube
(Commercial)

NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS (NBBI)

NBBI NB-23 PART 1 (2013) National Board Inspection Code -
Part 1 Installation

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2016; SUPP 2016) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31 (2016) Standard for the Installation of Oil-Burning Equipment

NFPA 54 (2018) National Fuel Gas Code

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4)
National Electrical Code

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-B-18897 (Rev F; CANS Notice 1) Boilers, Steam and Hot Water, Watertube (Straight Bare and Finned Tube), Cast Iron and Firebox, Packaged Type (40,000 to 35,000,000 BTU/HR Thermal Output Capacity)

UNDERWRITERS LABORATORIES (UL)

UL 1738 (2010; Reprint Nov 2014) Venting Systems for Gas-Burning Appliances, Categories II, III and IV

UL 353 (1994; Reprint Nov 2011) Standard for Limit Controls

UL 795 (2016) UL Standard for Safety Commercial-Industrial Gas Heating Equipment

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein.

1.3 QUALITY ASSURANCE

Boiler shall be suitable for installation in the space shown with ample room for opening doors and cleaning and removal and replacement of tubes. The boiler shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. The boiler shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13/CSA 4.9 test standard for the U.S. and Canada. The boiler shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 - IP Standard and the minimum efficiency requirements of the latest edition of the BTS2000 Standard. The boiler shall be certified for indoor installation. The boiler's Thermal Efficiency shall be verified through third party testing by the Hydronics Institute Division of AHRI and listed in the AHRI Certification Directory.

1.4 DESIGN REQUIREMENTS

Boiler must be suitable for installation in the space shown with ample room for opening doors and cleaning and removal and replacement of tubes.

Boiler must be designed and tested in accordance with ASME BPVC SEC IV, ASME CSD-1, NFPA 54, NFPA 31, NFPA 70 and ANSI Z21.13/CSA 4.9. Boiler must be installed in accordance with NBBI NB-23 PART 1. Paint boiler in accordance with manufacturer's recommendations.

1.4.1 Boiler Installation Requirements

1.4.1.1 Location

Install Boiler(s) and associated hot water pumps in a mechanical room inside the facility in accordance with NBBI NB-23 PART 1. Provide ample clearance around boilers to allow access for inspection, maintenance and repair. Passageways around all sides of boilers must have an unobstructed minimum width of 36 inches or the clearances recommended by the boiler manufacturer whichever is greater.

1.5 NAMEPLATES

Secure a plate to each major component of equipment containing the manufacturer's name, address, type or style, model or serial number, and catalog number. Also, display an energy star label as applicable. Each pressure vessel shall have an approved ASME stamp.

1.6 SAFETY STANDARDS

Hot water boilers, burners and supplementary control devices, safety interlocks, or limit controls required under this specification, must meet requirements of the following standards as applicable:

- a. Gas-Fired Units: ASME CSD-1, NFPA 54, NFPA 70, ANSI Z21.13/CSA 4.9 or UL 795.
- b. All Units: ASME BPVC SEC IV, NFPA 70 and ASME CSD-1.

Controls not covered by the above must have a UL label, UL listing mark, or must be listed in the Factory Mutual Approval Guide.

1.7 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fuel Train

SD-03 Product Data

Boilers

Boiler Trim and Control Equipment

Burners and Control Equipment

Stack, Breeching, and Supports

Direct Vent

Boiler Circulating Pumps

Expansion Tank

Air Separator

SD-06 Test Reports

Operational Tests

SD-07 Certificates

Boilers

Burners and Control Equipment

Boiler Trim and Control Equipment

Boiler manufacturer's certificate of boiler performance including evidence that the burners provided must be a make, model, and type certified and approved by the manufacturer of the boiler being provided.

SD-08 Manufacturer's Instructions

Boilers

Feedwater Treatment Feeder

SD-10 Operation and Maintenance Data

Boilers, Data Package 4

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Posted Operating Instructions for Heating Water Boilers

PART 2 PRODUCTS

2.1 BOILERS

2.1.1 General Requirements

Design, construction, installation, testing, and operation of boiler and appurtenances shall comply with NBBI NB-23 PART 1, ASME BPVC SEC IV, ASME CSD-1, NFPA 54, NFPA 31, ANSI Z21.13/CSA 4.9, and the manufacturer's instructions.

MIL-B-18897. Provide hot water heating boiler complete with firing equipment, combustion chamber, insulation with steel jacket, safety and operating controls, integral electrical wiring and other appurtenances, to make the boiler a complete, self-contained, fully-automatic unit, ready for service upon completion of utility connections.

Factory-fabricated, -assembled, and -tested, fin tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake

connections; water supply, return, and condensate drain connections; and controls. Heat Exchanger shall be stainless steel. Stainless steel venting shall be UL 1738 prefabricated multi-wall type. Pressure vessel shall be carbon steel with welded heads and tube connections. Burner shall be natural gas with forced draft fan and prepurge and postpurge sequences.

Gas Train shall comply with ASME CSD-1 combination gas valve with manual shutoff and pressure regulator. Provide spark ignition with 100 percent main-valve shutoff with electronic flame supervision.

Each boiler shall conform to the commercial design used by the manufacturer and shall permit free thermal expansion without placing undue stress on any part of the boiler.

Each boiler shall be specifically designed for condensing application. The boiler and its accessories shall be designed and installed to permit ready accessibility for operation, maintenance, and service. The boiler capacity shall be based on the ratings shown in HYI-005 or as certified by the American Boiler Manufacturers Association, or American Gas Association. The boiler shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 - IP Standard and the minimum efficiency requirements of the latest edition of the BTS-2000 Standard.

The boiler shall operate at a minimum of 94 percent thermal efficiency at full fire.

The boiler shall have an independent laboratory rating for Oxides of Nitrogen (NOx) of 20 ppm or less corrected to 3 percent O₂.

Boilers shall have a gateway device which will allow integration with BacNet (MSTP) protocol.

2.2 BURNERS AND CONTROL EQUIPMENT

2.2.1 Gas-Fired Power Burner

Gas-fired power burner. Direct spark (pilotless) type ignition system electrode-ignited natural gas type. Design burner and combustion control equipment for firing natural gas having a specific gravity of 0.6 and a heating value of approximately 1000 BTU per cubic foot and be an integral part of the boiler. Burner controls and safety equipment must conform to applicable requirements of ASME CSD-1, NFPA 54, ANSI Z21.13/CSA 4.9 and UL 795. Mount controls; including operating switches, indicating lights, gages, alarms, motor starters, fuses, and circuit elements of control systems on a single control panel or cabinet designed for separate mounting not on the burner. Locate flame scanner such that testing and cleaning of scanner can be accomplished without disassembly of burner. Provide fuel train as indicated..

2.3 BOILER TRIM AND CONTROL EQUIPMENT

Provide in accordance with ASME CSD-1 and ASME BPVC SEC IV and additional requirements specified below.

2.3.1 Emergency Disconnect Switch

Provide and locate on wall outside boiler room entrance or just inside door, when boiler room door is on building exterior as required by

ASME CSD-1 to allow rapid and complete shutdown of the boiler in the event of an emergency. Emergency switch must be a fuse-type safety switch. Switch must be red and furnished with a label indicating function of switch.

2.3.2 Relief Valves

Provide relieving capacity for the full output of boiler installed. Safety relief-valve piping must conform to ASTM A53/A53M, schedule 40 steel pipe and be piped full-size to a floor drain .

2.3.3 Pressure and Altitude Gage or Combination Pressure/Altitude Gage

Provide one located on supply water piping and one on return water piping.

2.3.4 Thermometer

Provide thermometer with a scale equivalent to 1.5 times outlet water temperature. Provide one located on supply water piping and one on return water piping.

2.3.5 Drain Tapping

Provide drain valve and piping to a floor drain .

2.3.6 Make-up Water Station

2.3.6.1 Pressure Reducing Station

Provide a water pressure-reducing valve and relief valve, or a combination of the two in the makeup water line to the boiler to maintain a water pressure in the hot water system. Provide a 3/4 inch globe valve by-pass around this valve.

2.3.6.2 Backflow Preventers

Provide strainer and reduced pressure backflow preventer upstream of bypass and pressure reducing valve.

2.3.7 Feedwater Treatment Feeder

Provide floor mounted, Type II - Shot-Type Feeder (manual, intermittent feed), as indicated for use with pressures up to 200 psig maximum.

2.3.8 Combustion Regulator

Provide adjustable temperature, thermostatic immersion type that must limit boiler water temperature to a maximum of 250 degrees F. Control must actuate burner through an electric relay system to maintain boiler water temperature within normal prescribed limits at loads within rated capacity of boiler.

2.3.9 Air Vent Valve

Provide with screwed connection, stainless steel disk, and stainless steel seats to vent entrapped air.

2.3.10 High Temperature Limit Switch

Provide adjustable immersible aquastat type with a temperature setting above that of the combustion regulator and below that of the lowest relief valve setting. Aquastat must function to cause a safety shutdown by closing fuel valves and shutting down burner equipment in the event that boiler water temperature rises to the high temperature limit setting. A safety shutdown due to high temperature must require manual reset before operation can resume and prevent recycling of burner equipment. Pre-set high temperature limit devices that cannot be easily tested are not allowed.

2.3.11 Low Water Level Cutoff Switch

Low water level cutoff must cause a safety shutdown by closing fuel valves and shutting down burner equipment in the event that water level drops below the lowest safe permissible water level established by the boiler manufacturer and ASME BPVC SEC IV. A safety shutdown due to low water must require manual reset before operation can resume and prevent recycling of burner equipment.

2.3.12 Boiler Safety Control Circuits

Provide boiler safety control circuits, including control circuits for burner and draft fan, must be single-phase, two-wire one-side grounded, and not over 120 volts. Provide safety control switching in ungrounded conductors. Provide overcurrent protection. In addition to circuit grounds, ground metal parts which do not carry current to a grounding conductor.

2.3.13 Post-Combustion Purge

Provide controls and wiring necessary to ensure operation of draft fan for a period of not less than 15 seconds or of sufficient duration to provide four complete air changes in the boiler combustion chamber (whichever is greater) following shutdown of burner upon satisfaction of heat demand and in accordance with ASME CSD-1 . Upon completion of post-combustion purge period, draft fan must automatically shutdown until next restart.

2.3.14 Draft

Comply with boiler manufacturer's recommendations.

2.3.15 Stack, Breeching, and Supports

Refer to individual boiler sizes for requirements.

Provide drain and condensate neutralization kit.

2.4 2.4 BOILER (80,000 - 399,000 BTUH)

The boiler shall be operated on Natural Gas. The boiler shall be capable of full modulation, firing down to 20 percent of rated input with a turndown ratio of 5:1

2.4.1 2.4.1 General

The boiler shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. There shall be no banding material,

bolts, gaskets or "O" rings in the header configuration. The 316L stainless steel combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly. A built-in trap shall allow condensation to drain from the heat exchanger assembly. The complete heat exchanger assembly shall carry a twelve (12) year limited warranty.

2.4.2 2.4.2 Efficiency

The boiler shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13/CSA 4.9 test standard for the U.S. and Canada. The boiler shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 - IP Standard and the minimum efficiency requirements of ANSI/ASHRAE 103-2017 Standard. The boiler shall meet U.S. Environmental Protection Agency and Department of Energy guidelines for "Energy Star" efficiency. The boiler shall operate at a minimum of 95 percent Annual Fuel Utilization Efficiency. The boiler shall be certified for indoor installation. The boiler's AFUE shall be verified through third party testing by the Hydronics Institute Division of AHRI and listed in the AHRI Certification Directory.

2.4.3 2.4.3 Construction

The boiler shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The burner shall be a premix design and constructed of high temperature stainless steel with a woven metal fiber outer covering to provide modulating firing rates. The boiler shall be supplied with a gas valve designed with negative pressure regulation and be equipped with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The boiler shall operate in a safe condition at a derated output with gas supply pressures as low as 4 inches of water column. The boiler shall be equipped with leveling legs.

2.4.4 2.4.4 Controls

The boiler shall utilize a 24 VAC control circuit and components. The control system shall have an electronic display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The boiler shall be equipped with; a temperature/pressure gauge, high limit temperature control certified to UL 353, ASME certified pressure relief valve, outlet water temperature sensor, return water temperature sensor, a UL 353 certified flue temperature sensor, outdoor air sensor, low water flow protection and built-in adjustable freeze protection.

The boiler shall feature control with a Multi-Colored Graphic LCD display with Navigation Dial and Soft Keys for, password security, three loop temperature setpoints with individual outdoor air reset curves, pump delay with adjustable freeze protection, pump exercise, domestic hot water prioritization with DHW modulation limiting and USB PC port connection. The boiler shall be capable of controlling a variable speed boiler pump to keep a constant Delta T at all modulation rates. The boiler shall have the capability to accept a 0-10 VDC input connection for BMS control of modulation or setpoint, enable/disable of the boiler, variable system pump signal and a 0-10VDC output of boiler modulation rate. The Boiler shall have a built-in cascade with sequencing options for "lead lag" or

"efficiency optimized" modulation logic, with both capable of rotation while maintaining modulation of up to eight boilers without utilization of an external controller. The Boiler shall be capable of communicating with same manufacturer boilers of different inputs in a hybrid system to maximize efficiency and turndown without the need for a third party control. Supply voltage shall be 120 volt / 60 hertz / single phase.

The boiler shall be equipped with two terminal strips for electrical connection. A low voltage connection board with 42 data points for safety and operating controls, i.e., Auxiliary Relay, Auxiliary Proving Switch, Alarm Contacts, Runtime Contacts, Manual Reset Low Water Cutoff, Flow Switch, High and Low Gas Pressure Switches, Tank Thermostat, Three Wall Thermostat/Zone Controls, System Supply Sensor, Outdoor Sensor, Building Management System Signal, Modbus Control Contacts and Cascade Control Circuit. A high voltage terminal strip shall be provided for supply voltage. The high voltage terminal strip plus integral relays are provided for independent pump control of the System pump, the Boiler pump and the Domestic Hot Water pump.

The boiler shall have a gateway device which will allow integration with BacNet (MSTP or IP) protocols. Where there is an existing BACnet building control system, the boilers shall be connected to the system and all required programming performed. In areas that do not have an existing BACnet control system, it will be for future connection when a building control system is installed.

2.4.5 2.4.5 Venting

The boiler shall be installed and vented in one of the following methods:

2.4.5.1 2.4.5.2 Direct Vent Vertical

Direct Vent Vertical system with a vertical roof top termination of both the vent and combustion air. The flue shall be CPVC, Stainless Steel or Polypropylene sealed vent material terminating at the roof top with the manufacturers specified vent termination. Stainless steel venting shall be UL 1738 prefabricated multi-wall type. A separate pipe shall supply combustion air directly to the boiler from the outside. The air inlet pipe may be CPVC, Stainless Steel or Polypropylene sealed pipe. The air inlet must terminate on the roof top with the manufacturer's specified air inlet cap. The boiler's total combined air intake length shall not exceed 100 equivalent feet. The boiler's total combined exhaust venting length shall not exceed 100 equivalent feet. Foam Core pipe is not an approved material for exhaust piping.

2.4.5.2 2.4.5.3 Vertical Vent with Sidewall Air

Vertical Vent with Sidewall Air system with a vertical rooftop termination of the vent with the combustion air being drawn horizontally from a sidewall. The flue shall be CPVC, Stainless Steel or Polypropylene sealed vent material terminating at the roof top with the manufacturers specified vent termination. Stainless steel venting shall be UL 1738 prefabricated multi-wall type. A separate pipe shall supply combustion air directly to the boiler from the outside. The air inlet may be CPVC, Stainless Steel or Polypropylene sealed pipe. The air inlet must terminate on a sidewall using the manufacturers specified air inlet cap. The boiler's total combined air intake length shall not exceed 100 equivalent feet. The boiler's total combined exhaust venting length shall not exceed 100 equivalent feet. Foam Core pipe is not an approved material for exhaust

pipng.

2.4.6 2.4.6 Additional Requirements

The boiler shall have an independent laboratory rating for Oxides of Nitrogen (NOx) of 20 ppm or less corrected to 3 percent O₂. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.

The boiler shall be suitable for use with poly propylene glycol, up to 50 percent concentration without contingencies.

The boiler shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments.

The Firing Control System shall be Direct Spark Ignition with Electronic Supervision.

2.5 ELECTRIC MOTORS

Electric motors must meet requirements of NEMA MG 1. Motors less than 1 hp must meet NEMA High Efficiency requirements. Motors 1 hp and larger must meet NEMA Premium Efficiency requirements. Motors which are an integral part of the packaged boiler system must be the highest efficiency available by the manufacturer of the packaged boiler.

2.6 BOILER CIRCULATING PUMPS

Circulating pumps for hot water shall be electrically driven single-stage centrifugal type. Boiler circulating pumps shall be supported by the piping on which installed and shall be closed-coupled shaft. The pump shaft shall be constructed of corrosion-resistant alloy steel, sleeve bearings and glands of bronze designed to accommodate a mechanical seal, and the housing of close-grained cast iron. Pump seals shall be capable of withstanding 240 degrees F temperature without external cooling. The motor shall have sufficient power for the service required, shall be of a type approved by the manufacturer of the pump and shall be suitable for the available electric service. Each pump suction and discharge connection shall be provided with a pressure gauge.

2.7 FITTINGS AND ACCESSORIES

2.7.1 Expansion Tank

The hot water pressurization system shall include a bladder-type expansion tank welded steel, constructed, tested, and stamped in accordance with ASME BPVC SEC VIII D1 for a working pressure of 125 psi and precharged to the minimum operating pressure. The tank's air chamber shall be fitted with an air charging valve and pressure gauge. The tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations. The tank shall have lifting rings and a drain connection. All components shall be suitable for a maximum operating temperature of 250 degrees F.

2.7.2 Air Separator

External air separation tank shall be steel combination air and sediment separator with internal coalescing medium to remove entrained air and

suspended solids. It shall be constructed, tested and stamped in accordance with ASME BPVC SEC VIII D1 for a working pressure of 125 psi.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

Install equipment in accordance with manufacturer's installation instructions and NBBI NB-23 PART 1. Grout equipment mounted on concrete foundations before installing piping. Install piping in such a manner as not to place a strain on equipment. Do not bolt flanged joints tight unless they match. Grade, anchor, guide, and support piping without low pockets. Feedwater treatment feeders must be mounted so that the top of the feeder is no higher than 48 inches above the finished floor.

3.2 EQUIPMENT FOUNDATIONS

Locate equipment foundations as indicated, designed, and made of sufficient size and weight to preclude shifting of equipment under operating conditions or under abnormal conditions that could be imposed upon the equipment. Foundations must meet requirements of the equipment manufacturer.

3.3 BOILER CLEANING

Before being placed in service, boiler must be boiled out for a period of 24 hours at a pressure not exceeding 12 psig. Solution to be used in the boiler for the boiling out process must consist of two pounds of trisodium phosphate per 100 gallons of water. Upon completion of boiling out, flush out boiler with potable water, drain, and charge with chemically treated water. Protect boiler and appurtenances against internal corrosion until testing is completed and boiler is accepted. Professional services are required for cleaning/treatment process.

3.4 FIELD QUALITY CONTROL

Perform and furnish everything required for inspections and tests as specified herein to demonstrate that boiler and auxiliary equipment, as installed, are in compliance with contract requirements. Start-up and operate the system. During this time, clean strainers until no further accumulation of foreign material occurs. Exercise care to minimize loss of water when strainers are cleaned. Adjust safety and automatic control instruments as necessary to place them in proper operation and sequence. Test instrumentation must be calibrated and have full scale readings from 1.5 to 2 times test values.

All boilers 400,000 btu/hr input and larger will require a hydrostatic test performed by the Contractor and witnessed by the Naval Facilities Engineering Command Boiler Inspector.

3.4.1 Operational Tests

Furnish the services of an engineer or technician approved by the boiler manufacturer of installation, startup, operational and safety testing. This person must remain on the job until each boiler has been successfully operated. Furnish and perform everything required for inspections and tests of the boiler and auxiliary equipment. Test instrumentation must be calibrated and have full-scale reading from 1.5 to 2 times test values. Demonstrate proper operability of combustion control, flame safeguard

control and safety interlocks. Provide a detailed description of all boiler startup and operational tests in the Commissioning Plan.

3.4.1.1 Preliminary Operational Test

Operate the boilers continuously for a period of at least 8 hours to demonstrate proper operability of the combustion control, flame safeguard control, and safety interlocks.

3.4.1.2 Acceptance Operational Test and Inspection

Prior to requesting an acceptance test, conduct a satisfactory operational test for at least 8 hours, and provide a certified statement that the equipment is installed per all requirements of this guide. Contracting Officer, upon receipt of the notice from the Contractor, will request a boiler inspection by a Naval Facilities Engineering and Expeditionary Warfare Center (EXWC) NAVFAC boiler inspector. Fifteen days advance notice is required for scheduling inspector to conduct acceptance operational test and inspection.

3.4.1.3 TEST OF BACKFLOW PREVENTION ASSEMBLIES

Backflow prevention assemblies shall be tested/certified by the installing contractor. After installation all double check and reduce pressure zone type back flow preventers shall be inspected, tested and certified by a certified tester and a tester certification and Test Data Certification Sheet submitted.

-- End of Section --

SECTION 23 73 33

HEATING, VENTILATING, AND COOLING SYSTEM

01/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC. (AMCA)

AMCA 210 (1999) Laboratory Methods of Testing Fans
for Aerodynamic Performance Rating

AMCA 500 (1994) Test Methods for Louvers, Dampers
and Shutters

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22 (1999; A 2001) Relief Valves for Hot Water
Supply Systems

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

ARI DCAACP Directory of Certified Applied Air
Conditioning Products

ARI 310/380 (1993) Packaged Terminal Air-Conditioners
and Heat Pumps

ARI 410 (1991) Forced-Circulation Air-Cooling and
Air-Heating Coils

ARI 430 (1999) Central-Station Air-Handling Units

ARI 590 (1992) Positive Displacement Compressor
Water-Chilling Packages

ANSI/AHRI 210/240 (2008; Add 1 2011; Add 2 2012) Performance
Rating of Unitary Air-Conditioning &
Air-Source Heat Pump Equipment

ARI 710 (1995) Liquid-Line Driers

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

ASHRAE 15 (2001) Safety Standard for Mechanical
Refrigeration System

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.3	(2016) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.5	(2013) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2001) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(2001) Forged Fittings, Socket-Welding and Threaded
ASME B16.18	(2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings
ASME/ANSI B16.22	(1995) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2002; Errata 2003; R 2006) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME/ANSI B16.26	(1988) Cast Copper Alloy Fittings for Flared Copper Tubes
ASME/ANSI B16.39	(1998) Malleable Iron Threaded Pipe Unions
ASME B31.1	(2014; INT 1-47) Power Piping
ASME/ANSI B31.5	(2001) Refrigeration Piping and Heat Transfer Components

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME BPVC	(2010) Boiler and Pressure Vessels Code
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AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	(2001; Errata, 2003) Performance Requirements for Water Pressure Reducing Valves
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ASTM INTERNATIONAL (ASTM)

ASTM A 53/A 53M	(2006a) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 106	(1999e1) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 193/A 193M	(2007) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(2001a) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service

ASTM A 525	(1991; Rev. B) Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A 653/A 653M	(2001a) Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock-Forming Quality
ASTM B 32	(2004) Standard Specification for Solder Metal
ASTM B 42	(2002e1) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B 88	(2003) Standard Specification for Seamless Copper Water Tube
ASTM B 280	(1999e1) Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B 306	(1999) Copper Drainage Tube (DWV)
ASTM B280	(2020) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM E84	(2018) Standard Test Method for Surface Burning Characteristics of Building Materials

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH
(FCCCHR)

FCCCHR-USC	(2002) List of Approved Backflow Prevention Assemblies
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-58	(2002) Standard for Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(2002a; R 2004) Standard for Butterfly Valves
MSS SP-69	(2003; R 2004) Standard for Pipe Hangers and Supports - Selection and Application
MSS SP-70	(2006) Standard for Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(2018) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-80	(2019) Bronze Gate, Globe, Angle and Check Valves

MSS SP-85 (2002) Standard for Cast Iron Globe & Angle Valves, Flanged and Threaded Ends

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4)
National Electrical Code

NFPA 90A (2015) Standard for the Installation of Air Conditioning and Ventilating Systems

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA R&W Manual (2001, 5th Ed) NRCA Roofing and Waterproofing Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA HVAC Duct Const Stds (1995; Addenda Nov 1997; 6th Printing 2001) HVAC Duct Construction Standards - Metal and Flexible

SMACNA Leakage Test Mnl (1985; 6th Printing 1997) HVAC Air Duct Leakage Test Manual

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (updated continuously online) Building Materials Directory

UL 181 (1996; Rev Dec 1998) Factory-Made Air Ducts and Air Connectors

UL 555 (1999; Rev thru Jan 2002) Fire Dampers

1.2 SYSTEM DESCRIPTION

Provide new heating, ventilating, and cooling (HVAC) systems complete and ready for operation. HVAC systems include equipment, ducts, and piping which is located within, on, under, and adjacent to buildings.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00, "Submittal Procedures."

SD-02 Shop Drawings

Temperature control systems

Equipment layout drawings for:

(1) Mechanical Rooms

(2) Mechanical Yards

SD-03 Product Data

Dedicated Outside Air Unit

Mini-Split heat pumps

Air-handling units

Air-cooled water chillers

Packaged terminal heat pumps

Unit heaters

Pumps, including performance curves for each impeller size

Exhaust fans

Fire dampers

Expansion tanks

Buffer tanks

Dirt-Air separators

Heat tape

Pipe hangers and supports

Flexible pipe connectors

Dampers

Diffusers, registers, and grilles

Outside air intake louvers

Flexible round ducts

Valves

Pipe and fittings

Dehumidifiers

SD-06 Test Reports

Air-handling units: greater than 2,000 cfm.

Air-cooled water chillers: greater than 180,000 Btuh.

SD-07 Certificates

Certification of welders' qualifications

Equipment field test plans

SD-08 Manufacturer's Instructions

Installation manual

SD-10 Operation and Maintenance Data

Mini-Split heat pumps, Data Package 3

Air-handling units, Data Package 3

Air-cooled water chillers, Data Package 3

Packaged terminal heat pumps, Data Package 2

Unit heaters, Data Package 2

Pumps, Data Package 2

Exhaust fans, Data Package 2

Fire dampers, Data Package 1

Submit in accordance with Section 01 78 23, "Operation and Maintenance Data."

SD-11 Closeout Submittals

Air-cooled water chillers start-up report

Air filter inventory

1.3.1 Temperature Control Systems

Drawings shall include point-to-point electrical wiring diagrams.

1.3.2 Equipment layout drawings

Submit drawings showing equipment layout including foot print, piping, conduit, control cabinets, door swings, and power disconnects.

1.3.3 Installation Manual

Provide for each item of equipment.

1.3.4 Certification of Welders' Qualifications

Submit copy of Welder Qualification Tests (Form QW-482) prior to site welding.

1.3.5 Equipment Field Test Plans

Submit within 120 calendar days after contract award for the following equipment.

- a. Air-handling units: packaged and multi-zone; greater than 2,000 cfm.
- b. Air-cooled water chillers: greater than 180,000 Btuh.

1.3.6 Air Filter Inventory

Submit an inventory of sizes and quantity of air filters required to be replaced. Inventory shall indicate location of each piece of equipment. Include sketches of drawings.

PART 2 PRODUCTS

2.1 EQUIPMENT

Dehydrate, purge, and charge refrigerant circuit with refrigerant and oil at factory. Factory oil and refrigerant charge shall be full amount required for operation, if within limits permitted by the Department of Transportation; otherwise, a holding charge shall be furnished. Field charging, where only a holding charge is shipped, shall be accomplished without breaking permanent refrigerant connections. Equipment using R-11, R-12, R-13, R-113, R-114, R-115, R-500, or R-502 as a refrigerant will not be permitted. Refrigerants shall have an Ozone Depletion Factor (ODF) of 0.05 or less. The ODF shall be in accordance with the "Montreal Protocol On Substances That Deplete The Ozone Layer," September 1987, sponsored by the United Nations Environment Program. Refrigerants that operate anywhere in the cycle below 20 psia will not be permitted. Efficiency of equipment shall meet the minimum's of Table 15701-1.

2.1.1 Dedicated Outside Air Unit

Unit shall include outdoor supply fan, exhaust air fan, recovery plate, 2-inch thick outdoor air and exhaust air filters, and outdoor and exhaust shut off dampers with chilled water and hot water reheat coils. Furnish flat panel filter section with 2-inch pleated MERV 8 filter. Provide side loading and removal of filters.

2.1.1.1 Unit Casing

- a. Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.
- b. Panels and access doors shall be constructed as a 2-inch nominal thick; thermal broke double wall assembly, injected with foam insulation with an R-value of not less than R-13.
 1. The inner liner shall be constructed of G90 galvanized steel.
 2. The outer panel shall be constructed of G90 galvanized steel.
 3. The floor plate shall be constructed as specified for the inner liner.
 4. Unit will be furnished with solid inner liners.
- c. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 5 inches of positive or 6 inches of negative static pressure. Deflection shall be measured at the panel midpoint.
- d. The casing leakage rate shall not exceed 0.50 cfm per square foot of casing surface area at design static pressure up to a maximum

of +5" w.c. in positive pressure sections and -6" w.c. in negative pressure sections (.0025 m3/s per square meter of cabinet area at 1.24 kPa static pressure)

- e. Module to module field assembly shall be accomplished with an overlapping, full perimeter internal splice joint that is sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.
- f. Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size handle assembly. Access doors shall swing outward for unit sections under negative pressure. Access doors on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.
- g. Construct drain pans from stainless steel with cross break and double sloping pitch to drain connection. Provide drain pans under cooling coil section. Drain connection centerline shall be a minimum of 3'' above the base rail to aid in proper condensate trapping. Drain connections that protrude from the base rail are not acceptable. There must be a full 2'' thickness of insulation under drain pan.

2.1.1.2 Fan Assemblies

- a. Acceptable fan assembly shall be a single width, single inlet, class II, direct-drive type plenum fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes. Provide access to motor and fan assembly through hinged access door.
- b. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door.

2.1.1.3 Cooling and Heating Coil

- a. Certification: Acceptable water cooling, water heating, steam, and refrigerant coils shall be certified in accordance with AHRI Standard 410 and bear the AHRI label. Coils exceeding the scope of the manufacturer's certification and/or the range of AHRI's standard rating conditions will be considered provided the manufacturer is a current member of the AHRI Forced Circulation Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with AHRI Standard 410. Manufacturer must be ISO 9002 certified.
- b. Water cooling coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection

grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.

1. Headers shall consist of seamless copper tubing to assure compatibility with primary surface. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.

2. Fins shall have a minimum thickness of 0.0075 inch aluminum plate construction. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Bare copper tubes shall not be visible between fins.

3. Coil tubes shall be 5/8 inch OD seamless copper, 0.020 inch nominal tube wall thickness, expanded into fins, brazed at joints.

4. Coil connections shall be carbon steel, NPT threaded connection. Connection size to be determined by manufacturer based upon the most efficient coil circuiting. Vent and drain fittings shall be furnished on the connections, exterior to the air handler. Vent connections provided at the highest point to assure proper venting. Drain connections shall be provided at the lowest point to insure complete drainage and prevent freeze-up.

5. Coil casing shall be a formed channel frame of galvanized steel.

- c. Water heating coil shall be provided. Provide access to coil(s) for service and cleaning. Enclose coil headers and return bends fully within unit casing. Unit shall be provided with coil connections that extend a minimum of 5" beyond unit casing for ease of installation. Drain and vent connections shall be provided exterior to unit casing. Coil connections must be factory sealed with grommets on interior and exterior panel liners to minimize air leakage and condensation inside panel assembly. If not factory packaged, Contractor must supply all coil connection grommets and sleeves. Coils shall be removable through side and/or top panels of unit without the need to remove and disassemble the entire section from the unit.

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5. Coil shall be furnished as an uncased galvanized steel to allow for thermal movement and slide into a pitched track for fluid drainage.

2.1.1.4 Energy Recovery Plate

The ERV core shall transfer both sensible and latent energy between the incoming fresh air stream and the exhaust stale air stream. The ERV core shall be in either a cross-flow or counter cross-flow orientation and have no moving parts. The ERV core shall be certified by AHRI under its Standard 1060 for Energy Recovery Ventilators. Products not currently AHRI certified will not be accepted. The ERV core shall achieve the minimum effectiveness value as indicated in the schedule. The fresh air stream must have complete separation from the stale air stream to prevent cross contamination. The ERV core shall have Exhaust Air Transport Ratio of less than 0.5% as tested to AHRI 1060 (EATR) to prevent cross-over of gases, contaminants or odors. The ERV core's Outdoor Air Correction Factor (OACF) shall not exceed 1.0 as tested to AHRI 1060 (OACF) Standard. The ERV core shall not be degraded or promote the growth of mold and bacteria with a rating of zero in testing according to ISO846 A and C. The ERV core must be able to tolerate freezing temperatures of -30C (-22F) and not have an increase in EATR or decrease in performance after being frozen. The ERV core must be able to tolerate high temperatures of +60C (140F) and not have an increase in EATR or decrease in performance at these elevated temperatures. The ERV core must be freeze tolerant tested to 40 freeze thaw cycles from -20C (-4F) to +20C (68F) while maintaining the energy recovery effectiveness and EATR rating of less than 0.5%. The ERV core must be water washable to remove dust and contaminants. The ERV core must be flame proof and comply with UL 723 with a flame spread index that shall not be over 25 and a smoke index that shall not be over 50. The ERV cores should have particulate filters positioned before the incoming air streams.

2.1.2 Dehumidifiers

Provide commercial rated, UL or ETL listed, dehumidifier units with a minimum 5 year manufacturer parts warranty on the sealed refrigerant system, capable of continuous operation, equipped with replaceable or washable filter media, designed to operate continuously without emptying a tank, and able to remove a minimum of 150 pints/day of moisture at room conditions of 80 degrees F and 60% relative humidity. Unit shall be hardwired to an appropriately rated electric circuit. Each unit shall be capable of gravity drain of condensate via hose to a floor drain or equipped with a condensate pump capable of continuous condensate discharge via a hose to a floor drain. Install clean filter media following installation. Provide 5 additional filter media in the factory sealed packaging and left in the mechanical room for each unit installed. Provide a dehumidifier with ability to control humidity setpoint in 5% RH increments or provide remote mounted humidistat to control the

dehumidifier as indicated on the plans.

2.1.3 Mini-Split Heat Pumps

Provide units factory assembled, designed, tested, and rated in accordance with ANSI/AHRI 210/240. System shall consist of a slim silhouette, compact, wall mounted indoor fan coil section with wired remote controller and a slim silhouette horizontal discharge outdoor unit which shall be of an inverter driven heat pump design.

- a. Outdoor Unit Cabinet: The casing shall be fabricated of galvanized steel, finished with an electrostatically applied, thermally fused acrylic or polyester powder coating in manufacturer's standard color. Assembly hardware shall be cadmium plated. Provide unit with two (2) steel mounting feet, traverse mounted across the cabinet base pan, welded mount, providing four (4) slotted mounting holes. Assembly shall withstand lateral wind gust up to 155 MPH.
- b. Outdoor Unit Fan: The unit shall be furnished with a direct drive, high performance propeller type fan. The condenser fan motor shall be a variable speed, direct current (DC) motor and shall have permanently lubricated bearings. Fan speed shall be switch automatically according to the number of operating indoor units and the compressor operating frequency. The fan motor shall be mounted with vibration isolation. The fan shall be provided with a raised guard to prevent contact with moving parts. The outdoor unit shall have horizontal discharge airflow.
- c. Outdoor Unit Coil: The outdoor unit coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing. The coil shall be protected with an integral guard. Refrigerant flow from the outdoor unit to the indoor units shall be independently controlled by means of individual electronic linear expansion valves for each indoor unit. Outdoor unit shall be pre-charged with sufficient R-410a refrigerant for up to thirty three (33) feet of refrigerant piping. All refrigerant lines between outdoor and indoor units shall be of annealed, refrigeration grade copper tubing, ARC Type, meeting ASTM B280 requirements, individually insulated in twin-tube, flexible, closed-cell, CFC-free (ozone depletion potential of zero), elastomeric material for the insulation of refrigerant pipes and tubes with thermal conductivity equal to or better than 0.27 BTU-inch/hour per Sq Ft / °F, a water vapor transmission equal to or better than 0.08 Perm-inch and superior fire ratings such that insulation will not contribute significantly to fire and up to 1" thick insulation shall have a Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E84. All refrigerant connections between outdoor and indoor units shall be flare type.
- d. Outdoor Unit Compressor: The compressor shall be a high performance, hermetic, inverter driven, variable speed, dual rotary type. The compressor motor shall be direct current (DC) type equipped with a factory supplied and installed inverter drive package. The outdoor unit shall be equipped with a suction side refrigerant accumulator. The compressor shall be equipped with an internal thermal overload. The outdoor unit must have the ability to operate over the full capacity range with a maximum height

difference of 40 feet and have refrigerant tubing length of 65 feet. The compressor shall be mounted to avoid the transmission of vibration.

- e. Outdoor Unit Electrical: The unit electrical power shall be voltage as indicated in schedule. The outdoor unit shall be controlled by the microprocessors located in the indoor unit and in the outdoor unit communicating system status, operation, and instructions digitally over A-Control - a system directing that the indoor unit be powered directly from the outdoor unit using a 3-wire, 14 ga. AWG connection plus ground. The outdoor unit shall be equipped with Pulse Amplitude Modulation (PAM) compressor inverter drive control.
- f. Indoor Unit Cabinet: The casing shall have a smooth front, white finish. Provide a separate, metal installation-plate that secures the indoor unit firmly to the wall. The installation-plate shall be securely attached to the wall using appropriate anchor method. Installing contractor shall determine the best method and be responsible for proper mounting of the installation plate to the wall.
- g. Indoor Unit Fan: The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor. The fan shall be statically and dynamically balanced and be powered by a motor with permanently lubricated bearing. Manual adjustable guide vanes shall be provided with the ability to change the airflow from side to side (left to right). Provide an integral, motorized, multi-position, horizontal air sweep flow louver. Unit shall be capable of five (5) positions plus Auto and Swing, controlled from the remote controller. The indoor fan shall operate at one of four (4) speeds. All speeds shall be selected from the remote controller.
- h. Indoor Unit Filter: Return air shall be filtered by means of washable filter.
- i. Indoor Unit Coil: The indoor unit coil shall be of nonferrous construction with smooth plate fins on copper tubing. All tube joints shall be brazed with phoscopper or silver alloy. The coils shall be pressure tested at the factory. A sloped, corrosion resistant condensate pan with drain shall be provided under the coil. An drain pan level switch shall be provided and installed on the condensate pan to prevent condensate from overflowing.
- j. Indoor Unit Electrical: The unit electrical power shall be voltage as indicated in schedule. The system shall be equipped with a system directing that the indoor unit be powered directly from the outdoor unit.
- k. System Control: Provide indoor unit with a wired remote controller mounted where indicated on plans. The wired remote controller shall be approximately 5" x 5" in size and white in color with a LCD display.

2.1.4 Air-Handling Units

Provide units factory assembled, designed, tested, and rated in accordance with ARI 430. Units shall be ARI certified for cooling. Provide heating

and cooling units including hot water coils and chilled water coils. Unit shall include fan section, coil section with drain pan, variable frequency motor controller, filter section and access panels. Insulate interior of casing with manufacturer's standard insulation. Provide nylon bushings for dampers.

- a. Fan section: Provide draw-through fan section including motor, starter, and drives.
- b. Coil section: Provide ARI 410 coils and slope for drainage. Provide insulated drain pans under cooling coils and valves.
- c. Filter section: Provide UL listed throwaway 1 inch thick fiberglass filters, standard dust-holding capacity, 350 fpm maximum face velocity. Provide gasketed hinged access panel with quick opening half-twist latches at end of filter rack.
- d. Space temperature controls: Provide controls under Section 23 09 23.13 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.
- e. Roof curbs: Provide factory-fabricated galvanized steel roof curbs, wood nailers, insulation, and seal strips in accordance with NRCA R&W Manual curb details for rooftop air-handling units. Roof curbs shall be furnished by unit manufacturer.
- f. Equipment selection: Air-handling unit (AHU) manufacturer shall certify the capability of the AHU to perform between the cumulative design minimum and maximum airflows. The AHU submittal selection shall be supported by fan curves clearly annotated showing operating points of the minimum and maximum airflow.

2.1.1.5 Air-Cooled Water Chillers

Provide single package units factory assembled, designed, tested, and rated in accordance with ARI 590 with air-cooled condensers. Provide not less than two independent refrigerant circuits for multicompressor units. Provide direct expansion shell and tube design, refrigerant circuits, including electric-motor-driven refrigerant compressors with integral crankcase heater, air-cooled condenser, receiver, chiller, piping, controls, and accessories mounted in a cabinet. Provide refrigerant, internal pressure relief device, solenoid valve, combination liquid-line strainer-drier, expansion valve, and service valves. Condenser discharge air shall be in vertical direction. Provide guards to protect condenser fins from mechanical damage. Provide equipment guards around base of unit. Crankcase heaters are not required when scroll compressors are provided.

- a. Controls: Provide factory-wired digital electronic controls including adjustable programmable thermostat for chilled water temperature control, high-low pressure control, low water temperature safety thermostat, ON-OFF unit switch, and nonrecycling pump-down relay. Controls shall also include maximum operating pressure expansion valves and programming of microprocessor chiller controls or high temperature controller for operation of compressors in cool down mode for start-up or changeover when entering water temperature is in 60 to 90 degree F range. Provide electrical interlock between water chiller and chilled water pump to prevent chiller from operating unless pump is running. Provide flow switch or flow sensors in chilled water

return piping to stop compressor in event of water flow failure. Condenser fan electric motors shall be drip-proof, with built-in three-phase overload protection, mounted inside the casing. Compressor motor stoppage due to thermal and pressure overload shall require manual restart. Provide control and interlock wiring. Provide thermostat controlled electric heater cable around chiller and exterior piping for freeze protection down to 0 degree F air temperature, to operate when ambient exterior air temperature falls below 40 degrees F. Provide low ambient control to 20 degrees F.

- b. Weatherproof casing: Provide removable gasketed panels designed to exclude driving rain for access to compressors, motors, and controls.
- c. Special corrosion protection: Provide condenser coils with copper tubes and plate copper fins or copper tubes and plate aluminum fins with phenolic coating factory applied to entire coil by immersion dipping and baking to 1.5 mil minimum dry film thickness. Rating of units shall be after application of phenolic coating.

2.1.6 Packaged Terminal Heat Pumps

Provide units factory assembled, designed, tested, and rated in accordance with ARI 310/380. Units shall be ARI certified or rated in ARI DCAACP. Units shall include refrigeration section, additional heating section (where indicated), separate outdoor weatherproof anodized aluminum louvers, forced ventilation, room cabinet, fans and motors, controls, wall sleeves, filters, dampers, grilles, subbases, leveling device, and power connections. Wall sleeves and installation shall be designed to exclude driving rain. Insulate interior of unit with manufacturer's standard insulation. Unit shall have slide-out chassis easily removed through room cabinet opening. Provide adjustable deflection inside air supply grille. Fan motors shall be permanent-split capacitor type. Provide wall mounted units minimum of 3-inches above floor.

- a. Filters: Provide permanent washable air filters or UL listed throwaway fiberglass filters, standard dust-holding capacity; removable through access door or panel.
- b. Safety controls: Provide compressor motors with thermal and overload protection, 5 minute anti-recycle timer, start capacitor kit, and crankcase heater. The above safety controls are not required when scroll compressors are provided.
- c. Supplemental heating section: Provide UL listed electric resistance heaters including internal fusing integral with unit; fan shall run until heater cools. Provide controls to operate heater only when indoor thermostat is in heating mode and outdoor thermostat indicates outside temperature is below 35 degrees F or unit balance point, whichever is higher; and when unit is in defrost mode at any outside temperature.
- d. Space temperature controls: Provide controls including adjustable COOLER-WARMER temperature control thermostats with COOL-OFF-HEAT system switch and HIGH-MEDIUM-LOW fan switch, and FAN ONLY switch.
- e. Anti-Ligature Cover: Provide Sloped top, 3/32" on 3/16"

staggered center, laser cut perforated. Floor Mounting: Offset floor angles are provided loose. Floor-mounted units with openings low in front for make-up air flow. Vertical Wall Mounting: 90 Degree, powder coated cold rolled steel provided loose. Visible mounting hardware is self drilling zinc plated torx head security screw.

Enclosure Material: CR, 12 Gauge cold rolled steel
Grille Material: SS, 11 Gauge stainless steel
First Coating - Zinc Rich Primer
Second Coating - Hybrid-Epoxy, Loss Gloss, White
Accessories: Screw Down Access Doors (torx head) security machine screws

- f. Special corrosion protection: Provide condenser coils constructed of copper tubes and plate copper fins or copper tubes and plate aluminum fins with phenolic coating factory applied to entire coil by immersion dipping and baking to 1.5 mil minimum dry film thickness. Rating of units shall be after application of phenolic coating.

2.1.7 Unit Heaters

Provide factory-assembled, propeller or blower type fan unit heaters arranged for horizontal air discharge as indicated. Each unit shall include hot water coil, fan, electric motor, housing, and air discharge vanes or diffusers. Horizontal discharge type units shall have adjustable deflectors for control of horizontal and vertical airflow. Each unit shall be provided with threaded mounting holes for attaching threaded hanger rods. Fan motor shall be controlled by wall-mounted adjustable thermostat with higher end of scale range factory set at 75 degrees F. Controls shall be automatic of the on-off type.

2.1.8 Pumps

- a. In-Line pumps: Provide pumps constructed of manufacturer's standard materials suitable for chilled water and hot water heating systems. Pumps shall have mechanical seals and drip-proof electric motors.

2.1.9 Exhaust Fans

AMCA 210 with AMCA seal. Provide centrifugal type exhaust fans with aluminum housing, fan wheel, and bird screen. Motors shall be completely shielded from the airstream. Provide exhaust opening and gravity closing type automatic backdraft dampers.

2.2 ELECTRICAL

2.2.1 Electrical Motors, Controllers, Contactors, and Disconnects

Furnish with respective pieces of equipment. Motors, controllers, contactors, and disconnects shall conform to Section 26 20 00, "Interior Wiring Systems." Provide electrical connections under Section, 26 20 00, "Interior Wiring Systems." Provide controllers and contactors with maximum of 120-volt control circuits, and auxiliary contacts for use with controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of providing additional electrical service and related work shall be included under this section.

2.2.2 Electrical Work

Provide under Section 26 20 00, "Interior Wiring Systems." Provide control wiring under Section 23 09 23.13, BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC. Provide control wiring under this section in accordance with NFPA 70.

2.3 METAL DUCT SYSTEMS

Provide shop-fabricated, zinc-coated steel ducts conforming to ASTM A 525 or ASTM A 653/A 653M coating designation G60. Fabricate, construct, brace, reinforce, install, support, and seal ducts and accessories, and test ducts in accordance with SMACNA HVAC Duct Const Stds and SMACNA Leakage Test Mnl. Cover duct transverse joints with single component synthetic rubber type compound suitable for use with passivated coating on zinc-coated steel. Lap joints in direction of flow. Provide ducts straight and smooth on inside with neatly finished airtight joints. Provide air supply and return openings in ducts with air diffusers, registers, or grilles.

2.3.1 Flexible Duct Connectors

Provide airtight flexible duct connectors at duct connections to each air-conditioning unit, air-handling unit, exhaust fan, and ventilating fan. Support connectors at each end with metal angle frame bands, securely bolt in place. Provide not less than 20 ounce glass fabric duct connectors coated on both sides with neoprene.

2.3.2 Turning Vanes

Provide fabricated tees and square elbows with turning vanes in accordance with SMACNA HVAC Duct Const Stds for vanned elbows. Turning vanes shall be single wall with trailing edges.

2.3.3 Dampers

Provide factory manufactured opposed blade adjustable manual dampers where indicated for duct heights of 12 inches and larger. Provide factory manufactured single leaf dampers for duct heights less than 12 inches. Provide damper shafts with 2 inch standoffs to clear 2 inches of duct insulation with bearings at both ends of the shafts. Provide adjustment quadrant with indicator and locking devices. Provide galvanized steel dampers one gage heavier than duct in which dampers are installed. Provide automatic dampers under Section 23 09 23.13, BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

2.3.4 Diffusers, Registers, and Grilles

Provide factory-fabricated metal units with edges rolled or rounded where exposed to view, and factory primed with white enamel finish. Provide each diffuser and register with factory-fabricated, group-operated, adjustable, opposed-blade, air-volume-control dampers, key or screwdriver operated from the face of unit without the use of a tool. Provide each unit with rubber or plastic installation gaskets. Diffusers in same room shall have same face design.

- a. Diffusers: Provide round, square, or rectangular diffusers as indicated. Ceiling diffusers shall be designed to deliver air in

a horizontal direction. Provide baffles or other devices as required for proper air distribution pattern.

- b. Registers: Provide double deflection supply registers arranged to control air direction, throw, and drop. Exhaust and return air registers shall have single set of nondirectional face bars or vanes having the same appearance as supply registers. Provide face bars or vanes spaced not more than 0.75 inch on center and not less than 0.62 inch depth.
- c. Grilles: Provide as specified for registers without air-volume-control dampers.

2.3.5 Outside Air Intake Louvers

Louvers shall bear AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500. Maximum pressure drop shall be 0.1 inch WG, unless indicated otherwise. Louvers shall have maximum water penetration of 0.20 ounce per square foot of free area at free velocity of 800 fpm. Provide aluminum alloy with anodized finish frames and blades assembled with stainless steel screws, including 0.5-inch mesh aluminum screen mounted in extruded aluminum frame. Louvers are specified in Section 08 91 00, "Metal Wall Louvers."

2.3.6 Access Doors

Provide for access to volume dampers, fire dampers, plenum chambers, and where indicated. Provide each door with double wall zinc-coated steel construction, gasketed airtight, with continuous hinges and cam latches. Insulate access doors with one-inch thick rigid insulation. Provide 12 inch by 12 inch door, except where larger sizes are indicated, or provide 12 inches by height of duct when duct is less than 12 inches high. Provide keyed-alike 90 degree turn cam locks on each access door in sleeping rooms; furnish three keys.

2.3.7 Fire Dampers

UL 555 and NFPA 90A. Dampers shall be listed in UL Bld Mat Dir. Dampers when open shall not protrude into the ducts.

2.3.8 Flexible Round Ducts

UL 181 and NFPA 90A with factory-applied insulation, vapor barrier, and end connections. Fire hazard rating of duct assembly shall not exceed 25 for flame spread and 50 for smoke developed. Provide ducts designed for working pressures of 2 inches W.G. positive and 1.5 inches W.G. negative. Flexible round duct length shall not exceed 5 feet. Secure connections by applying adhesive for 2 inches over rigid duct, apply flexible duct 2 inches over rigid duct, apply metal clamp, and provide minimum of three No. 8 sheet metal screws through clamp and rigid duct.

- a. Inner duct core: Flexible core shall be interlocking spiral or helically corrugated and constructed of zinc-coated steel, aluminum, or stainless steel; or shall be constructed of inner liner of continuous galvanized spring steel wire helix fused to continuous, fire-retardant, flexible vapor barrier film, inner duct core.
- b. Insulation: Inner duct core shall be insulated with mineral fiber

blanket type flexible insulation, minimum of one inch thick. Insulation shall be covered on exterior with manufacturer's standard fire retardant vapor barrier jacket for flexible round duct.

2.4 PIPING SYSTEMS

Provide the following pipe and fittings. Provide dielectric fittings, unions or flanges between steel piping and copper tubing for all piping sizes; except that copper alloy valves and strainers may be used without dielectric fittings, unions or flanges. Water piping sizes 4 inches and smaller shall be copper tubing. Water piping sizes larger than 4 inches shall be copper tubing or steel piping. If steel piping is provided, provide a solids-from-water separator.

2.4.1 Soldered Joint Copper Tubing

Provide ASTM B 88, Type L for aboveground piping, Type K for buried piping, with ASME B16.18 or ASME/ANSI B16.22 solder joint fittings, unions, and flanges; provide adapters as required. Provide ASTM B 42 copper pipe nipples with threaded end connections. Provide ASTM B 32, 95-5 tin-antimony solder, or provide Plumbing Code approved lead-free solder.

2.4.2 Copper Tubing Piping Systems

Provide copper tubing for the following piping systems, except water piping sizes larger than 4 inches shall be copper tubing or steel piping.

- a. Chilled water, chilled-hot water, and hot water piping.
- b. Cold drain piping from drain pans.
- c. Fuel oil supply and return piping with ASME/ANSI B16.26 flared fittings or compression type fittings.

2.4.3 Copper Cold Drain Piping

Provide copper tubing in accordance with paragraph entitled "Copper Tubing" for piping sizes one inch and smaller. Provide ASTM B 306 copper tubing and ASME B16.23 solder joint fittings for piping sizes larger than one inch. In lieu of copper tubing, 1.25 inch Schedule 40 polyvinyl chloride (PVC) plastic pipe, fittings, and solvent cement may be provided.

2.4.4 Copper Refrigerant Tubing

Provide ASTM B 280, cleaned, dehydrated, and sealed. Provide ASME/ANSI B16.22 solder joint refrigerant fittings and adapters. Provide silver brazing alloy solder and silver brazing alloy flux. During brazing operations bleed a small amount of dry oil-free nitrogen continuously through the refrigerant tubing. Provide ASME/ANSI B16.26 flared fittings.

2.4.5 Buried Preinsulated Water Piping

Provide buried preinsulated water piping in conduit complete and ready for operation. Install in accordance with fabricator's published literature. Provide copper tubing for carrier piping; carrier piping sizes larger than 4 inches may be steel piping. Minimum depth of cover shall be

2 feet.

- a. Factory-applied insulation: Provide polyurethane or polyisocyanate insulation, rated for not less than 250 degrees F service, completely filling the space between carrier pipe and conduit.
- b. Factory-applied conduit: Provide each section of carrier pipe with insulation and conduit complete with waterproof conduit caps at both ends. Mark each section of conduit with fabricator's name, product identification, and publications to which the items conform. Provide same type of insulation and conduit material over field-insulated joints and fittings; provide waterproof shrink sleeves over field-insulated joints to overlap not less than 6 inches of each conduit section.
- c. Bedding: Accurately grade trench bedding with minimum of 6 inches of sand. Backfill sand to minimum of 6 inches above and below conduit. Lay bedding to firmly support conduit along entire length.
- d. Buried utility warning tape: Provide detectable tape for warning of buried piping.

2.4.6 Steel Piping Systems

Provide steel piping for the following piping systems.

- a. Gas piping.

2.4.6.1 Steel Pipe

Provide ASTM A 53/A 53M Type E or Type S, or ASTM A 106 steel pipe; except ASTM A 53/A 53M, Type F steel pipe may be provided for water pipe sizes larger than 4 inches and for steam pipe less than 100 psig. Provide Weight Class STD or Schedule No. 40 black steel pipe for welding end connections. Provide Weight Class XS or Schedule No. 80 black steel pipe for threaded end connections and for condensate piping.

2.4.6.2 Steel Pipe Fittings

Provide ASME B16.3 or ASME B16.11 threaded fittings, and ASME/ANSI B16.39 threaded unions. Provide ASME B16.9 butt welding fittings of the same material and weight as the piping in which fittings are installed; provide backing rings compatible with piping materials being butt welded. Provide ASME B16.11 socket welding fittings.

2.4.6.3 Steel Pipe Unions

Provide ASME/ANSI B16.39, Class 150, unions with threaded end connections on one side of threaded valve in steel piping systems.

2.4.6.4 Steel Pipe Flanges

Provide ASME B16.5, Class 150 welding neck flanges. Extend bolts no less than two full threads beyond the nut with the bolts tightened to the required torque.

- a. Gaskets: Provide one piece factory cut gaskets suitable for the

intended service. Provide full-face gaskets for flat-face flanged joints, and ring gaskets for raised-face flanged joints.

- b. Bolts: Provide ASTM A 193/A 193M, Grade B7 bolts.
- c. Nuts: ASTM A 194/A 194M, Grade 7.
- d. Washers: Provide steel flat circular washers under bolt heads and nuts.

2.4.6.5 Direct Buried Steel Piping

Provide pipe and fittings with exterior coal tar epoxy painting system.

2.4.7 Valves

Valves shall have flanged end connections, except valves smaller than 2.5 inches may have threaded end connections with a union on one side of the valve. Solder end connections may be used for connections between copper alloy valves and copper tubing.

2.4.7.1 Gate Valves

MSS SP-80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP-70, Class 125.

2.4.7.2 Globe and Angle Valves

MSS SP-80, Class 125, except sizes 2.5 inches and larger shall conform to MSS SP-85, Class 125.

2.4.7.3 Check Valves

MSS SP-80, Class 125, swing check; except sizes 2.5 inches and larger shall conform to MSS SP-71, Class 125.

2.4.7.4 Butterfly Valves

MSS SP-67, except sizes 2.5 inches and larger shall have lugged or wafer body designed for installation between ASME Class 150 flanges. Valves shall have two-position lever handles, except when infinite position lever handles are indicated.

2.4.7.5 Ball Valves

Full port design, copper alloy body, except sizes 2.5 inches and larger shall be cast-iron body. Valves shall have two-position lever handles. Ball valves may be provided in lieu of gate valves.

2.4.7.6 Square Head Cocks

Provide copper alloy or cast-iron body with copper alloy plugs, suitable for 125 psig water working pressure.

2.4.7.7 Air Venting Valves

Provide copper alloy body valves with automatic or manual air vent as indicated.

2.4.7.8 Combination Pressure and Temperature Relief Valves

ANSI Z21.22, copper alloy body, automatic reseating, test lever, and discharge capacity based on AGA temperature steam rating.

2.4.7.9 Water Pressure Reducing Valves

ASSE 1003, copper alloy body, automatic reseating, with test lever.

2.4.7.10 Water Temperature Regulating Valves

Provide copper alloy body, direct acting, pilot operated, for the intended service.

2.4.7.11 Flow Control Balancing Valves

Copper alloy or cast iron body, copper alloy or stainless internal working parts, and integral pointer that indicates the degree of valve opening. Valves shall be suitable for 125 psig at 190 degrees F hot water. Valve shall function as a service valve when in fully closed position. Valve body shall have factory-installed tapings for differential pressure meter connections for verification of pressure differential across valve orifice. Meter connections shall have positive check valves or shutoff valves. Each valve shall have metal tag showing the gallons per minute flow for each differential pressure reading.

2.4.7.12 Backflow Prevention Assemblies

Provide reduced pressure principle type backflow prevention assemblies which are approved by and has a current "Certificate of Approval" from the FCCCHR-USC. Listing of the particular make, model/design, and size in the current FCCCHR-USC will be acceptable as the required proof.

2.4.7.13 Refrigerant Valves

ASME/ANSI B31.5, and shall be copper alloy. Provide valves in each system for servicing and for isolating system components in compliance with ASHRAE 15.

2.5 PIPING ACCESSORIES

2.5.1 Pipe Hangers and Supports

Provide MSS SP-58 and MSS SP-69, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

2.5.2 Strainers

Pressure and temperature range shall be for the intended service. Provide blowoff outlet with pipe nipple, gate valve, and discharge pipe nipple. Provide stainless steel strainer element with perforations of 0.047 inch for water, 0.031 inch for steam mixed with condensate, and 0.016 inch for

steam. Provide copper alloy or cast-iron body strainers in steam and condensate systems up to 100 psig. Provide steel body strainers in steam and condensate systems 100 psig and greater.

2.5.3 Traps

Provide traps of the types indicated with stainless steel internals. Pressure and temperature range shall be for the intended service. Traps for steam at 100 psig and greater shall be minimum of ASME Class 150.

2.5.4 Pressure Gages

Provide single style pressure gage with 4.5-inch dial, brass or aluminum case, bronze tube, gage cock, pressure snubber, and syphon. Provide scale range for intended service.

2.5.5 Thermometers

Provide bi-metal dial type thermometers with stainless steel case, stem, and fixed thread connection; 3 inch diameter dial with glass face gasketed within the case; and accuracy within 2 percent of scale range. Provide scale range for intended service.

2.5.6 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide one-inch minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material.

2.5.6.1 Sleeves in Masonry and Concrete

Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2.5.6.2 Sleeves not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

2.5.7 Flexible Pipe Connectors

Provide flexible bronze or stainless steel piping connectors with single braid where indicated. Connectors shall be suitable for the intended service.

2.5.8 Sight Glass and Refrigerant Drier

ARI 710. Provide in refrigerant liquid piping.

2.5.9 Expansion Tanks

Construct of steel for minimum working pressure of 125 psig. Tank shall have polypropylene or butyl lined diaphragm which keeps the air charge separated from the water.

2.5.10 Buffer Tanks

Buffer tanks for chilled water systems exposed to exterior weather and sunlight shall be insulated with 2" closed cell, formaldehyde-free, low-VOC, and fiber-free insulation with a insulation rating of R-8 or greater. Insulation shall be UL listed and have an anti-microbial agent applied at the factory with a built-in vapor retarder. Exterior located tanks shall have a sealed 0.020" or thicker aluminum jacket fully enclosing the insulation.

Chilled Water expansion tanks located inside of mechanical rooms and mechanical outbuildings shall be insulated with 2" closed cell, formaldehyde-free, low-VOC, and fiber-free insulation with a insulation rating of R-8 or greater. Insulation shall be UL listed and have an anti-microbial agent applied at the factory with a built-in vapor retarder. Heating Hot Water expansion tanks shall be located inside mechanical buildings and shall be provided with a minimum 2" silicone or fiberglass based insulation, factory designed to fit the tank.

2.5.11 Dirt-Air Separators

Provide Coalescent type Dirt-Air separator with internal perforated stainless steel air collector tube to direct released air to automatic air vent, and removing solids of 75 microns and larger with specific gravity of 1.2 and greater. Construct of steel for minimum working pressure of 125 psig. Insulate in accordance with 23 07 00.

2.5.12 Hydraulic Separator

Provide a hydraulic separator for each hydronic system with a primary and secondary loop. The hydraulic separator shall be designed and constructed per ASME BPVC, manufactured of a carbon steel exterior, 304 stainless steel interior baffles, and be minimally rated for a design pressure of 125 psig @ 200 degrees Fahrenheit. Unit shall be factory equipped with a blowdown valve and an air vent. The selected unit shall be factory manufactured with flanged or grooved pipe connections to match the diameter of the design pipe size to which it is connected without the use of pipe reducers. Insulate in accordance with 23 07 00.

2.5.13 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.6 HEAT TAPE FOR FREEZE PROTECTION OF PIPING

Provide parallel conduction type that is composed of two copper conductors separated by conductive material and all encased in an insulating jacket. The heat tape shall be self-regulating that decreases heat output as temperature increases at each point along the length of tape. Provide voltage as indicated. Provide heat tape complete with fittings, adapters,

and fittings, adapters, and other devices to connect tape to standard rigid steel conduit junction boxes, switches, or other devices as indicated. Provide tape sealants and jumper connectors up to 5-inches in length for connecting multiple runs. Provide a thermostat that activates the heat tape on drop of outside air temperature at 38 F. Thermostat shall have maximum tolerance of plus or minus 5 degrees F and maximum operating differential of 6 degrees F within temperature operating range. Wattage per foot of pipe at 50 F shall be as follows. This wattage may be achieved by spiraling the tape around the pipe.

Pipe Diameter (Inches)	1/2	3/4	1	1.25	1.5	2	3	4	6	8
Watt/Foot	2	2	2.5	2.5	3	3.5	4	6	7	8

2.6.1 Pressure/Temperature Test Ports (Plugs)

Provide solid bras test plugs where indicated. Test plug shall be capable of receiving a pressure or temperature probe 1/8-inch o.d. Dual seal core shall be rated zero leakage from vacuum to 200 psig and 0 F to 220 F. Each plug shall be extended through pipe insulation and be capped. Provide 2 each, pressure gauge adapters with 1/8-inch o.d. probe, 5-inch stem pocket testing thermometers for 0 F to 220 F.

2.7 ACCESS DOORS FOR VALVES

Provide factory-prefabricated and primed flush face steel access doors including steel door frame for with continuous hinges and turn-screw-operated latch. Provide door frame installation in plaster and masonry walls. Furnish doors under this section; install doors under appropriate section of this specification.

2.8 CHEMICAL FEED TANK

Construct of steel for minimum working pressure of 125 psig. Provide chemical pipe, fittings, and valves as specified for water piping. Add borate-nitrite corrosion inhibitors to initial fill water for heating and cooling water systems in concentrations of one-half ounce per gallon of system water.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 HVAC System

Installation of HVAC system including equipment, materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with ASME B31.1, ASME/ANSI B31.5, NFPA 70, and in accordance with the manufacturer's recommendations.

3.2 PIPING

Test, inspect, and approve piping before burying, covering, or concealing. Provide fittings for changes in direction of piping and for connections. Make changes in piping sizes through tapered reducing fittings; bushings

will not be permitted. Install valves with stems horizontal or above. Provide flanges or unions at valves, traps, strainers, and connections to equipment; unions are not required in copper tubing piping systems.

- a. Threaded connections: Provide Teflon pipe thread paste on male threads. Do not thread metal pipe into plastic piping.
- b. Pipe hangers and supports: Provide additional pipe hangers and supports at in-line water pumps and flanged valves.
- c. Piping to receive insulation: Provide temporary wood spacers between the pipe hangers and supports, and the pipe in order to properly slope the piping and establish final elevations. Provide temporary wood spacers of same thickness as insulation to be provided under Section 23 07 00, INSULATION OF MECHANICAL SYSTEMS. Support plastic piping every 4 feet. Support metal piping as follows.

MAXIMUM SPACING (FEET)

Nominal Pipe Size (inches)	One and under	1.25	1.5	2	2.5	3	3.5	4	5	6
Copper Tubing	6	7	8	8	9	10	11	12	13	14
Steel Pipe	7	8	9	10	11	12	13	14	16	17

- d. Cleaning of piping: Keep interior and ends of new piping and existing piping affected by Contractor's operations, cleaned of water and foreign matter during installation by using plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.
- e. Demolition: Remove materials so as not to damage materials which are to remain. Replace existing work damaged by Contractor's operations with new work of same construction.
- f. Tee Joints: Extracted tee joints may be made in copper tube. Make joint with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, provide dimpled depth stops. Notch the branch tube for proper penetration into fitting to assure a free flow joint. Braze extracted joints using a copper phosphorous classification brazing filler metal. Soldered joints shall not be permitted.

3.3 ADJUSTMENTS

Adjust controls and equipment so as to give satisfactory operation. Adjust entire water temperature control system and place in operation so that water quantities circulated are as indicated. Air duct systems shall be adjusted and balanced so that air quantities at outlets are as indicated and so that distribution from supply outlets is free from drafts and has uniform velocity over the face of each outlet.

3.4 PUMPS

After testing, adjusting, and balancing, trim the impellers on all pumps 10 hp and greater to actual flow conditions plus 10 percent discharge head. Readjust throttling device to correct flow rate.

3.5 INSTRUCTING OPERATING PERSONNEL

Upon completion of work and at time designated by Contracting Officer, provide services of competent technician for period of not less than one 8-hour working day for instruction of Government operating personnel in proper operation and maintenance of equipment.

3.6 FIELD QUALITY CONTROL

Upon completion and before final acceptance of work, test each system in service to demonstrate compliance with the contract requirements. Adjust controls and balance systems prior to final acceptance of completed systems. Test controls through every cycle of operation. Test safety controls to demonstrate performance of required function. Correct defects in work provided by Contractor and repeat tests. Furnish steam, fuel, water, electricity, instruments, connecting devices, and personnel for tests. Flush and clean piping and boiler before placing in operation. Clean equipment, piping, strainers, ducts, and filters.

3.6.1 Piping Systems Except for Refrigerant Piping

Before insulating, hydrostatically test each new piping system at not less than 188 psig. Maintain pressure for 2 hours with no leakage or reduction in gage pressure. Obtain approval before applying insulation.

3.6.2 Refrigerant Piping

Perform following when field piping connections are provided.

- a. Pressure test: Test refrigerant piping using dry, oil-free nitrogen, and prove tight at 300 psig on the high side and 150 psig on the low side. Maintain pressure for 2 hours with no leakage or reduction in gage pressure
- b. Evacuation: Using high vacuum pump and certified micron gage, reduce absolute pressure on both sides of system simultaneously to 300 microns. After reaching this point charge system with proper refrigerant until pressure of zero psig is obtained. Repeat evacuation-charging procedure for two more cycles, totaling to three evacuation-charging cycles. On final evacuation, secure pump and maintain 300 microns for 2 hours before charging with required final refrigerant.

3.6.3 Air Ducts

Obtain approval before applying insulation.

3.6.4 Equipment

3.6.4.1 Field Testing

Test each item of equipment in operation for continuous period of not less

than 24 hours under every condition of operation in accordance with each equipment manufacturer's recommendation. Verify that the equipment operating parameters are within limits recommended by the manufacturer.

3.6.4.2 Equipment Requiring Field Test Plans

Furnish equipment field test plans developed by each equipment manufacturer detailing recommended field test procedures for each item of equipment. Field test plans developed by the installing Contractor, or the equipment sales agency furnishing the equipment will not be acceptable. The Contracting Officer will review and approve the field test plan for each item of equipment prior to commencement of field testing of the equipment.

- a. Equipment Items to Test: Equipment requiring field test plans are listed in paragraph "SD-08, Statements."
- b. Coordinated Testing: Indicate in each field test plan when work required by this section requires coordination with test work required by other specification sections. Furnish test procedures for the simultaneous or integrated testing of equipment controls which interlock and interface with controls factory prewired or external controls for the equipment provided under Section 23 09 23.13, BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.
- c. Prerequisite Testing: Equipment for which performance testing is dependent upon the completion of the work covered by Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC must have that work completed as a prerequisite to testing work under this section. Indicate in each field test plan when such prerequisite work is required.
- d. Test Procedure: Indicate in each field test plan each equipment manufacturers published installation, start-up, and field acceptance test procedures. Include in each test plan a detailed step-by-step procedure for testing all automatic controls provided by the manufacturer. Each test plan shall include the required test reporting forms to be completed by the Contractor's testing representatives. Procedures shall be structured to test the controls through all modes of control to confirm that the controls are performing with the intended sequence of control. Controllers shall be verified to be properly calibrated and have the proper set point to provide stable control of their respective equipment.
- e. Performance Variables: Each test plan shall list performance variables that are required to be measured or tested as part of the field test. Include in the listed variables performance requirements indicated on the equipment schedules on the design drawings. Manufacturer shall furnish with each test procedure a description of acceptable results that have been verified. Manufacturer shall identify the acceptable limits or tolerances within which each tested performance variable shall acceptably operate.
- f. Job Specific: Each test plan shall be job specific and shall address the particular item of equipment and particular conditions which exist with this contract. Generic or general preprinted test procedures are not acceptable.
- g. Specialized Components: Each test plan shall include procedures

for field testing and field adjusting specialized components, such as hot gas bypass control valves, or pressure valves.

3.6.4.3 Equipment Requiring Field Test Reports:

- a. Equipment Items for Reports: Equipment requiring field test reports are listed in paragraph "SD-12, Field Test Reports."
- b. Manufacturer's Recommended Test: Conduct the manufacturer's recommend field testing in compliance with the approved test plan. Furnish a factory trained field representative authorized by and to represent the equipment manufacturer at the complete execution of the field testing.
- c. Operational Test: Conduct a continuous 24 hour operational test for each item of equipment. Equipment shutdown before the test period is completed shall result in the test period being started again and run for the required duration. For the duration of the test period, compile an operational log of each item of equipment. Log required entries every two hours. Use the test report forms for logging the operational variables.
- d. Notice of Tests: Conduct the manufacturer's recommended tests and the operational tests; record the required data using the approved reporting forms. Notify the Contracting Officer in writing at least 15 calendar days prior to the testing. Within 30 calendar days after acceptable completion of testing, submit each test report for review and approval.
- e. Report Forms: Type all data entries and writing on the test report forms. Completed test report forms for each item of equipment shall be reviewed, approved, and signed by the Contractor's test director and the QC Manager. The manufacturer's field test representative shall review, approve, and sign the report of the manufacturer's recommended test. Signatures shall be accompanied by the person's name typed.
- f. Deficiency Resolution: The test requirements acceptably met; deficiencies identified during the tests shall be corrected in compliance with the manufacturer's recommendations and corrections retested in order to verify compliance.

3.6.5 Boiler

Hydrostatically test at pressure of not less than 60 psig before being placed in operation. Notify Contracting Officer in writing when boiler is ready for testing and before boiler is operated. Government boiler inspector shall be notified by the Contracting Officer and shall witness boiler tests and approve before boiler units are placed in operation or accepted.

3.6.6 Additional Field Testing

Provide testing, adjusting, and balancing (TAB) of ducts, piping, and equipment under Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

3.6.7 Testing EMCS Equipment

- a. All EMCS equipment shall be given an operation test.
- b. Items not operating properly shall be repaired or replaced and retested.

TABLE 15701-1
EQUIPMENT MINIMUM EFFICIENCY REQUIREMENTS
Equipment must meet each rating listed

<u>Equipment Type</u>	<u>Efficiency</u>	<u>Rating Condition</u>
Air to Air Unitary Air Conditioner (Packaged and Split)		
<65 Mbtu/hr	12.0 SEER	
65-135 Mbtu/hr	11.0 EER	
	11.4 IPLV	
136-240 Mbtu/hr	10.8 EER	
	11.2 IPLV	
Air to Air Unitary Heat Pump (Packaged and Split)		
<65 Mbtu/hr	12.0 SEER	
	7.7 HSPF	
65-135 Mbtu/hr	10.1 EER	
	10.4 IPLV	
	3.2 COP	
136-240 Mbut/hr	9.3 EER	
	9.5 IPLV	
	3.1 COP	
Air Cooled Water Chiller	1.23 Full Load kW/ton	ARI 550/590-98
	.90 IPLV kW/ton	ARI 550/590-98
Air Cooled Condensing Units	12.0 SEER	
	11.0 EER	
	11.4 IPLV	
Room Air Conditioner (Window, not thru the wall)		
<20,000 btu/hr	10.7 EER	DOE test procedure
=>20,000 btu/hr	9.42 EER	DOE test procedure
Package Terminal Air Conditioner	10- $(.16 \times \text{Cap}/1000) \times \text{EER}$	ARI 310/380 @ 95 F Outdoor
	12.2- $(.2 \times \text{Cap}/1000) \times \text{EER}$	ARI 310/380 @ 82 F Outdoor
Package Terminal Heat Pump	10- $(.16 \times \text{Cap}/1000) \times \text{EER}$	ARI 310/380 @ 95 F Outdoor
	12.2- $(.2 \times \text{Cap}/1000) \times \text{EER}$	ARI 310/380 @ 82 F Outdoor
	2.9- $(.026 \times \text{Cap}/1000) \times \text{COP}$	ARI 310/380 @ 47 F Outdoor

*Capacity is cooling capacity in but/hr. Use 7,000 if cap is less than 7,000, use 15,000 if cap is greater than 15,000.

TABLE 15701-1
EQUIPMENT MINIMUM EFFICIENCY REQUIREMENTS
Equipment must meet each rating listed

<u>Equipment Type</u>	<u>Efficiency</u>	<u>Rating Condition</u>
Computer Room Air Conditioner	8.9 EER	
Water Source Heat Pump		
Open Loop	16.2 EER	@ 59 F EWT
	3.6 COP	@ 50 F EWT
Closed Loop	14.1 EER	@ 77 F EWT
	3.3 COP	@ 32 F EWT
Oil Fired Heating Boilers		
Water	83% Et	
Steam	83% Et	
Natural Gas Fired Heating Boiler		
Water	80% Et	
Steam		
<2,500,000	79% Et	
=>2,500,000	80% Et	
Direct Vent Gas-Fired Central Furnaces		
<225,000 input	90%	
-- End of Section --		

SECTION 26 08 00

APPARATUS INSPECTION AND TESTING

08/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2017; Errata 2017) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
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1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Acceptance tests and inspections

SD-07 Certificates

Qualifications of organization, and lead engineering technician

Acceptance test and inspections procedure

1.3 QUALITY ASSURANCE

1.3.1 Qualifications

Contractor shall engage the services of a qualified testing organization to provide inspection, testing, calibration, and adjustment of the electrical distribution system and generation equipment listed in paragraph entitled "Acceptance Tests and Inspections" herein. Organization shall be independent of the supplier, manufacturer, and installer of the equipment. The organization shall be a first tier subcontractor. No work required by this section of the specification shall be performed by a second tier subcontractor.

- a. Submit name and qualifications of organization. Organization shall have been regularly engaged in the testing of electrical materials, devices, installations, and systems for a minimum of 5 years. The organization shall have a calibration program, and test instruments used shall be calibrated in accordance with NETA ATS.
- b. Submit name and qualifications of the lead engineering technician performing the required testing services. Include a list of three comparable jobs performed by the technician with specific names and telephone numbers for reference. Testing, inspection, calibration, and adjustments shall be performed by an engineering technician,

certified by NETA or the National Institute for Certification in Engineering Technologies (NICET) with a minimum of 5 years' experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices.

1.3.2 Acceptance Tests and Inspections Reports

Submit certified copies of inspection reports and test reports. Reports shall include certification of compliance with specified requirements, identify deficiencies, and recommend corrective action when appropriate. Type and neatly bind test reports to form a part of the final record. Submit test reports documenting the results of each test not more than 10 days after test is completed.

1.3.3 Acceptance Test and Inspections Procedure

Submit test procedure reports for each item of equipment to be field tested at least 45 days prior to planned testing date. Do not perform testing until after test procedure has been approved.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 ACCEPTANCE TESTS AND INSPECTIONS

Testing organization shall perform acceptance tests and inspections. Test methods, procedures, and test values shall be performed and evaluated in accordance with NETA ATS, the manufacturer's recommendations, and paragraph entitled "Field Quality Control" of each applicable specification section. Tests identified as optional in NETA ATS are not required unless otherwise specified. Equipment shall be placed in service only after completion of required tests and evaluation of the test results have been completed. Contractor shall supply to the testing organization complete sets of shop drawings, settings of adjustable devices, and other information necessary for an accurate test and inspection of the system prior to the performance of any final testing. Contracting Officer shall be notified at least 14 days in advance of when tests will be conducted by the testing organization. Perform acceptance tests and inspections on applicable equipment and systems specified in the following sections:

- a. Section 26 12 19.10 THREE-PHASE PAD-MOUNTED TRANSFORMERS
- b. Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Medium voltage cables and grounding systems only.

3.2 SYSTEM ACCEPTANCE

Final acceptance of the system is contingent upon satisfactory completion of acceptance tests and inspections.

3.3 PLACING EQUIPMENT IN SERVICE

A representative of the approved testing organization shall be present when equipment tested by the organization is initially energized and placed in service.

20-0075 Repair BEQ FC530

-- End of Section --

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SECTION 26 12 19.10

THREE-PHASE PAD-MOUNTED TRANSFORMERS

04/04

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318 (2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

ASTM INTERNATIONAL (ASTM)

ASTM A 167 (1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM C 260 (2001) Air-Entraining Admixtures for Concrete

ASTM D 92 (2002; Rev. A) Flash and Fire Points by Cleveland Open Cup IP Designation: 36/84 (89); AASHTO No.: T 48; DIN 51 376

ASTM D 97 (2002) Pour Point of Petroleum Products IP Designation: 15/95

ASTM D 877 (2002) Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes

ASTM D 1535 (1997) Specifying Color by the Munsell System

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 712-C-98-075 (1998) Fate, Transport and Transformation Test Guidelines - OPPTS 835.3100- "Aerobic Aquatic Biodegradation"

EPA 600/4-90/027F (1993) Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms

FM GLOBAL (FM)

FM P7825 (2003) Approval Guide

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 386	(2016) Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C57.12.00	(2000) Liquid-Immersed Distribution, Power, and Regulating Transformers (IEEE)
IEEE C57.12.28	(2014) Standard for Pad-Mounted Equipment - Enclosure Integrity
IEEE C57.12.80	(2002) Terminology for Power and Distribution Transformers (IEEE)
IEEE C57.12.90	(1999) Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers (IEEE)
IEEE C57.98	(1993; Correction 1998) Guide for Transformer Impulse Tests (IEEE)
IEEE C62.11	(2012) Standard for Metal-Oxide Surge Arresters for Alternating Current Power Circuits (>1kV)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C37.47	(2000) High Voltage Current-Limiting Type Distribution Class Fuses and Fuse Disconnecting Switches
NEMA C57.12.26	(1993) Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors, High-Voltage, 34 500 Grd Y/19 920 Volts and Below; 2500 kVA and Smaller
NEMA C57.12.29	(1999; Errata 2000) Pad-Mounted Equipment - Enclosure Integrity for Coastal Environments

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2017; Errata 2017) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD)

OECD Test 203 (1993) Fish Acute Toxicity Test

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 431 Energy Efficiency Program for Certain
Commercial and Industrial Equipment

UNDERWRITERS LABORATORIES (UL)

UL 467 (2013; Reprint Jun 2017) UL Standard for
Safety Grounding and Bonding Equipment

1.2 RELATED REQUIREMENTS

Section 26 08 00, "Apparatus Inspection and Testing," applies to this section, with the additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

As an exception to this paragraph, transformers manufactured by ABB in Jefferson City, MO; by Cooper Power Systems in Waukesha, WI; by GE in Shreveport, LA; or by Howard Industries in Laurel, MS need not meet the submittal requirements of this contract. Instead, the following shall be submitted:

- a. A certification, from the manufacturer, that the technical requirements of this specification shall be met.
- b. An outline drawing of the transformer with devices identified (paragraph entitled "Pad-Mounted Transformer Drawings", item a).
- c. ANSI nameplate data of the transformer (paragraph entitled "Pad-Mounted Transformer Drawings", item b).
- d. Manufacturer's published time-current curves (on full size logarithmic paper) of the transformer high side fuses (paragraph entitled "Pad-Mounted Transformer Drawings", item e).
- e. Routine and other tests (in PART 2, see paragraph entitled "Routine and Other Tests"), shall be conducted by the manufacturer and may be witnessed by the government (in Part 2, see paragraph entitled "Source Quality Control"). Provide transformer test schedule required by submittal item "SD-11 Closeout Submittals". Provide certified copies of the tests.
- f. Provide acceptance test reports required by submittal item "SD-06 Test Reports".
- g. Provide operation and maintenance manuals required by submittal item "SD-10 Operation and Maintenance Data".

SD-02 Shop Drawings

Pad-mounted transformer drawings; G

SD-03 Product Data

Pad-mounted transformers; G

SD-06 Test Reports

Acceptance checks and tests

SD-07 Certificates

Transformer losses

SD-09 Manufacturer's Field Reports

Pad-mounted transformer design tests

Pad-mounted transformer routine and other tests

SD-10 Operation and Maintenance Data

Transformer(s), Data Package 5; G

SD-11 Closeout Submittals

Transformer test schedule

1.4 QUALITY ASSURANCE

1.4.1 Pad-Mounted Transformer Drawings

Drawings shall indicate, but not be limited to the following:

- a. An outline drawing, with front, top, and side views.
- b. ANSI nameplate data.
- c. Elementary diagrams and wiring diagrams with terminals identified of watt-hour meter and current transformers.
- d. One-line diagram, including switch(es), current transformers, meters, and fuses.
- e. Manufacturer's published time-current curves (on full size logarithmic paper) of the transformer high side fuses.

1.4.2 Transformer Losses

Submit certification from the manufacturer indicating conformance with the paragraph entitled "Specified Transformer Losses."

1.4.3 Transformer Product Data

Submittal shall include manufacturer's information for each component, device, and accessory provided with the transformer.

1.4.4 Test Results

Submit report of test results as specified by paragraph entitled "Field Quality Control"

1.5 MAINTENANCE

1.5.1 Additions to Operation and Maintenance Data

In addition to requirements of Data Package 5, include the following on the actual transformer(s) provided:

- a. An instruction manual with pertinent items and information highlighted
- b. An outline drawing, front, top, and side views
- c. Prices for spare parts and supply list
- d. Routine and field acceptance test reports
- e. Fuse curves for primary fuses
- f. Actual nameplate diagram
- g. Date of purchase

1.5.2 Operation and Maintenance Data

Submit operation and maintenance data in accordance with Section 01 78 23, "Operation and Maintenance Data" and as specified herein.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

Products and materials not considered to be pad-mounted transformers and related accessories are specified in Section 33 71 02, "Underground Transmission and Distribution", and Section 26 20 00, "Interior Distribution System".

2.2 THREE-PHASE PAD-MOUNTED TRANSFORMERS

IEEE C57.12.28, NEMA C57.12.29 and as specified herein.

2.2.1 Compartments

The high- and low-voltage compartments shall be separated by steel isolating barriers extending the full height and depth of the compartments. Compartment doors: hinged lift-off type with stop in open position and three-point latching.

2.2.1.1 High Voltage, Dead-Front

High-voltage compartment shall contain the incoming line, insulated high-voltage load-break connectors, bushing well inserts, feed-thru inserts, six high-voltage bushing wells configured for loop feed application, access to oil-immersed fuses, dead-front surge arresters, tap changer handle, connector parking stands with insulated standoff bushings, protective caps, and ground pad.

- a. Insulated high-voltage load-break connectors: IEEE Std 386, rated 15 kV, 95 kV BIL. Current rating: 200 amperes rms continuous. Short time rating: 10,000 amperes rms symmetrical for a time duration of 0.17 seconds. Connector shall have a steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material.
- b. Bushing well inserts and feed-thru inserts: IEEE Std 386, 200 amperes, 15 kV Class. Provide a bushing well insert for each bushing well unless indicated otherwise. Provide feed-thru inserts as indicated.
- c. Provide bayonet type, oil-immersed, expulsion fuses in series with oil-immersed, partial-range, current-limiting fuses. Bayonet fuse links shall sense both high currents and high oil temperature in order to provide thermal protection to the transformer. Coordinate transformer protection with expulsion fuse clearing low-current faults and current-limiting fuse clearing high-current faults beyond the interrupting rating of the expulsion fuse. In order to eliminate or minimize oil spills, the bayonet fuse assembly shall include an oil retention valve inside the housing which closes when the fuse holder is removed and an external drip shield. Warning shall be conspicuously displayed within the high-voltage compartment cautioning against removing or inserting fuses unless the load-break switch is in the open position and the tank pressure has been released.

Bayonet fuse assembly: 150 kV BIL.

Oil-immersed current-limiting fuses: NEMA C37.47; 50,000 rms amperes symmetrical interrupting rating at the system voltage specified.

- d. Surge arresters: IEEE C62.11, rated 10 kV, fully shielded, dead-front, metal-oxide-varistor, elbow type with resistance-graded gap, suitable for plugging into inserts. Provide six arresters for loop feed circuits.
- e. Parking stands: Provide a parking stand near each bushing well. Provide insulated standoff bushings for parking of energized load-break connectors on parking stands.
- f. Protective caps: IEEE Std 386, 200 amperes, 15 kV Class. Provide insulated protective caps (not shipping caps) for insulating and sealing out moisture from unused bushing well inserts and insulated standoff bushings.

2.2.1.2 Low Voltage

Low-voltage compartment shall contain low-voltage bushings with NEMA spade terminals, accessories, metering, stainless steel or laser-etched anodized aluminum diagrammatic transformer nameplate, and ground pad.

- a. Accessories shall include drain valve with sampler device, fill plug, pressure relief device, liquid level gage, pressure-vacuum gage, and dial type thermometer with maximum temperature indicator.

2.2.2 Transformer

- a. Less-flammable liquid-insulated, two winding, 60 hertz, 65 degrees C rise above a 30 degrees C average ambient, self-cooled type.

- b. Transformer shall be rated as indicated on the drawings and 95 kV BIL.
- c. Transformer voltage ratings: 12,470Y/7200 V - 208/120V.
- d. Tap changer shall be externally operated, manual type for changing tap setting when the transformer is de-energized. Provide four 2.5 percent full capacity taps, two above and two below rated primary voltage. Tap changers shall clearly indicate which tap setting is in use.
- e. Minimum tested impedance shall not be less than 5 percent at 85 degrees C.
- f. Audible sound levels shall comply with the following:

<u>kVA</u>	<u>DECIBELS (MAX)</u>
75	51
112.5	55
150	55
225	55
300	55
500	56
750	57
1000	58
1500	60

- g. Transformer shall include lifting lugs and provisions for jacking under base. The transformer base construction shall be suitable for using rollers or skidding in any direction. Provide transformer top with an access handhole. Transformer shall have its kVA rating conspicuously displayed on its enclosure. The transformer shall have an insulated low-voltage neutral bushing with NEMA spade terminal, and with removable ground strap.

2.2.2.1 Specified Transformer Losses

Provide transformer efficiency calculations utilizing the actual no-load and load loss values obtained during the routine tests performed on the actual transformer(s) prepared for this project. No-load losses (NLL) shall be referenced at 20 degrees C. Load losses (LL) shall be referenced at 55 degrees C and at 50 percent of the nameplate load. The transformer is not acceptable if the calculated transformer efficiency is less than the efficiency indicated in the "KVA / Efficiency" table below. That table is based on requirements contained within 10 CFR 431, Subpart K.

<u>kVA</u>	<u>EFFICIENCY (percent)</u>
75	2.45
225	2.52

2.2.3 Insulating Liquid

- a. Less-flammable transformer liquids: NFPA 70 and FM P7825 for less-flammable liquids having a fire point not less than 300 degrees C tested per ASTM D 92 and a dielectric strength not less than 33 kV tested per ASTM D 877. Provide identification of transformer as "non-PCB" and "manufacturer's name and type of fluid" on the nameplate.

The fluid shall be a biodegradable electrical insulating and cooling liquid classified by UL and approved by FM as "less flammable" fluids. The fluid shall meet the following fluid properties:

1. Pour point: ASTM D 97, less than -15 degree C
2. Aquatic biodegradation: EPA 712-C-98-075, 100%
3. Trout toxicity: OECD Test 203, zero mortality of EPA 600/4-90/027F, pass

2.2.3.1 Liquid-Filled Transformer Nameplates

Power transformers shall be provided with nameplate information in accordance with IEEE C57.12.00 and as modified or supplemented by this section.

2.2.4 Corrosion Protection

Bases and cabinets of transformers shall be corrosion resistant and shall be fabricated of stainless steel conforming to ASTM A 167, Type 304 or 304L. Base shall include any part of pad-mounted transformer that is within 3 inches of concrete pad. Paint bases, cabinets, and tanks Munsell 7GY3.29/1.5 green. Paint coating system shall comply with IEEE C57.12.28 regardless of base, cabinet, and tank material. The Munsell color notation is specified in ASTM D 1535.

2.3 GROUNDING AND BONDING

UL 467. Provide grounding and bonding as specified in Section 33 71 02, "Underground Transmission and Distribution."

2.4 CAST-IN-PLACE CONCRETE

Shall be composed of fine aggregate, coarse aggregate, portland cement, and water so proportioned and mixed as to produce a plastic, workable mixture. Fine aggregate shall be of hard, dense, durable, clean, and uncoated sand. The coarse aggregate shall be reasonably well graded from 3/16 inch to 1 inch. The fine and coarse aggregates shall be free from injurious amounts of dirt, vegetable matter, soft fragments or other deleterious substances. Water shall be fresh, clean, and free from salts, alkali, organic matter, and other impurities. Concrete associated with electrical work for other than encasement of underground ducts shall be 4000 psi minimum 28-day compressive strength unless specified otherwise. Slump shall not exceed 4 inches. Retempering of concrete will not be permitted. Exposed, unformed concrete surfaces shall be given a smooth, wood float finish. Concrete shall be cured for a period of not less than 7 days, and concrete made with high early strength portland cement shall be repaired by patching honeycombed or otherwise defective areas with cement mortar as directed by the Contracting Officer. Air entrain concrete exposed to weather using an air-entraining admixture conforming to ASTM C 260. Air content shall be between 4 and 6 percent.

2.5 SOURCE QUALITY CONTROL

2.5.1 Transformer Test Schedule

The Government reserves the right to witness tests. Provide transformer

test schedule for tests to be performed at the manufacturer's test facility. Submit required test schedule and location, and notify the Contracting Officer 30 calendar days before scheduled test date. Notify Contracting Officer 15 calendar days in advance of changes to scheduled date.

a. Test Instrument Calibration

1. The manufacturer shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.
2. The accuracy shall be directly traceable to the National Institute of Standards and Technology.
3. Instrument calibration frequency schedule shall not exceed 12 months for both test floor instruments and leased specialty equipment.
4. Dated calibration labels shall be visible on all test equipment.
5. Calibrating standard shall be of higher accuracy than that of the instrument tested.
6. Keep up-to-date records that indicate dates and test results of instruments calibrated or tested. For instruments calibrated by the manufacturer on a routine basis, in lieu of third party calibration, include the following:
 - (a) Maintain up-to-date instrument calibration instructions and procedures for each test instrument.
 - (b) Identify the third party/laboratory calibrated instrument to verify that calibrating standard is met.

2.5.2 Design Tests

IEEE C57.12.00, and IEEE C57.12.90. Section 5.1.2 in IEEE C57.12.80 states that "design tests are made only on representative apparatus of basically the same design." Submit design test reports (complete with test data, explanations, formulas, and results), in the same submittal package as the catalog data and drawings for the specified transformer(s). Design tests shall have been performed prior to the award of this contract.

- a. Tests shall be certified and signed by a registered professional engineer.
- b. Temperature rise: "Basically the same design" for the temperature rise test means a pad-mounted transformer with the same coil construction (such as wire wound primary and sheet wound secondary), the same kVA, the same cooling type (ONAN), the same temperature rise rating, and the same insulating liquid as the transformer specified.
- c. Lightning impulse: "Basically the same design" for the lightning impulse dielectric test means a pad-mounted transformer with the same BIL, the same coil construction (such as wire wound primary and sheet wound secondary), and a tap changer, if specified. Design lightning impulse tests shall include both the primary and secondary windings of

that transformer.

1. IEEE C57.12.90, paragraph 10.3 entitled "Lightning Impulse Test Procedures," and IEEE C57.98.
 2. State test voltage levels.
 3. Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test report.
- d. Lifting and moving devices: "Basically the same design" requirement for the lifting and moving devices test means a test report confirming that the lifting device being used is capable of handling the weight of the specified transformer in accordance with NEMA C57.12.26.
- e. Pressure: "Basically the same design" for the pressure test means a pad-mounted transformer with a tank volume within 30 percent of the tank volume of the transformer specified.

2.5.3 Routine and Other Tests

IEEE C57.12.00. Routine and other tests shall be performed by the manufacturer on the actual transformer(s) prepared for this project to ensure that the design performance is maintained in production. Submit test reports, by serial number and receive approval before delivery of equipment to the project site. Required tests and testing sequence shall be as follows:

- a. Cold resistance measurements (provide reference temperature)
- b. Phase relation
- c. Ratio
- d. No-load losses (NLL) and excitation current
- e. Load losses (LL) and impedance voltage
- f. Dielectric
 1. Impulse
 - (a) State test voltage levels
 - (b) Provide photographs of oscilloscope display waveforms or plots of digitized waveforms with test reports. As an alternative, photographs of oscilloscope display waveforms or plots of digitized waveforms may be hand-delivered at the factory witness test.
 - (c) The Officer in Charge (OIC) will select the transformers to be tested.
 2. Applied voltage
 3. Induced voltage
- g. Leak

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.2 GROUNDING

NFPA 70 and IEEE C2, except that grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms.

3.2.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02, "Underground Transmission and Distribution". Connect ground conductors to the upper end of ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.2.2 Pad-Mounted Transformer Grounding

Provide separate copper grounding conductors and connect them to the ground loop as indicated. When work in addition to that indicated or specified is required to obtain the specified ground resistance, the provision of the contract covering "Changes" shall apply.

3.2.3 Connections

Make joints in grounding conductors and loops by exothermic weld or compression connector. Exothermic welds and compression connectors shall be installed as specified in Section 33 71 02, "Underground Transmission and Distribution."

3.2.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.3 INSTALLATION OF EQUIPMENT AND ASSEMBLIES

Install and connect pad-mounted transformers furnished under this section as indicated on project drawings, the approved shop drawings, and as specified herein.

3.4 FOUNDATION FOR EQUIPMENT AND ASSEMBLIES

Mount transformer on prefabricated concrete support as indicated on drawings. Slab shall be placed on a 6 inch thick, well-compacted gravel base. Top of concrete support shall be approximately 12 inches above finished grade with gradual slope for drainage.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete support. Coordinate dimensions of cable wells with transformer cable training areas.

3.4.1 Cast-In-Place Concrete

Cast-in-place concrete work shall conform to the requirements of ACI 318.

3.4.2 Sealing

When the installation is complete, the Contractor shall seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals shall be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.5 FIELD QUALITY CONTROL

3.5.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.5.1.1 Pad-Mounted Transformers

a. Visual and mechanical inspection

1. Compare equipment nameplate information with specifications and approved shop drawings.
2. Inspect physical and mechanical condition. Check for damaged or cracked insulators and leaks.
3. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.
4. Verify correct liquid level in tanks.
5. Perform specific inspections and mechanical tests as recommended by manufacturer.
6. Verify correct equipment grounding.
7. Verify the presence of transformer surge arresters.

b. Electrical tests

1. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.
2. Perform insulation-resistance tests.
3. Perform turns-ratio tests.
4. Perform insulation power-factor/dissipation-factor tests on windings.
5. Sample insulating liquid. Sample shall be tested for:
 - (a) Dielectric breakdown voltage
 - (b) Acid neutralization number
 - (c) Specific gravity

- (d) Interfacial tension
 - (e) Color
 - (f) Visual condition
 - (g) Water in insulating liquid
 - (h) Measure dissipation factor or power factor
6. Perform dissolved gas analysis (DGA).
 7. Test for presence of PCB.
 8. Verify that the tap-changer is set at specified ratio.
 9. Verify proper secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

3.5.1.2 Current Transformers

a. Visual and mechanical inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.
2. Inspect physical and mechanical condition.
3. Verify correct connection.
4. Verify that adequate clearances exist between primary and secondary circuit.
5. Inspect all bolted electrical connections for high resistance using low-resistance ohmmeter, verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey.
6. Verify that required grounding and shorting connections provide good contact.

b. Electrical tests

1. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.
2. Perform insulation-resistance test.
3. Perform a polarity test.
4. Perform a ratio-verification test.

3.5.1.3 Watthour Meter

a. Visual and mechanical inspection

1. Compare equipment nameplate data with specifications and approved shop drawings.

2. Inspect physical and mechanical condition.
3. Verify tightness of electrical connections.

b. Electrical tests

1. Calibrate watthour meters according to manufacturer's published data.
2. Verify that correct multiplier has been placed on face of meter, where applicable.
3. Verify that current transformer secondary circuits are intact.

3.5.1.4 Grounding System

a. Visual and mechanical inspection

1. Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

1. Perform ground-impedance measurements utilizing the fall-of-potential method. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground testing megger in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.
2. Submit the measured ground resistance of each ground rod and grounding system, indicating the location of the rod and grounding system. Include the test method and test setup (i.e., pin location) used to determine ground resistance and soil conditions at the time the measurements were made.

3.5.2 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

-- End of Section --

SECTION 26 20 00
INTERIOR DISTRIBUTION SYSTEM

01/07

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2011; R 2017) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C80.1	(1994) Rigid Steel Conduit - Zinc Coated
NEMA C80.3	(1994) Electrical Metallic Tubing - Zinc Coated (EMT)
NEMA FU 1	(2002) Low Voltage Cartridge Fuses
NEMA ICS 1	(2000; R 2015) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2000) Industrial Automation Control Products and Systems Section Terminal Blocks
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA KS 1	(2001) Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
NEMA TC 14	(2002) Filament-Wound Reinforced Thermosetting Resin Conduit (RTRC) and Fittings
NEMA TC 2	(1998) Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

NEMA TC 3	(1999) PVC Fittings for Use with Rigid PVC Conduit and Tubing
NEMA WD 1	(1999) General Color Requirements for Wiring Devices
NEMA WD 6	(2002) Wiring Devices - Dimensional Specifications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
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UNDERWRITERS LABORATORIES (UL)

UL 1	(2000) Flexible Metal Conduit
UL 1242	(2006; Reprint Mar 2014) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 1449	(2014; Reprint Jul 2017) UL Standard for Safety Surge Protective Devices
UL 1660	(2000; R 2002, Bul. 2002) Liquid-Tight Flexible Nonmetallic Conduit
UL 198C	(1986; R 1998) High-Interrupting-Capacity Fuses, Current-Limiting Types
UL 198E	(1988; R 1988) Class R Fuses
UL 198H	(1988; R 1993) Class T Fuses
UL 20	(2000; R 2002, Bul. 2002) General-Use Snap Switches
UL 360	(1996; R 2001, Bul. 2002) Liquid-Tight Flexible Steel Conduit
UL 44	(2018) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 467	(2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment
UL 486A	(1997; R 2001, Bul. 2002, 2003) Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 486B	(1997; R 2001, Bul. 2002, 2003) Wire Connectors for Use with Aluminum Conductors
UL 486C	(2000; R 2002) Splicing Wire Connectors
UL 489	(2016) UL Standard for Safety Molded-Case

	Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 498	(2001; R 2002) Attachment Plugs and Receptacles
UL 5	(1996; R 2001) Surface Metal Raceways and Fittings
UL 50	(2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 508	(1999; R 2002, Bul. 2003) Industrial Control Equipment
UL 510	(2017) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2013; Reprint Aug 2017) UL Standard for Safety Metallic Outlet Boxes
UL 514B	(2012; Reprint Nov 2014) Conduit, Tubing and Cable Fittings
UL 514C	(2014; Reprint Nov 2018) UL Standard for Safety Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 6	(2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel
UL 651	(2011; Reprint Nov 2018) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 67	(1993; R 2002) Panelboards
UL 797	(2000; Bul. 2002) Electrical Metallic Tubing
UL 83	(2017) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 869A	(1998; Bul. 2002) Reference Standard for Service Equipment
UL 886	(1994; R 1999, Bul. 2002) Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
UL 943	(1993; R 2002, Bul. 2002) Ground-Fault Circuit-Interrupters

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;
submittals not having a "G" designation are for Contractor Quality Control

approval. The following shall be submitted in accordance with Section
01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panelboards; G

SD-03 Product Data

Receptacles; G

Circuit breakers; G

Switches; G

Motor controllers; G

Manual motor starters

Surge protective devices; G

SD-06 Test Reports

600-volt wiring test

Grounding system test

Ground-fault receptacle test

SD-07 Certificates

Fuses

SD-10 Operation and Maintenance Data

Electrical Systems, Data Package 5; G

Submit operation and maintenance data in accordance with Section
01 78 00, "Closeout Submittals" and as specified herein.

1.3 QUALITY ASSURANCE

1.3.1 Fuses

Submit coordination data as specified in article entitled, "FUSES" of this section.

1.4 MAINTENANCE

1.4.1 Electrical Systems

Submit operation and maintenance manuals for electrical systems that provide basic data relating to the design, operation, and maintenance of the electrical distribution system for the building. This shall include:

- a. Single line diagram of the "as-built" building electrical system.
- b. Schematic diagram of electrical control system (other than HVAC, covered elsewhere).

- c. Manufacturers' operating and maintenance manuals on active electrical equipment.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

2.2 CONDUIT AND FITTINGS

Shall conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

NEMA C80.1, UL 6.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, and EPC-80 in accordance with NEMA TC 2, UL 651 in accordance with NEMA TC 14.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, NEMA C80.3.

2.2.5 Flexible Metal Conduit

UL 1.

2.2.5.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.6 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

2.2.6.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.6.2 Fittings for EMT

Steel compression type.

2.2.6.3 Fittings for Use in Hazardous (Classified) Locations

UL 886.

2.2.7 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3, UL 514B.

2.2.8 Liquid-Tight Flexible Nonmetallic Conduit

UL 1660.

2.3 SURFACE RACEWAY

2.3.1 Surface Metal Raceway

UL 5, two-piece painted steel, totally enclosed, snap-cover type. Surface Metal Raceway shall be screwed or bolted to the wall, stick on type is not allowed.

2.4 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

2.4.1 Outlet Boxes in Hazardous (Classified) Locations

UL 886.

2.5 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

2.6 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

2.6.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and ampacities shown are based on copper, unless indicated otherwise. All conductors shall be copper.

2.6.1.1 Equipment Manufacturer Requirements

When manufacturer's equipment requires copper conductors at the terminations or requires copper conductors to be provided between components of equipment, provide copper conductors or splices, splice boxes, and other work required to satisfy manufacturer's requirements.

2.6.1.2 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3

low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

2.6.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutral shall be white with colored (not green) stripe. Color of ungrounded conductors in different voltage systems shall be as follows:

a. 208/120 volt, three-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

2.6.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN conforming to UL 83 or Type XHHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.6.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.7 SPLICES AND TERMINATION COMPONENTS

UL 486A and UL 486B, as applicable, for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.8 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. For metal outlet boxes, plates on unfinished walls shall be of zinc-coated sheet steel or cast metal having round or beveled edges. Plates on finished walls shall be satin finish stainless steel or brushed-finish aluminum, minimum 0.03 inch thick. Screws shall be machine-type with countersunk heads in color to match finish of plate. Sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

2.9 SWITCHES

2.9.1 Toggle Switches

NEMA WD 1, UL 20, single pole, double pole, three-way, and four-way,

totally enclosed with bodies of thermoplastic and/or thermoset plastic and mounting strap with grounding screw. Handles shall be Grey thermoplastic. Wiring terminals shall be screw-type, side-wired. Contacts shall be silver-cadmium and contact arm shall be one-piece copper alloy. Switches shall be rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.

2.9.2 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Fused switches shall utilize Class R fuseholders and fuses, unless indicated otherwise. Switches serving as motor-disconnect means shall be horsepower rated. Provide switches in NEMA 4X or 3R stainless (all exterior switches shall be 4X or 3R Stainless) and NEMA 1 enclosure as indicated on drawings per NEMA ICS 6.

2.10 RECEPTACLES

UL 498, hard use, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of Grey as per NEMA WD 1. Face and body shall be thermoplastic supported on a metal mounting strap. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap. The receptacle shall contain triple-wire power contacts and double or triple-wire ground contacts.

2.10.1 Weatherproof Receptacles

Provide in cast metal box with gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. Provide caps with a spring-hinged flap. Receptacle shall be UL listed for use in "wet locations with plug in use."

2.10.2 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFI devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.10.3 Dryer Receptacles

NEMA 14-30 configuration, rated 30 amperes, 125/250 volts. Furnish one matching plug with each receptacle.

2.11 Panelboards

UL 67 and UL 50 having a short-circuit current rating as indicated. Panelboards for use as service disconnecting means shall additionally conform to UL 869A. Panelboards shall be circuit breaker-equipped. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the drawings. Use of "Subfeed Breakers" is not acceptable unless specifically indicated otherwise. Where "space only" is indicated, make provisions for future installation of breakers. Panelboard locks shall be keyed same.

Directories shall indicate load served by each circuit in panelboard. Directories shall also indicate source of service to panelboard (e.g., Panel PA served from Panel MDP). Type directories and mount in holder behind transparent protective covering. Panelboards shall be listed and labeled for their intended use.

2.11.1 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Main buses and back pans shall be designed so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet.

2.11.2 Circuit Breakers

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker shall be mounted. Breaker terminals shall be UL listed as suitable for type of conductor provided. Series rated circuit breakers and plug-in circuit breakers are unacceptable.

2.11.2.1 Multipole Breakers

Provide common trip-type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.11.2.2 Circuit Breaker With GFCI

UL 943 and NFPA 70. Provide with "push-to-test" button, visible indication of tripped condition, and ability to detect and trip on current imbalance of 6 milliamperes or greater per requirements of UL 943 for Class A GFI devices, for personnel protection.

2.11.2.3 Circuit Breakers for HVAC Equipment

Circuit breakers for HVAC equipment having motors (group or individual) shall be marked for use with HACR type and UL listed as HACR type.

2.12 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch. Time-current characteristics curves of fuses serving motors or connected in series with circuit breakers or other circuit protective devices shall be coordinated for proper operation. Submit coordination data for approval. Fuses shall have voltage rating not less than circuit voltage.

2.12.1 Cartridge Fuses, Current Limiting Type (Class R)

UL 198E, Class RK-1 and RK-5 time-delay type. Associated fuseholders shall be Class R only.

2.12.2 Cartridge Fuses, Current Limiting Type (Classes J, L, and CC)

UL 198C, Class J for zero to 600 amperes, Class L for 601 to 6,000 amperes, and Class CC for zero to 30 amperes.

2.12.3 Cartridge Fuses, Current Limiting Type (Class T)

UL 198H, Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

2.13 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2, . Controllers shall have thermal overload protection in each phase and shall have one spare normally open and one spare normally closed auxiliary contact. Magnetic-type motor controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with pressure, float, or similar automatic-type or maintained-contact switch, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in motor control circuit in "hand" and "automatic" positions. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. For each motor not in sight of controller or where controller disconnecting means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position. Provide controllers in hazardous locations with classifications as indicated.

2.13.1 Enclosures for Motor Controllers

NEMA ICS 6.

2.13.2 Pushbutton Stations

Provide with "start/stop" momentary contacts having one normally open and one normally closed set of contacts, and red lights to indicate when motor is running. Stations shall be heavy duty, oil-tight design.

2.13.3 Pilot and Indicating Lights

Provide LED cluster lamps.

2.13.4 Terminal Blocks

NEMA ICS 4.

2.14 MANUAL MOTOR STARTERS (MOTOR RATED SWITCHES)

Single, Double and Three pole designed for surface mounting with overload protection .

2.15 TELEPHONE SYSTEM

Provide system of telephone wire-supporting structures, including: conduits with pull wires surface mounted raceway, terminal boxes, outlet and junction boxes and other accessories for telephone outlets. Additional requirements are in Section 27 10 00, "Structured Telecommunications Cabling and Pathway System."

2.15.1 Outlet Boxes for Telephone System

Standard type, as specified herein. Mount flush in finished walls at height specified for outlet receptacles. Outlet boxes for wall-mounted telephones shall be 5 inch square by 2 7/8 in deep; mounted at height as indicated.

2.15.2 Cover Plates

Modular telephone type with same finish specified for receptacle and switch cover plates.

2.15.3 Conduit Sizing

Conduit for single outlets shall be minimum of 1 1/4 in and for multiple outlets minimum sized per TIA-569. Size conduits for telephone risers to telephone cabinets, junction boxes, distribution centers, and telephone service, as indicated.

2.15.4 Backboards

Interior grade plywood, 3/4 in thick, 4 by 8 ft minimum. Plywood shall be fire rated.

2.15.5 Terminal Cabinets

Construct of zinc-coated sheet steel. Cabinets shall be constructed with interior dimensions not less than those indicated. Trim shall be fitted with hinged door and flush catch. Doors shall provide maximum-size openings to the box interiors. Boxes shall be provided with 5/8 in backboard having a two-coat insulating varnish finish. Match trim, hardware, doors, and finishes to lighting panelboards.

2.16 GROUNDING AND BONDING EQUIPMENT

UL 467. Ground rods shall be copper-clad steel, with minimum diameter of 3/4 in and minimum length of 10 ft.

2.17 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations in accordance with PART 4 of the RFP.

2.18 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices which comply with UL 1449 at the service entrance panelboard. Provide surge protectors in a NEMA 1 enclosure per NEMA ICS 6. Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-
Each phase to neutral (L-N)

Neutral to ground (N-G)
Phase to ground (L-G)

Surge protective devices at the service entrance shall have a minimum surge current rating of 80,000 amperes per mode minimum . The maximum line to neutral (L-N) Suppressed Voltage Rating (SRV) shall be:

500V for 208Y/120V, three phase system
900V for 480Y/277V, three phase system

The minimum MCOV (Maximum Continuous Operating Voltage) rating shall be:

300/150V for 208Y/120V, three phase system
600/320V for 480Y/277V, three phase system

EMI/RFI filtering shall be provided for each mode with the capability to attenuate high frequency noise. Minimum attenuation shall be 20db.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to requirements of NFPA 70 and to requirements specified herein.

3.1.1 Underground Service

Underground service conductors and associated conduit shall be continuous from service entrance equipment to outdoor power system connection.

3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures shall be labeled and identified as such.

3.1.2.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, each enclosure, new and existing, shall be labeled as one of several enclosures containing service entrance disconnect devices. Label, at minimum, shall indicate number of service disconnect devices housed by enclosure and shall indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph entitled "Nameplates." Use lettering of at least 0.25 in in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure, shall be provided only as permitted by NFPA 70.

3.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, or rigid nonmetallic conduit, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size shall be 1/2 in in diameter for low voltage lighting and power circuits.

3.1.3.1 Restrictions Applicable to EMT

- a. Do not install underground.
- b. Do not encase in concrete, mortar, grout, or other cementitious materials.
- c. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.
- d. Do not use in hazardous areas.
- e. Do not use outdoors.
- f. Do not use in fire pump rooms.

3.1.3.2 Restrictions Applicable to Nonmetallic Conduit

- a. PVC Schedule 40 and PVC Schedule 80
 - (1) Do not use in areas where subject to severe physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, hospitals, power plants, missile magazines, and other such areas.
 - (2) Do not use in hazardous (classified) areas.
 - (3) Do not use in fire pump rooms.
 - (4) Do not use in penetrating fire-rated walls or partitions, or fire-rated floors.
 - (5) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

3.1.3.3 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph entitled "Flexible Connections."

3.1.3.4 Service Entrance Conduit, Underground

PVC, Type-EPC 40, galvanized rigid steel or steel IMC. Underground portion shall be encased in minimum of 3 in of concrete and shall be installed minimum 18 in below slab or grade.

3.1.3.5 Underground Conduit Other Than Service Entrance

Plastic-coated rigid steel; PVC, Type EPC-40.

3.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 in away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

3.1.4.1 Conduit Installed Under Floor Slabs

Conduit run under floor slab shall be located a minimum of 12 in below the vapor barrier. Seal around conduits at penetrations thru vapor barrier.

3.1.4.2 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

3.1.4.3 Conduit Support

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1 1/2 in in reinforced concrete beams or to depth of more than 3/4 in in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 in inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.4.4 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.4.5 Pull Wire

Install pull wires in empty conduits. Pull wire shall be plastic having minimum 200-lb tensile strength. Leave minimum 36 in of slack at each end of pull wire.

3.1.4.6 Telephone and Signal System Conduits

Refer to Section 27 10 00, "Structured Telecommunications Cabling and Pathway System."

3.1.4.7 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.4.8 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 in above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.4.9 Flexible Connections

Provide flexible steel conduit between 3 and 6 ft in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 1/2 in diameter. Provide liquidtight flexible nonmetallic conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.

3.1.5 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when surface mounted on interior walls exposed up to 7 ft above floors and walkways, or when installed in hazardous areas and when specifically indicated. Boxes in other locations shall be sheet steel, except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system. Each box shall have volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures shall be minimum 4 in square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; fixtures shall be readily removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type

fastener maximum 24 in from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.5.1 Boxes

Boxes for use with raceway systems shall be minimum 1 1/2 in deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 in square, except that 4 by 2 in boxes may be used where only one raceway enters outlet. Telephone outlets shall be minimum of 5 inch square by 2 7/8 deep, except for wall mounted telephones.

3.1.5.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, except where cast-metal boxes are required in locations specified herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.6 Mounting Heights

Mount panelboards, enclosed circuit breakers, and disconnecting switches so height of operating handle at its highest position is maximum 78 in above floor. Mount lighting switches and receptacles as indicated. Measure mounting heights of wiring devices and outlets to center of device or outlet.

3.1.7 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with Section 23 09 23.13, "BACnet Direct Digital Control Systems for HVAC".

3.1.8 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.9 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 in. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.10 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated

walls, partitions, floors, or ceilings in accordance with PART 4 of the RFP.

3.1.11 Grounding and Bonding

In accordance with NFPA 70. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telephone system grounds, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods on exterior of building. Interconnect all grounding media in or on the structure to provide a common ground potential. This shall include electrical service, telephone system grounds, as well as underground metallic piping systems. Interconnection to the gas line shall be made on the customer's side of the meter. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.11.1 Resistance

Maximum resistance-to-ground of grounding system shall not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

3.1.11.2 Telephone Service

Provide main telephone service equipment ground consisting of separate ground wire, sized per TIA-607, in conduit between equipment backboard and readily accessible grounding connection. Equipment end of ground wire shall consist of coiled length at least twice as long as terminal cabinet or backboard height.

3.1.12 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.

3.1.13 Repair of Existing Work

Repair of existing work, demolition, and modification of existing electrical distribution systems shall be performed as follows:

3.1.13.1 Workmanship

Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved.

3.1.13.2 Existing Concealed Wiring to be Removed

Existing concealed wiring to be removed shall be disconnected from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.

3.1.13.3 Removal of Existing Electrical Distribution System

Removal of existing electrical distribution system equipment shall include equipment's associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, and fittings, back to equipment's power source as indicated.

3.1.14 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible.

3.2 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test.

3.2.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

3.2.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

3.2.3 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

3.2.4 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

-- End of Section --

SECTION 26 27 14.00 20

ELECTRICITY METERING

02/11

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C37.90.1	(2013) Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
IEEE C57.13	(2008) Standard Requirements for Instrument Transformers
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2017; Errata 2017) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.1	(2008) Electric Meters Code for Electricity Metering
ANSI C12.18	(2006) Protocol Specification for ANSI Type 2 Optical Port
ANSI C12.20	(2010) Electricity Meters - 0.2 and 0.5 Accuracy Classes
ANSI C12.7	(2005) Requirements for Watthour Meter Sockets
NEMA C12.19	(2008) Utility Industry End Device Data Tables

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
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1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Stds Dictionary.

1.3 SUBMITTALS

Technical data packages consisting of technical data and computer software (meaning technical data which relates to computer software) which are specifically identified in this project and which may be defined/required in other specifications shall be delivered strictly in accordance with the CONTRACT CLAUSES and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. All submittals not specified as technical data packages are considered 'shop drawings' under the Federal Acquisition Regulation Supplement (FARS) and shall contain no proprietary information and be delivered with unrestricted rights.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Electricity meters

The most recent meter product data shall be submitted as a Technical Data Package and shall be licensed to the project site. Any software shall be submitted on CD-ROM and 5 hard copies of the software user manual shall be submitted for each piece of software provided.

Current transformer

Potential transformer

External communications devices

Configuration Software

The most recent version of the configuration software for each type (manufacturer and model) shall be submitted as a Technical Data Package and shall be licensed to the project site. Software shall be submitted on CD-ROM and 5 hard copies of the software user manual shall be submitted for each piece of software provided.

SD-06 Test Reports

Acceptance checks and tests

System functional verification

Building meter installation sheet, per building

Completed meter installation schedule

Completed meter data schedule

Meter configuration template

Contractor shall fill in the meter configuration template and submit to the Activity for concurrence.

Meter configuration report

The meter configuration report shall be submitted as a Technical Data Package.

SD-10 Operation and Maintenance Data

Electricity Meters and Accessories, Data Package 5

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein.

SD-11 Closeout Submittals

System functional verification

1.4 QUALITY ASSURANCE

1.4.1 Installation Drawings

Drawings shall be provided in hard-copy and electronic format, and shall include but not be limited to the following:

- a. Wiring diagrams with terminals identified of advanced meter, current transformers, potential transformers, protocol modules, communications interfaces, Ethernet connections, . For each typical meter installation, provide a diagram.
- b. One-line diagram, including meters, switch(es), current transformers, potential transformers, protocol modules, communications interfaces, Ethernet connections, telephone outlets, and fuses. For each typical meter installation, provide a diagram.

1.4.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 1 year prior to bid opening. The 1-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product, or an earlier release of the product, shall have been on sale on the commercial market through advertisements, manufacturers catalogs, or brochures during the prior 1-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3 Material and Equipment Manufacturing Data

Products manufactured more than 1 year prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 MAINTENANCE

1.5.1 Additions to Operation and Maintenance Data

In addition to requirements of Data Package 5, include the following on the actual electricity meters and accessories provided:

- a. A condensed description of how the system operates
- b. Block diagram indicating major assemblies
- c. Troubleshooting information
- d. Preventive maintenance
- e. Prices for spare parts and supply list

1.6 WARRANTY

The equipment items and software shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment and software on a regular and emergency basis during the warranty period of the contract.

1.7 SYSTEM DESCRIPTION

1.7.1 System Requirements

Electricity metering, consisting of meters and associated equipment, will be used to record the electricity consumption and other values as described in the requirements that follow and as shown on the drawings. Communication system requirements are contained in a separate specification section as identified in paragraph entitled "Communications Interfaces".

1.7.2 Selection Criteria

Metering components and software are part of a system that includes the physical meter, data recorder function and communications method. Every building site identified shall include sufficient metering components to measure the electrical parameters identified and to store and communicate the values as required.

Contractor shall verify that the electricity meter installed on any building site is compatible with the base-wide metering system with respect to the types of meters selected and the method used to program the meters for initial use. Software and meter programming tools are necessary to set up the meters described by this specification. New software tools different from the meter programming methods currently used by base personnel will require separate approval for use.

The Base Wide Metering System is "ITRON_CENTRON" metering.

PART 2 PRODUCTS

2.1 ELECTRICITY METERS AND ACCESSORIES

Provide meter(s) and connect the meter(s) to the existing AMI DAS. The contractor shall use the existing government laptop computers to configure the meter using existing software loaded on the computer. The contractor will not be allowed to modify any software or add any additional software to the computer. Alternatively, the government will configure the meter(s), which must be compatible with the existing system, using existing software. Contract shall insure that the meter(s) will transmit the specified data to the DAS. The current meters being used by Camp Lejeune are: ITRON_CENTRON.

2.1.1 Physical and Common Requirements

- a. Provide metering system components in accordance with the Metering System Schedule shown in this specification. Provide Meter configuration template.
- b. Meter shall have NEMA 3R enclosure for surface mounting with bottom or rear penetrations.
- c. Surge withstand capability shall conform to IEEE C37.90.1.
- d. Use #12 SIS (XHHW, or equivalent) wiring with ring lugs for all meter connections. Color code and mark the conductors as follows:
 - (1) Red - Phase A CT - C1
 - (2) Orange - Phase B CT - C2
 - (3) Brown - Phase C CT - C3
 - (4) Gray with white stripe - neutral current return - C0
 - (5) Black - Phase A voltage - V1
 - (6) Yellow - Phase B voltage - V2
 - (7) Blue - Phase C voltage - V3
 - (8) White - Neutral voltage

2.1.2 Potential Transformer Requirements

- a. Meter shall be capable of connection to the service voltage phases and magnitude being monitored. If the meter is not rated for the service voltage, provide suitable potential transformers to send an acceptable voltage to the meter.
- b. Voltage input shall be optically isolated to 2500 volts DC from signal and communications outputs. Components shall meet or exceed IEEE C37.90.1.
- c. Provide one fuse per phase, Class RK type, to protect the voltage input to the meter. Size fuses as recommended by the meter manufacturer. Fusing shall either be inside the secondary compartment of the transformer or inside the same enclosure as the CT shorting device.

2.1.3 Current Transformer Requirements

- a. Current transformer shall be installed with a rating as shown in the schedule.

- b. Current transformers shall have an Accuracy Class of 0.3 (with a maximum error of plus/minus 0.3 percent at 5.0 amperes) when operating within the specified rating factor.
- c. Current transformers shall be solid-core, bracket-mounted for new installations using ring-tongue lugs for electrical connections. Current transformers shall be accessible and the associated wiring shall be installed in an organized and neat workmanship arrangement. Current transformers that are retrofitted onto existing switchgear busbar can be a busbar split-core design.
- d. Current transformers shall have:
 - (1) Insulation Class: All 600 volt and below current transformers shall be rated 10 KV BIL.
 - (2) Frequency: Nominal 60 Hz.
 - (3) Burden: Burden class shall be selected for the load.
 - (4) Phase Angle Range: 0 to 60 degrees.
- e. Meter shall accept current input from standard instrument transformers (5A secondary current transformers).
- f. Current inputs shall have a continuous rating in accordance with IEEE C57.13.
- g. Provide one single-ratio current transformer for each phase per power transformer with characteristics listed in the following table.

Single-Ratio Current Transformer Characteristics

kVA	Sec. Volt	CT Ratio	RF	Meter Acc. Class
75	208Y/120	100/5	2.0	0.3 thru B0.1
225	208Y/120	200/5	2	0.3 thru B0.1

2.1.4 Meter Requirements

Electricity meters shall include the following features:

- a. Meter shall comply with ANSI C12.1, NEMA C12.19, and ANSI C12.20.
- b. Meter sockets shall comply with ANSI C12.7.
- c. Provide socket-mounted meters .
- d. Meter shall be a Class 20, transformer rated design.
- e. Use Class 200 meters for direct current reading without current transformers for applications with an expected load less than 200 amperes, where indicated.
- f. Meter shall be rated for use at temperature from minus 40 degrees Centigrade to plus 85 degrees Centigrade.
- g. The meters shall have an electronic demand recording register and shall be secondary reading as indicated. The register shall be used

to indicate maximum kilowatt demand as well as cumulative or continuously cumulative demand. Demand shall be measured on a block-interval basis and shall be capable of a 5 to 60 minute interval and initially set to a 15-minute interval. It shall have provisions to be programmed to calculate demand on a rolling interval basis. Meter readings shall be true RMS.

- h. The meter electronic register shall be of modular design with non-volatile data storage. Downloading meter stored data shall be capable via an optical port. Recording capability of data storage with a minimum capability of 89 days of 15 minute, 2 channel interval data. The meter shall be capable of providing at least 2 KYZ pulse outputs (dry contacts). Default initial configuration (unless identified otherwise by base personnel) shall be:
 - (1) First channel - kWh
 - (2) Second channel - kVARh
 - (3) KYZ output #1 - kWh
 - (4) KYZ output #2 - kVARh
- i. All meters shall have identical features available in accordance with this specification. The meter schedule identifies which features shall be activated at each meter location.
- j. Enable switches for Time of Use (TOU), pulse and load profile measurement module at the factory.
- k. Meter shall have an optical port on front of meter capable of speeds from 9600 to a minimum of 19.2k baud, and shall be initially set at 9600 baud. Optical device shall be compatible with ANSI C12.18.
- l. Meters shall be 120-480 volts auto ranging.
- m. Provide blank tag fixed to the meter faceplate for the addition of the meter multiplier, which will be the product of the current transformer ratio and will be filled in by base personnel on the job site. The meter's nameplate shall include:
 - (1) Meter ID number.
 - (2) Rated voltage.
 - (3) Current class.
 - (4) Metering form.
 - (5) Test amperes.
 - (6) Frequency.
 - (7) Catalog number.
 - (8) Manufacturing date.
- n. Meter covers shall be polycarbonate resins with an optical port and reset. Backup battery shall be easily accessible for change-out after removing the meter cover.
- o. The normal billing data scroll shall be fully programmable. Data scroll display shall include the following.
 - (1) Number of demand resets.
 - (2) End-of-interval indication.
 - (3) Maximum demand.
 - (4) New maximum demand indication.
 - (5) Cumulative or continuously cumulative.

- (6) Time remaining in interval.
 - (7) Kilowatt hours.
 - p. The register shall incorporate a built-in test mode that allows it to be tested without the loss of any data or parameters. The following quantities shall be available for display in the test mode:
 - (1) Present interval's accumulating demand.
 - (2) Maximum demand.
 - (3) Number of impulses being received by the register.
 - q. Pulse module simple I/O board with programmable ratio selection.
 - r. Meters shall be programmed after installation via an optical port. Optical display shall show TOU data, peak kWh, semi-peak kWh, off peak kWh, and phase angles.
 - s. Self-monitoring to provide for:
 - (1) Unprogrammed register.
 - (2) RAM checksum error.
 - (3) ROM checksum error.
 - (4) Hardware failure.
 - (5) Memory failure.
 - (6) EPROM error.
 - (7) Battery status (fault, condition, or time in service).
 - t. Liquid crystal alphanumeric displays, 9 digits, blinking squares confirm register operation. 6 Large digits for data and smaller digits for display identifier.
 - u. Display operations, programmable sequence with display identifiers. Display identifiers shall be selectable for each item. Continually sequence with time selectable for each item.
 - v. The meters shall support three modes of registers: Normal Mode, Alternate Mode, and Test Mode. The meter also shall support a "Toolbox" or "Service Information" (accessible in the field) through an optocom port to a separate computer using the supplied software to allow access to instantaneous service information such as voltage, current, power factor, load demand, and the phase angle for individual phases.
 - w. Meter shall have a standard 4-year warranty.
- 2.1.5 Disconnect Method
- a. Provide a 10-pole safety disconnect complete with isolation devices for the voltage and current transformer inputs, including a shorting means for the current transformers.
- 2.1.6 Installation Methods
- a. Stand Mounted Adjacent to Transformer ("STAND" in Metering Systems Schedule). Meter base shall be mounted on a structural steel pole approximately 4 feet from the transformer pad. This can be used for multiple meters associated with a single transformers.

2.2 COMMUNICATIONS INTERFACES

Meter shall be fully integrate into an existing Itron fixed network automatic meter reading system leveraging 900 MHz RF technology. Meter shall be equipped with a high powered RF 900 MHz electronic receiver transmitter communication modules. Meter shall provide standard consumption and interval data messages to an Itron fixed network repeater or collection station. Meter RF transmission shall include the unit identification number, unit type, energy usage, tamper status, and CRC check. Meter shall be based on a solid sate metering platform. Meter shall provide an accuracy of 0.3% or better. Meter shall provide a partial load profile including usage, demand, and power factor.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70 (National Electrical Code), and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

3.1.1 Scheduling of Work and Outages

The Contract Clauses shall govern regarding permission for power outages, scheduling of work, coordination with Government personnel, and special working conditions.

3.1.2 Configuration Software

The standard meter shall include the latest available version of firmware and software. Meter shall either be programmed at the factory or shall be programmed in the field. Meters shall have a password that shall be provided to the contracting officer upon project completion. When field programming is performed, turn field programming device over to the Contracting Officer at completion of project. When interfacing software is used for a meter that is different than the existing meters in use at the Activity, turn the software over to the Contracting Officer at completion of the project.

3.2 FIELD QUALITY CONTROL

Perform the following acceptance checks and tests on all installed meters.

3.2.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

a. Meter Assembly

(1) Visual and mechanical inspection.

(a) Compare equipment nameplate data with specifications and approved shop drawings.

(b) Inspect physical and mechanical condition. Confirm the meter is firmly seated in the socket, the socket is not abnormally heated, the display is visible, and the ring and seal on the cover

are intact.

(c) Inspect all electrical connections to ensure they are tight. For Class 200 services, verify tightness of the service conductor terminations for high resistance using low-resistance ohmmeter, or by verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.

(d) Record model number, serial number, firmware revision, software revision, and rated control voltage.

(e) Verify operation of display and indicating devices.

(f) Record password and user log-in for each meter.

(g) Verify grounding of metering enclosure.

(h) Set all required parameters including instrument transformer ratios, system type, frequency, power demand methods/intervals, and communications requirements. Verify that the CT ratio and the PT ratio are properly included in the meter multiplier or the programming of the meter. Confirm that the multiplier is provided on the meter face or on the meter.

(i) Provide building meter installation sheet, per building for each facility. See example Graphic E-S1.

(j) Provide the completed meter installation schedule for the installation. See example Graphic E-S2.

(k) Provide the completed meter data schedule for the installation. See example Graphic E-S3.

(2) Electrical tests.

(a) Apply voltage or current as appropriate to each analog input and verify correct measurement and indication.

(b) Confirm correct operation and setting of each auxiliary input/output feature including mechanical relay, digital, and analog.

(c) After initial system energization, confirm measurements and indications are consistent with loads present.

(d) Make note of, and report, any "Error-Code" or "Caution-Code" on the meter's display.

(3) Provide meter configuration report.

b. Current Transformers

(1) Visual and mechanical inspection.

(a) Compare equipment nameplate data with specification and approved shop drawings.

(b) Inspect physical and mechanical condition.

- (c) Verify correct connection, including polarity.
- (d) Inspect all electrical connections to ensure they are tight.
- (e) Verify that required grounding and shorting connections provide good contact.

(2) Electrical Tests.

Verify proper operation by reviewing the meter configuration report.

3.2.2 System Functional Verification

Verify that the installed meters are working correctly in accordance with the meter configuration report:

- a. The correct meter form is installed.
- b. All voltage phases are present.
- c. Phase rotation is correct.
- d. Phase angles are correct.
- e. The new meter accurately measures power magnitude and direction, and can communicate as required by paragraph entitled "Communications Interfaces".

-- End of Section --

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SECTION 26 41 00

LIGHTNING PROTECTION SYSTEM

11/13

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81 (2012) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

NFPA 780 (2017) Standard for the Installation of Lightning Protection Systems

UNDERWRITERS LABORATORIES (UL)

UL 96 (2016) UL Standard for Safety Lightning Protection Components

UL 467 (2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment

UL Electrical Construction (2012) Electrical Construction Equipment Directory

1.2 RELATED REQUIREMENTS

1.2.1 Verification of Dimensions

Confirm all details of work, verify all dimensions in field, and advise Contracting Officer of any discrepancy before performing work. Obtain prior approval of Contracting Officer before making any departures from the design.

1.2.2 System Requirements

Provide a system furnished under this specification consisting of the latest UL Listed products of a manufacturer regularly engaged in production of lightning protection system components. Comply with NFPA 70, NFPA 780, and UL 96.

1.2.3 Lightning Protection System Installers Documentation

Provide documentation showing that the installer is certified with a

commercial third-party inspection company whose sole work is lightning protection, or is a UL Listed Lightning Protection Installer. In either case, the documentation must show that they have completed and passed the requirements for certification or listing, and have a minimum of 2 years documented experience installing lightning protection systems for DoD projects of similar scope and complexity.

1.3 SUBMITTALS

Government approval is required for submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Overall lightning protection system

Each major component

SD-06 Test Reports

Lightning Protection and Grounding System Test Plan

Lightning Protection and Grounding System Test

SD-07 Certificates

Lightning Protection System Installers Documentation

Component UL Listed and Labeled

Lightning protection system inspection certificate

Roof manufacturer's warranty

1.4 QUALITY ASSURANCE

In each standard referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" or "must" has been substituted for "should" wherever it appears. Interpret references in these standards to "authority having jurisdiction," or words of similar meaning, to mean Contracting Officer.

1.4.1 Installation Drawings

1.4.1.1 Overall System Drawing

Submit installation shop drawing for the overall lightning protection system. Include on the drawings the physical layout of the equipment (plan view and elevations), mounting details, relationship to other parts of the work, and wiring diagrams.

1.4.1.2 Major Components

Submit detail drawings for each major component including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions.

1.4.2 Component UL Listed and Labeled

Submit proof of compliance that components are UL Listed and Labeled. Listing alone in UL Electrical Construction, which is the UL Electrical Construction Directory, is not acceptable evidence. In lieu of Listed and Labeled, submit written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that items have been tested and conform to requirements and testing methods of Underwriters Laboratories.

1.4.3 Lightning Protection and Grounding System Test Plan

Provide a lightning protection and grounding system test plan. Detail both the visual inspection and electrical testing of the system and components in the test plan. Identify (number) the system test points/locations along with a listing or description of the item to be tested and the type of test to be conducted. As a minimum, include a sketch of the facility and surrounding lightning protection system as part of the specific test plan for each structure. Include the requirements specified in paragraph, "Testing of Integral Lightning Protection System" in the test plan.

1.4.4 Lightning Protection System Inspection Certificate

Provide certification from a commercial third-party inspection company whose sole work is lightning protection, stating that the lightning protection system complies with NFPA 780. Third party inspection company cannot be the system installer or the system designer. Alternatively, provide a UL Lightning Protection Inspection Master Label Certificate for each facility indicating compliance to NFPA 780.

Inspection must cover every connection, air terminal, conductor, fastener, accessible grounding point and other components of the lightning protection system to ensure 100% system compliance. This includes witnessing the tests for the resistance measurements for ground rods with test wells, and for continuity measurements for bonds. It also includes verification of proper surge protective devices for power, data and telecommunication systems. Random sampling or partial inspection of a facility is not acceptable.

1.5 SITE CONDITIONS

Confirm all details of work, verify all dimensions in field, and advise Contracting Officer of any discrepancy before performing work. Obtain prior approval of Contracting Officer before changing the design.

PART 2 PRODUCTS

2.1 MATERIALS

Do not use a combination of materials that forms an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, provide conductors with protective coatings, such as tin or lead, or oversize conductors. Where a mechanical hazard is involved, increase conductor size to compensate for the hazard or protect conductors. When metallic conduit or tubing is provided, electrically bond conductor to conduit or tubing at the upper and lower ends by clamp type connectors or

welds (including exothermic). All lightning protection components, such as bonding plates, air terminals, air terminal supports and braces, chimney bands, clips, connector fittings, and fasteners are to comply with the requirements of UL 96 classes as applicable.

2.1.1 Main and Bonding Conductors

NFPA 780 and UL 96 Class I, Class II, or Class II modified materials as applicable.

2.2 COMPONENTS

2.2.1 Air Terminals

Provide solid air terminals with a blunt tip. Tubular air terminals are not permitted. Support air terminals more than 24 inches in length by suitable brace, supported at not less than one-half the height of the terminal.

2.2.2 Ground Rods

Provide ground rods made of copper-clad steel conforming to conform to UL 467. Provide ground rods that are not less than 3/4 inch in diameter and 10 feet in length. Do not mix ground rods of copper-clad steel or solid copper on the job.

2.2.3 Connections and Terminations

Provide connectors for splicing conductors that conform to UL 96, class as applicable. Conductor connections can be made by clamps or welds (including exothermic). Provide style and size connectors required for the installation.

2.2.4 Connector Fittings

Provide connector fittings for "end-to-end", "Tee", or "Y" splices that conform to NFPA 780 and UL 96.

PART 3 EXECUTION

3.1 INTEGRAL SYSTEM

Provide a lightning protection system that meets the requirements of NFPA 780. Lightning protection system consists of air terminals, roof conductors, down conductors, ground connections, grounding electrodes and ground ring electrode conductor. Expose conductors on the structures except where conductors are required to be in protective sleeves. Bond secondary conductors with grounded metallic parts within the building. Make interconnections within side-flash distances at or below the level of the grounded metallic parts.

3.1.1 Roof-Mounted Components

Coordinate with the roofing manufacturer and provide certification that the roof manufacturer's warranty is not violated by the installation methods for air terminals and roof conductors.

3.1.1.1 Air Terminals

Use adhesive shoes with adhesive approved by the roof manufacturer when installing air terminals on "rubber" (EPDM) type roofs. In areas of snow or constant wind, ensure that a section of roofing material (minimum dimensional area of 1 square foot) is first glued to the roof and then the air terminal is glued to it unless the roof manufacturer recommends another solution. Use a standing seam base for installation of air terminals on a standing seam metal roof that does not produce any roof penetrations.

3.1.1.2 Roof Conductors

Use adhesive shoes with adhesive approved by the roof manufacturer when installing roof conductors on "rubber" (EPDM) type roofs. Use a standing seam base for installation of roof conductors on a standing seam metal roof that does not produce any roof penetrations.

3.1.2 Down Conductors

Protect exposed down conductors from physical damage as required by NFPA 780. Use Schedule 80 PVC to protect down conductors. Paint the Schedule 80 PVC to match the surrounding surface with paint that is approved for use on PVC.

3.1.3 Ground Connections

Attach each down conductor and ground ring electrode to ground rods by welding (including exothermic), brazing, or compression. All connections to ground rods below ground level must be by exothermic weld connection or with a high compression connection using a hydraulic or electric compression tool to provide the correct circumferential pressure. Accessible connections above ground level and in test wells can be accomplished by mechanical clamping.

3.1.4 Grounding Electrodes

Extend driven ground rods vertically into the existing undisturbed earth for a distance of not less 10 feet. Set ground rods not less than 3 feet nor more than 8 feet, from the structure foundation, and at least beyond the drip line for the facility. After the completed installation, measure the total resistance to ground using the fall-of-potential method described in IEEE 81. Maximum allowed resistance of a driven ground rod is 25 ohms, under normally dry conditions. Contact the Contracting Officer for direction on how to proceed when two of any three ground rods, driven not less than 10 feet into the ground, a minimum of 10 feet apart, and equally spaced around the perimeter, give a combined value exceeding 50 ohms immediately after having driven. For ground ring electrode, provide continuous No. 1/0 bare stranded copper cable. Lay ground ring electrode around the perimeter of the structure in a trench not less than 3 feet nor more than 8 feet from the nearest point of the structure foundation, and at least beyond the drip line for the facility. Install ground ring electrode to a minimum depth of 30 inches. Install a ground ring electrode in earth undisturbed by excavation, not earth fill, and do not locate beneath roof overhang, or wholly under paved areas or roadways where rainfall cannot penetrate to keep soil moist in the vicinity of the cable.

3.2 APPLICATIONS

3.2.1 Nonmetallic Exterior Walls with Metallic Roof

Bond metal roof sections together which are insulated from each other so that they are electrically continuous, having a surface contact of at least 3 square inches.

3.3 RESTORATION

Where sod has been removed, place sod as soon as possible after completing the backfilling. Restore, to original condition, the areas disturbed by trenching, storing of dirt, cable laying, and other work. Overfill to accommodate for settling. Include necessary topsoil, fertilizing, liming, seeding, sodding, sprigging or mulching in any restoration. Maintain disturbed surfaces and replacements until final acceptance.

3.4 FIELD QUALITY CONTROL

3.4.1 Lightning Protection and Grounding System Test

Test the lightning protection and grounding system to ensure continuity is not in excess of 1 ohm and that resistance to ground is not in excess of 25 ohms. Provide documentation for the measured values at each test point. Test the ground rod for resistance to ground before making connections to the rod. Tie the grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Include in the written report: locations of test points, measured values for continuity and ground resistances, and soil conditions at the time that measurements were made. Submit results of each test to the Contracting Officer.

-- End of Section --

SECTION 26 51 00.00 22

INTERIOR LIGHTING

08/12

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A641/A641M (2009a; R 2014) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

ASTM B117 (2016) Standard Practice for Operating Salt Spray (Fog) Apparatus

GREEN SEAL (GS)

GC-12 (1997) Occupancy Sensors

ILLUMINATING ENGINEERING SOCIETY (IES)

IESNA HB-10 (2011) IES Lighting Handbook, 10th Edition

IESNA LM-79 (2008) Electrical and Photometric Measurements of Solid-State Lighting Products

IESNA LM-80 (2008) Measuring Lumen Maintenance of LED Light Sources

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

IEEE C2 (2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

IEEE C62.41.2 (2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/IEC 60529 (2004) Degrees of Protection Provided by Enclosures (IP Code)

NEMA ANSLG C78.377 (2017) Electric Lamps- Specifications for the Chromaticity of Solid State Lighting Products

ANSI C82.77 Harmonic Emission Limits - Related Power

Quality Requirements for Lighting Equipment

NEMA 250 (2018) Enclosures for Electrical Equipment
(1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2021) Life Safety Code

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA
20-1; TIA 20-2; TIA 20-3; TIA 20-4)
National Electrical Code

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 15 Radio Frequency Devices (47 CFR 15)

UNDERWRITERS LABORATORIES (UL)

UL 1310 (2018) UL Standard for Safety Class 2
Power Units

UL 1598 (2008; Reprint Oct 2012) Luminaires

UL 8750 (2015; Reprint Oct 2019) UL Standard for
Safety Light Emitting Diode (LED)
Equipment for Use in Lighting Products

UL 924 (2006; Reprint Feb 2011) Standard for
Emergency Lighting and Power Equipment

1.2 RELATED REQUIREMENTS

Materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in this section.

1.3 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.
- b. Average life is the time after which 50 percent will have failed and 50 percent will have survived under normal conditions.
- c. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in IESNA LM-80.
- d. Total harmonic distortion (THD) is the root mean square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SYSTEM DESCRIPTION

1.4.1 Lighting Control System

Provide lighting control system as indicated. Lighting control equipment shall include, if indicated: control modules, power packs, dimming ballasts, occupancy sensors, and light level sensors.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Data, drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IESNA HB-10, as applicable, for the lighting system specified.

SD-01 Preconstruction Submittals

LED Luminaire Warranty

SD-02 Shop Drawings

LED Luminaire drawings; G

SD-03 Product Data

LED Luminaires; G

Exit signs; G

Emergency lighting equipment; G

Occupancy sensors; G

SD-06 Test Reports

LED Luminaire - IESNA LM-79 Test Report

LED Light Source - IESNA LM-80 Test Report

Operating test

Submit test results as stated in paragraph entitled "Field Quality Control."

SD-07 Certificates

Luminaire Useful Life Certificate

Submit certification from the manufacturer indicating the expected useful life of the luminaires provided. The useful life shall be directly correlated to the IESNA LM-80 test data, adjusted for the thermal properties of manufacturer's luminaire, and adjusted for local average ambient operating conditions.

SD-10 Operation and Maintenance Data

Lighting Control System, Data Package 5; G

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein, showing all light fixtures, control modules, control zones, occupancy sensors, power packs, schematic diagrams and all interconnecting control wire, conduit, and associated hardware.

1.6 QUALITY ASSURANCE

1.6.1 Drawing Requirements

1.6.1.1 LED Luminaire Drawings

Include dimensions, accessories, and installation and construction details. Photometric data, including zonal lumen data, average and minimum ratio, and candlepower distribution data shall accompany shop drawings.

1.6.2 LED Luminaire - IESNA LM-79 Test Report

Submit test report on manufacturer's standard production model luminaire. Submittal shall include all photometric and electrical measurements, as well as all other pertinent data outlined under "14.0 Test Report" in IESNA LM-79.

1.6.3 LED Light Source - IESNA LM-80 Test Report

Submit report on manufacturer's standard production LED package, array, or module. Submittal shall include:

- a. Testing agency, report number, date, type of equipment, and LED light source being tested.
- b. All data required by IESNA LM-80.

1.6.3.1 Test Laboratories

Test laboratories for the IESNA LM-79 and IESNA LM-80 test reports shall be one of the following:

- a. National Voluntary Laboratory Accreditation Program (NVLAP) accredited for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program.
- b. One of the qualified labs listed on the Department of Energy - Energy Efficiency & Renewable Energy, Solid-State Lighting web site.
- c. A manufacturer's in-house lab that meets the following criteria:
 1. Manufacturer has been regularly engaged in the design and production of high intensity discharge roadway and area luminaires and the manufacturer's lab has been successfully certifying these fixtures for a minimum of 15 years.
 2. Annual equipment calibration including photometer calibration in accordance with National Institute of Standards and Technology.

1.6.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.6.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.6.5.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.5.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.7.1 LED Luminaire Warranty

Provide Luminaire Useful Life Certificate.

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

- a. Provide a written five year on-site replacement warranty for material, fixture finish, and workmanship. On-site replacement includes transportation, removal, and installation of new products.

1. Finish warranty shall include warranty against failure and against

substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

2. Material warranty shall include:

(a) All power supply units (drivers).

(b) Replacement when more than 10 percent of LED sources in any lightbar or subassembly(s) are defective or non-starting.

- b. Warranty period must begin on date of beneficial occupancy. Contractor shall provide the Contracting Officer signed warranty certificates prior to final payment.

PART 2 PRODUCTS

2.1 LED LUMINAIRES

UL 1598, ANSI C82.77 and UL 8750. Provide luminaires as indicated in luminaire schedule and plates or details on project plans. Provide luminaires complete with light sources of quantity, type, and wattage indicated. All luminaires of the same type shall be provided by the same manufacturer. Details, shapes, and dimensions are indicative of the general type desired, but are not intended to restrict selection to luminaires of a particular manufacturer. Luminaires of similar designs, light distribution and brightness characteristics, and of equal finish and quality will be acceptable as approved.

2.1.1 General Requirements

- a. LED luminaire housings shall be die cast or extruded aluminum.
- b. LED luminaires shall be rated for operation within an ambient temperature range of minus 22 degrees F to 122 degrees F.
- c. Luminaires shall be UL listed for wet locations per UL 1598 where indicated. Optical compartment for LED luminaires shall be sealed and rated a minimum of IP65 per ANSI/IEC 60529.
- d. LED luminaires shall produce a minimum efficacy of 60 lumens per watt driven at a maximum 600 mA, tested per IESNA LM-79. Theoretical models of initial raw LED lumens per watt are not acceptable.
- e. Luminaires shall have IES distribution and NEMA field angle classifications as indicated in luminaire schedule on project plans per IESNA HB-10.
- f. Housing finish shall be baked-on enamel, anodized, or baked-on powder coat paint. Finish shall be capable of surviving ASTM B117 salt fog environment testing for 2500 hours minimum without blistering or peeling.
- g. Luminaires shall be fully assembled and electrically tested prior to shipment from factory.
- h. The finish color shall be as indicated in the luminaire schedule or detail on the project plans.
- i. Luminaire lenses shall be constructed of clear OR frosted tempered

glass or UV-resistant acrylic.

- j. Incorporate modular electrical connections, and construct luminaires to allow replacement of all or any part of the optics, heat sinks, power supply units, ballasts, surge suppressors and other electrical components using only a simple tool, such as a manual or cordless electric screwdriver.
- k. Luminaires shall have a nameplate bearing the manufacturer's name, address, model number, date of manufacture, and serial number securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.
- l. All factory electrical connections shall be made using crimp, locking, or latching style connectors. Twist-style wire nuts are not acceptable.

2.1.2 LED Light Sources

- a. Correlated Color Temperature (CCT) shall be in accordance with NEMA ANSLG C78.377:

Nominal CCT: 3500 degrees K: 3465 plus or minus 245 degrees K

- b. Color Rendering Index (CRI) shall be:

Greater than or equal to 80 for 3000 - 3500 degrees K light sources.

- c. Color Consistency:

Manufacturer shall utilize a maximum 4-step MacAdam ellipse binning tolerance for color consistency of LEDs used in luminaires.

2.1.3 LED Power Supply Units (Drivers)

UL 1310. LED Power Supply Units shall meet the following requirements:

- a. Minimum efficiency shall be 85 percent.
- b. Drive current per LED shall not exceed 600 mA, plus or minus 10 percent.
- c. Shall be rated to operate between ambient temperatures of minus 22 degrees F and 104 degrees F.
- d. Shall be designed to operate on the voltage system to which they are connected, typically ranging from 120 V to 480 V nominal.
- e. Operating frequency shall be: 50 or 60 Hz.
- f. Power Factor (PF) shall be greater than or equal to 0.90.
- g. Total Harmonic Distortion (THD) current shall be less than or equal to 20 percent.
- h. Shall meet requirements of FCC Part 15 (47 CFR 15), Class B.
- i. Shall be RoHS-compliant.

- j. Shall be mounted integral to luminaire. Remote mounting of power supply is not allowed.
- k. Power supplies in luminaires shall be UL listed with a sound rating of A.
- m. Shall be equipped with over-temperature protection circuit that turns light source off until normal operating temperature is achieved.

2.1.4 Surge Protection

Provide surge protection integral to luminaire to meet "C Low" waveforms as defined in IEEE C62.41.2, Scenario 1 Location Category C.

2.2 RECESS- AND FLUSH-MOUNTED FIXTURES

Provide type that can be relamped from the bottom. Access to ballast shall be from the bottom. Trim for the exposed surface of flush-mounted fixtures shall be as indicated.

2.3 SUSPENDED FIXTURES

Provide hangers capable of supporting twice the combined weight of fixtures supported by hangers. Provide with swivel hangers to ensure a plumb installation. Hangers shall be cadmium-plated steel with a swivel-ball tapped for the conduit size indicated. Hangers shall allow fixtures to swing within an angle of 45 degrees. Brace pendants 4 feet or longer to limit swinging. Single-unit suspended fluorescent fixtures shall have twin-stem hangers. Multiple-unit or continuous row fluorescent fixtures shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Rods shall be a minimum 0.18 inch diameter.

2.4 SWITCHES

2.4.1 Toggle Switches

Provide toggle switches as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.5 EXIT SIGNS

UL 924, NFPA 70, and NFPA 101. Exit signs shall be self-powered type. Exit signs shall use no more than 5 watts.

2.5.1 Self-Powered LED Type Exit Signs (Battery Backup)

Provide with automatic power failure device, test switch, pilot light, integral self-testing module and fully automatic high/low trickle charger in a self-contained power pack. Battery shall be sealed electrolyte type, shall operate unattended, and require no maintenance, including no additional water, for a period of not less than 5 years. LED exit sign shall have emergency run time of 1 1/2 hours (minimum). The light emitting diodes shall have rated lamp life of 70,000 hours (minimum).

2.6 EMERGENCY LIGHTING EQUIPMENT

UL 924, NFPA 70, and NFPA 101. Provide lamps in wattage indicated.

2.6.1 Emergency Lighting Unit

Provide as indicated. Emergency lighting units shall be rated for 12 volts, except units having no remote-mounted lamps and having no more than two unit-mounted lamps may be rated 6 volts. Provide integral self-testing module.

2.7 SELF-TESTING MODULE

Self-testing module for exit signs and emergency lighting equipment shall perform the following functions:

- a. Continuous monitoring of charger operation and battery voltage with visual indication of normal operation and of malfunction.
- b. Monthly discharge cycling of battery with monitoring of transfer circuit function, battery capacity and emergency lamp operation with visual indication of malfunction. The battery capacity test may be conducted by using a synthetic load.
- c. Manual test switch to simulate a discharge test cycle.
- d. Module shall have low voltage battery disconnect (LVD) and brown-out protection circuit.

2.8 OCCUPANCY SENSORS

UL listed. Comply with GC-12. Occupancy sensors and power packs shall be designed to operate on the voltage indicated. Sensors and power packs shall have circuitry that only allows load switching at or near zero current crossing of supply voltage. Occupancy sensor mounting as indicated. Sensor shall have an LED occupant detection indicator. Sensor shall have adjustable sensitivity and adjustable delayed-off time range of 5 minutes to 15 minutes. Wall mounted sensors shall match the color of adjacent wall plates as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, ceiling mounted sensors shall be white. Ceiling mounted sensors shall have 360 degree coverage unless otherwise indicated.

- c. ultrasonic/Infrared Combination Sensor

2.9 SUPPORT HANGERS FOR LIGHTING FIXTURES IN SUSPENDED CEILINGS

2.9.1 Wires

ASTM A641/A641M, galvanized regular coating, soft temper, 0.1055 inches in diameter (12 gage).

2.10 EQUIPMENT IDENTIFICATION

2.10.1 Manufacturer's Nameplate

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.10.2 Labels

Provide labeled luminaires in accordance with UL 1598 requirements. All luminaires shall be clearly marked for operation of specific light sources and ballasts according to proper lamp type. The following lamp characteristics shall be noted in the format "Use Only _____":

- a. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

All markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Ballasts shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

2.11 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Lamps

Lamps of the type, wattage, and voltage rating indicated shall be delivered to the project in the original cartons and installed just prior to project completion. Lamps installed and used for working light during construction shall be replaced prior to turnover to the Government if more than 15 percent of their rated life has been used. Lamps shall be tested for proper operation prior to turn-over and shall be replaced if necessary with new lamps from the original manufacturer.

3.1.2 Lighting Fixtures

Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. Installation shall meet requirements of NFPA 70. Mounting heights specified or indicated shall be to the bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed. Recessed and semi-recessed fixtures shall be independently supported from the building structure by a minimum of four wires per fixture and located near each corner of each fixture.

3.1.3 Suspended Fixtures

Suspended fixtures shall be provided with 45 degree swivel hangers so that they hang plumb and shall be located with no obstructions within the 45 degree range in all directions. The stem, canopy and fixture shall be capable of 45 degree swing. Pendants, or chains 4 feet or longer excluding fixture shall be braced to prevent swaying using three cables at

120 degree separation. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 10 feet or as recommended by the manufacturer, whichever is less.

3.1.4 Exit Signs and Emergency Lighting Units

Wire exit signs and emergency lighting units ahead of the switch to the normal lighting circuit located in the same room or area.

3.1.5 Occupancy Sensor

Provide quantity of sensor units indicated as a minimum. Provide additional units to give full coverage over controlled area. Full coverage shall provide hand and arm motion detection for office and administration type areas and walking motion for industrial areas, warehouses, storage rooms and hallways. Locate the sensor(s) as indicated and in accordance with the manufacturer's recommendations to maximize energy savings and to avoid nuisance activation and deactivation due to sudden temperature or airflow changes and usage.

3.2 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in PART 4 of the RFP.

3.3 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that equipment operates in accordance with requirements of this section.

-- End of Section --

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SECTION 26 56 00

EXTERIOR LIGHTING

05/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2016) Standard Practice for Operating Salt Spray (Fog) Apparatus
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EUROPEAN UNION (EU)

Directive 2011/65/EU	(2011) Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment
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ILLUMINATING ENGINEERING SOCIETY (IES)

IES HB-10	(2011; Errata 2015) IES Lighting Handbook
IES LM-79	(2008) Electrical and Photometric Measurements of Solid-State Lighting Products
IES LM-80	(2015) Measuring Lumen Maintenance of LED Light Sources
IES RP-8	(2018; Addenda 1 2020) Recommended Practice for Lighting Roadway and Parking Facilities
IES RP-16	(2017) Nomenclature and Definitions for Illuminating Engineering
IES TM-15	(2011) Luminaire Classification System for Outdoor Luminaires
IES TM-21	(2019) Projecting Long Term Lumen Maintenance of LED Light Sources

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2018) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ANSLG C78.377	(2017) Electric Lamps- Specifications for the Chromaticity of Solid State Lighting Products
NEMA C82.77-10	(2020) Harmonic Emission Limits - Related Power Quality Requirements
NEMA C136.31	(2018) Roadway and Area Lighting Equipment - Luminaire Vibration
NEMA ICS 2	(2000; R 2005; Errata 2008) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA IEC 60529	(2004) Degrees of Protection Provided by Enclosures (IP Code)
NEMA SSL 1	(2016) Electronic Drivers for LED Devices, Arrays, or Systems
NEMA SSL 3	(2011) High-Power White LED Binning for General Illumination

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
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UNDERWRITERS LABORATORIES (UL)

UL 773	(2016; Reprint Nov 2017) UL Standard for Safety Plug-In, Locking Type Photocontrols for Use with Area Lighting
UL 773A	(2016; Reprint May 2018) UL Standard for Safety Nonindustrial Photoelectric Switches for Lighting Control
UL 1310	(2018) UL Standard for Safety Class 2 Power Units
UL 1598	(2008; Reprint Oct 2012) Luminaires
UL 8750	(2015; Reprint Oct 2019) UL Standard for Safety Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.2 RELATED REQUIREMENTS

Materials not considered to be luminaires, luminaire accessories, or lighting equipment are specified in Section(s) 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Luminaires and accessories installed in interior of buildings or attached to the exterior of a building are specified in Section 26 51 00.00 22 INTERIOR LIGHTING.

1.3 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications and on the drawings must be as defined in IEEE 100 and IES RP-16.
- b. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in IES LM-80.
- c. For LED luminaires, "Luminaire Efficacy" (LE) is the appropriate measure of energy efficiency, measured in lumens/watt. This is gathered from LM-79 data for the luminaire, in which absolute photometry is used to measure the lumen output of the luminaire as one entity, not the source separately and then the source and housing together.
- d. Total Harmonic Distortion (THD) is the Root Mean Square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Luminaire Drawings; G

Control System One-Line Diagram; G

SD-03 Product Data

Luminaires; G

Light Sources; G

LED Drivers; G

Luminaire Warranty; G

Lighting Controls Warranty; G

Photosensors; G

Time Clock; G

Lighting Contactor; G

SD-05 Design Data

Luminaire Design Data; G

SD-06 Test Reports

IES LM-79 Test Report; G

IES LM-80 Test Report; G

IES TM-21 Test Report; G

SD-10 Operation and Maintenance Data

Lighting System, Data Package 5; G

Exterior Lighting Control System, Data Package 5; G
Maintenance Staff Training Plan; G

End-User Training Plan; G

1.5 QUALITY ASSURANCE

Data, drawings, and reports must employ the terminology, classifications and methods prescribed by the IES HB-10 as applicable, for the lighting system specified.

1.5.1 Drawing Requirements

1.5.1.1 Luminaire Drawings

Include dimensions, accessories, and installation and construction details. Photometric data, including CRI, CCT, TM-15-11 BUG rating, LED driver type, zonal lumen data, and candlepower distribution data per LM-79 must accompany shop drawings.

1.5.2 Luminaire Design Data

- a. Provide distribution data according to IES classification type as defined in IES HB-10 and IES RP-8.
- b. B.U.G. rating for the installed position as defined by IES TM-15 and shielding as defined by IES RP-8.
- c. Provide safety certification and file number for the luminaire family. Include listing, labeling and identification in accordance with NFPA 70 (NEC). Applicable testing bodies are determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) and include: CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratories).
- d. Provide long term lumen maintenance projections for each LED luminaire in accordance with IES TM-21. Data used for projections must be obtained from testing in accordance with IES LM-80.
- e. Provide wind loading calculations for luminaires mounted on poles.

Weight and effective projected area (EPA) of luminaires and mounting brackets must not exceed maximum rating of pole as installed in particular wind zone area.

1.5.3 IES LM-79 Test Report

Submit test report on manufacturer's standard production model of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data as outlined under "14.0 Test Report" in IES LM-79.

1.5.4 IES LM-80 Test Report

Submit report on manufacturer's standard production LED light source (package, array, or module) of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data as outlined under "8.0 Test Report" in IES LM-80.

1.5.5 IES TM-21 Test Report

Submit test report on manufacturer's standard production LED light source (package, array or module) of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data, as well as required interpolation information as outlined under "7.0 Report" in IES TM-21.

1.5.6 Test Laboratories

Test laboratories for the IES LM-79 and IES LM-80 test reports must be one of the following:

- a. National Voluntary Laboratory Accreditation Program (NVLAP) accredited for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program.
- b. One of the qualified labs listed on the Department of Energy - Energy Efficiency & Renewable Energy, Solid-State Lighting web site.
- c. One of the EPA-Recognized Laboratories listed at for LM-80 testing.

1.5.7 Regulatory Requirements

Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated. Provide luminaires and assembled components that are approved by and bear the label of UL for the applicable location and conditions unless otherwise specified.

1.5.8 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for six months prior to bid opening. The six-month period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the six-month period. Where

two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.8.1 Alternative Qualifications

Products having less than a six-month field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.8.2 Material and Equipment Manufacturing Date

Do not use products manufactured more than six months prior to date of delivery to site, unless specified otherwise.

1.6 WARRANTY

Support all equipment items by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6.1 Luminaire Warranty

Provide and transfer to the government the original LED luminaire manufacturers standard commercial warranty for each different luminaire manufacturer used in the project.

- a. Provide a written five year minimum replacement warranty for material, luminaire finish, and workmanship. Provide written warranty document that contains all warranty processing information needed, including customer service point of contact, whether or not a return authorization number is required, return shipping information, and closest return location to the luminaire location.

- (1) Finish warranty must include failure and substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

- (2) Material warranty must include:

- (a) All LED drivers and integral control equipment.

- (b) Replacement when more than 10 percent of LED sources in any lightbar or subassembly(s) are defective, non-starting, or operating below 70 percent of specified lumen output.

- b. Warranty period must begin in accordance with the manufacturer's standard warranty starting date.

- c. Provide replacements that are promptly shipped, without charge, to the using Government facility point of contact and that are identical to or an improvement upon the original equipment. All replacements must include testing of new components and installation.

1.6.2 Lighting Controls Warranty

Provide and transfer to the government the original lighting controls

manufacturers standard commercial warranty for each different lighting controls manufacturer used in the project. Warranty coverage must begin from date of final system commissioning or three months from date of delivery, whichever is the earliest. Warranty service must be performed by a factory-trained engineer or technician.

- a. Unless otherwise noted, provide a written five year minimum warranty on the complete system for all systems with factory commissioning. Provide warranty that covers 100 percent of the cost of any replacement parts and services required over the five years which are directly attributable to the product failure. Failures include, but are not limited to, the following:
 - (1) Software: Failure of input/output to execute switching or dimming commands.
 - (2) Damage of electronic components due to transient voltage surges.
 - (3) Failure of control devices, including but not limited to photosensors and motion sensors.
- b. Provide a written five year minimum warranty on all input devices against defect in workmanship or materials provided by device manufacturer.
- c. Provide a written five year minimum warranty on all control components attached to luminaires against defect in workmanship or materials.

1.7 OPERATION AND MAINTENANCE MANUALS

1.7.1 Lighting System

Provide operation and maintenance manuals for the lighting system in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA that provide basic data relating to the design, operation, and maintenance of the lighting system. Include the following:

- a. Manufacturers' operating and maintenance manuals.
- b. Luminaire shop drawings for modified and custom luminaires.
- c. Luminaire Manufacturers' standard commercial warranty information as specified in paragraph LUMINAIRE WARRANTY.

1.7.2 Exterior Lighting Control System

Provide operation and maintenance manuals for the exterior lighting control system in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA that provide basic data relating to the design, operation, and maintenance of the exterior lighting control system. Include the following:

- a. Control System One-Line Diagram
- b. Product data for all devices, including installation and programming instructions.
- c. Training materials, such as videos or in-depth manuals, that cover basic operation of the lighting control system and instructions on

modifying the control system. Training materials must include calibration, adjustment, troubleshooting, maintenance, repair, and replacement.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

2.2 LUMINAIRES

UL 1598, NEMA C82.77-10. Provide luminaires as indicated in the luminaire schedule and XL plates or details on project plans, complete with light source, wattage, and lumen output indicated. All luminaires of the same type must be provided by the same manufacturer. Luminaires must be specifically designed for use with the LED driver and light source provided.

2.2.1 Luminaires

UL 8750, IES LM-79, IES LM-80. For all luminaires, provide:

- a. Complete system with LED drivers and light sources.
- b. Housing constructed of non-corrosive materials. All new aluminum housings must be anodized or powder-coated. All new steel housings must be treated to be corrosion resistant.
- c. IES TM-21, IES LM-80. Minimum L70 lumen maintenance value of 50,000hours unless otherwise indicated in the luminaire schedule. Luminaire drive current value must be identical to that provided by test data for luminaire in question.
- d. Minimum efficacy as specified in the luminaire schedule. Theoretical models of initial lamp lumens per watt are not acceptable. If efficacy values are not listed in the luminaire schedule, provide luminaires that meet the following minimum values:

Luminaire Style	Minimum Luminaire Efficacy
Area and Roadway (pole mounted, arm mounted)	95 LPW
Pedestrian Post-Top (pole mounted, arm mounted)	90 LPW
Bollard	35 LPW
Accent (adjustable landscape, sign lighting)	35 LPW
Linear Accent (facade, wallwash)	80 LPW
Exterior Wall Sconce	50 LPW
Steplight	30 LPW
Parking Garage Luminaire	100 LPW

- e. Product rated for operation within an ambient temperature range of minus 22 degrees F to 104 degrees F.

- f. UL listed for wet locations. Optical compartment for LED luminaires must be sealed and rated a minimum of IP65 per NEMA IEC 60529.
- g. IES HB-10. Light distribution and NEMA field angle classifications as indicated in luminaire schedule on project plans.
- h. Housing finish that is baked-on enamel, anodized, or baked-on powder coat paint. Finish must be capable of surviving ASTM B117 salt fog environment testing for 2500 hours minimum without blistering or peeling.
- i. LED driver and light source package, array, or module are accessible for service or replacement without removal or destruction of luminaire.
- j. IES TM-15. Does not exceed the BUG ratings as listed in the luminaire schedule.. If BUG ratings are not listed in the luminaire schedule, provide luminaires that meet the following minimum values for each application and mounting conditions:

Lighting Application	Mounting Conditions	BUG Rating
Area and Roadway	All	B3-U0-G3
Pedestrian Post-Top	All	B2-U1-G1
Exterior Wall Sconce	Above 4 feet AFF	B1-U0-G2
Exterior Wall Sconce	Below or at 4 feet AFF	B4-U0-G4
Steplight	Above 4 feet AFF	B1-U1-G2
Steplight	Below or at 4 feet AFF	B4-U1-G4
Parking Garage Luminaire	Ceiling mounted	B4-U4-G3

- k. Fully assembled and electrically tested prior to shipment from factory.
- l. Finish color is as indicated in the luminaire schedule or detail on the project plans.
- m. Lenses constructed of frosted tempered glass or UV-resistant acrylic.
- n. All factory electrical connections are made using crimp, locking, or latching style connectors. Twist-style wire nuts are not acceptable.
- o. NEMA C136.31. Comply with 3G vibration testing.
- p. Incorporate modular electrical connections, and construct luminaires to allow replacement of all or any part of the optics, heat sinks, LED drivers, surge suppressors and other electrical components using only a simple tool, such as a manual or cordless electric screwdriver.

2.3 LIGHT SOURCES

NEMA ANSLG C78.377, NEMA SSL 3. Provide type, lumen rating, and wattage as indicated in luminaire schedule on project plans.

2.3.1 LED Light Sources

Provide LED light sources that meet the following requirements:

- a. NEMA ANSLG C78.377. Emit white light and have a nominal Correlated Color Temperature (CCT) of 4000 Kelvin.
- b. Minimum Color Rendering Index (CRI) of 70.
- c. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.
- d. Light source color consistency by utilizing a binning tolerance within a 4-step McAdam ellipse.

2.4 LED DRIVERS

NEMA SSL 1, UL 1310. Provide LED Drivers that are electronic, UL Class 1 or Class 2, constant-current type and meet the following requirements:

- a. The combined LED driver and LED light source system is greater than or equal to the minimum luminaire efficacy values as listed in the luminaire schedule provided.
- b. Operate at a voltage of 120-277 volts at 50/60 hertz, with input voltage fluctuations of plus or minus 10 percent.
- c. Power Factor (PF) greater than or equal to 0.90 at full input power and across specified dimming range.
- d. Maximum Total Harmonic Distortion (THD) less than or equal to 20 percent at full input power and across specified dimming range.
- e. Operates for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.
- f. Meets the "Elevated" (10kV/10kA) requirements per IEEE C62.41.2 -2002. Manufacturer must indicate whether failure of the electrical immunity system can possibly result in disconnect of power to luminaire. Provide surge protection that is integral to the LED driver.
- g. Contains integral thermal protection that reduces the output power to protect the driver and light source from damage if the case temperature approaches or exceeds the driver's maximum operating temperature.
- h. Complies with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).
- i. Class A sound rating for all drivers mounted under a covered structure, such as a canopy, or where otherwise appropriate.
- j. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.
- k. UL listed for wet locations typical of exterior installations.

1. Rated to operate between ambient temperatures of minus 22 degrees F and 104 degrees F.

2.5 LIGHTING CONTROLS

2.5.1 Devices

2.5.1.1 Time Clock

NEMA ICS 6. House time clock in a surface-mounted, lockable NEMA 1 enclosure constructed of painted steel or plastic polymer. Provide electronic type time clock that meets the following criteria:

- a. astronomic programming function, providing a total of 56 on/off set points.
- b. 24 hour type digital clock display format.
- c. Power outage back-up for switch utilizing lithium battery which provides coverage for a minimum of seven days.
- d. Capable of controlling a minimum of 1 channels or loads.
- e. Contacts are rated for 30 amps at 120-277 VAC resistive load in a SPST normally open (NO) configuration.
- f. Contains function that allows automatic control to be skipped on certain selected days of the week daylight savings time automatic adjustment EEPROM memory module photosensor input.

2.5.1.2 Photosensors

UL 773, UL 773A. Provide Photosensors that meet the following requirements:

- a. Hermetically sealed, cadmium sulfide light sensor type, rated at 18 watts, 120 volts, 50/60 Hz with single-pole, single-throw contacts.
- b. Turns ON at 1 to 3 footcandles and turns OFF at 3 to 15 footcandles.
- c. Designed to fail to the ON position.
- d. Housing is constructed of die cast aluminum, rated to operate within a temperature range of minus 40 to 158 degrees F.
- e. Time delay that prevents accidental switching from transient light sources.
- f. Directional lens in front of the cell to prevent fixed light sources from creating a turnoff condition.
- g. Designed for 20-year service to match life expectancy of long-life LED fixtures and exceed 15,000 operations at full load. Provide photosensors with zero-cross technology to withstand severe in-rush current and extend relay life.
- h. Swivel base type housing with 1/2 in threaded base for mounting to a junction box or conduit.

- i. Provide photosensors with metal oxide varistor (MOV) type surge protection.

2.5.1.3 Lighting Contactor

NEMA ICS 2. Provide a mechanically-held lighting contactor housed in a NEMA 1 enclosure conforming to NEMA ICS 6. Contactor must have 4 poles, configured as normally open (NO). Contacts must be rated 600 volts, 30 amperes for a resistive load. Coil operating voltage must be 120 volts. Contactor must have silver cadmium oxide double-break contacts and coil clearing contacts for mechanically held contactors and must require no arcing contacts. Provide contactor with hand-off-automatic selector switch.

2.6 EQUIPMENT IDENTIFICATION

2.6.1 Manufacturer's Nameplate

Each item of equipment must have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.6.2 Labels

UL 1598. Luminaires must be clearly marked for operation of specific light sources and drivers according to proper light source type. Note the following luminaire characteristics in the format "Use Only _____":

- a. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.
- b. Driver and dimming protocol.

Markings related to light source type must be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when light sources are in place. LED drivers must have clear markings indicating dimming type and indicate proper terminals for the various outputs.

2.7 FACTORY APPLIED FINISH

NEMA 250. Provide all luminaires and lighting equipment with factory-applied painting system that as a minimum meets requirements of corrosion-resistance testing.

PART 3 EXECUTION

3.1 INSTALLATION

IEEE C2, NFPA 70.

3.1.1 Luminaires

Install all luminaires in accordance with the luminaire manufacturer's written instructions. Install all luminaires at locations and heights as indicated on the project plans. Level all luminaires in accordance to manufacturer's written instructions.

3.1.2 LED Drivers

Provide LED drivers integral to luminaire as constructed by the manufacturer.

3.1.3 Lighting Controls

3.1.3.1 Photosensors

Aim photosensor according to manufacturer's recommendations.

3.1.4 Grounding

Ground noncurrent-carrying parts of equipment including luminaires, brackets, and metallic enclosures as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.2 FIELD QUALITY CONTROL

3.2.1 Tests

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Perform initial operational test, consisting of the entire system energized for 72 consecutive hours without any failures of any kind occurring in the system. All circuits must test clear of faults, grounds, and open circuits.

3.2.1.1 Lighting Control Verification Test

Verify lighting control system and devices operate according to approved sequence of operations. Verification tests are to be completed after commissioning.

3.3 CLOSEOUT ACTIVITIES

3.3.1 Training

Provide on-site training to the Owner's personnel in the operation and maintenance of lighting and lighting control system. Provide training that includes calibration, adjustment, troubleshooting, maintenance, repair, and replacement.

3.3.1.1 Maintenance Staff Training

Submit a Maintenance Staff Training Plan at least 30 calendar days prior to training session that describes training procedures for Owner's personnel in the operation and maintenance of lighting and lighting control system. Provide on-site training which demonstrate full system functionality, assigning schedules, calibration adjustments for light levels and sensor sensitivity, integration procedures for connecting to third-party devices, and manual override including information on appropriate use. Provide protocols for troubleshooting, maintenance, repair, and replacement, and literature on available system updates and process for implementing updates.

3.3.1.2 End-User Training

Submit a End-User Training Plan at least 30 calendar days prior to training session that describes training procedures for end-users on the lighting control system. Provide demonstration for each type of user interface. Provide users with the curfew schedule as currently commissioned, including conditional programming based on astronomic time clock functionality. Provide users with the correct contact information for maintenance personnel who will be available to address any lighting control issues.

-- End of Section --

SECTION 27 10 00

BUILDING TELECOMMUNICATIONS CABLING SYSTEM
06/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D709 (2016) Standard Specification for
Laminated Thermosetting Materials

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)

ECIA EIA/ECA 310-E (2005) Cabinets, Racks, Panels, and
Associated Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative
Dictionary of IEEE Standards Terms

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-83-596 (2016) Indoor Optical Fiber Cables

ICEA S-90-661 (2012) Category 3, 5, & 5e Individually
Unshielded Twisted Pair Indoor Cables for
Use in General Purpose and LAN
Communications Wiring Systems Technical
Requirements

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA/BICSI 568 (2006) Standard for Installing Building
Telecommunications Cabling

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI/NEMA WC 66 (2013) Performance Standard for Category 6
and Category 7 100 Ohm Shielded and
Unshielded Twisted Pairs

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA
20-1; TIA 20-2; TIA 20-3; TIA 20-4)
National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-1152 (2009) Requirements for Field Test

	Instruments and Measurements for Balanced Twisted-Pair Cabling
TIA-455-21	(1988a; R 2012) FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices
TIA-492AAAA	(2009b) 62.5-um Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers
TIA-526-14	(2015c) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
TIA-526-7	(2015a) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
TIA-568-C.0	(2009; Add 1 2010; Add 2 2012) Generic Telecommunications Cabling for Customer Premises
TIA-568-C.1	(2009; Add 2 2011; Add 1 2012) Commercial Building Telecommunications Cabling Standard
TIA-568-C.2	(2009; Errata 2010; Add 2 2014; Add 1 2016) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA-568-C.3	(2008; Add 1 2011) Optical Fiber Cabling Components Standard
TIA-569	(2015d) Commercial Building Standard for Telecommunications Pathways and Spaces
TIA-570	(2012c) Residential Telecommunications Infrastructure Standard
TIA-606	(2012b; Add 1 2015) Administration Standard for the Telecommunications Infrastructure
TIA-607	(2011b) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
TIA/EIA-598	(2014d) Optical Fiber Cable Color Coding
TIA/EIA-604-3	(2004b; R 2014) Fiber Optic Connector Intermateability Standard (FOCIS), Type SC and SC-APC, FOCIS-3

U.S. FEDERAL COMMUNICATIONS COMMISSION (FCC)

FCC Part 68	Connection of Terminal Equipment to the Telephone Network (47 CFR 68)
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UNDERWRITERS LABORATORIES (UL)

UL 1286	(2008; Reprint Feb 2015) Office Furnishings
UL 1666	(2007; Reprint Jun 2012) Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
UL 444	(2008; Reprint Apr 2015) Communications Cables
UL 467	(2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment
UL 50	(2015) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 514C	(2014; Reprint Nov 2018) UL Standard for Safety Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 969	(1995; Reprint Sep 2014) Standard for Marking and Labeling Systems
UL 2043	(2013) Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces

1.2 RELATED REQUIREMENTS

Section 01 33 00 SUBMITTAL PROCEDURES, Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and Section 33 82 00 TELECOMMUNICATIONS, OUTSIDE PLANT (OSP) apply to this section with additions and modifications specified herein.

Contact Camp Lejeune Base Telephone (aka Telecommunications Support Division or TSD) for special requirements on classified service cabling and color, unofficial service, under slab cabling, using water block, and any item not covered in this document.

Buildings with Special Network Requirements such as Classified networks, other government agencies (Navy NMCfI, Navy Medical, DLA, VA. Etc.), Marine Corps Community Services, Commercial ISP's, and CATV may require additional guidance outside this specification. Controlled or Restricted Access Areas may contain Classified networks may require Protected Distribution System which shall be installed in accordance with the current CNSSI No. 7003, and other restricted release publications. Classified networks may require shielded twisted pair, specific separation, distinct colored components, and shall be in accordance with current CNSSAM TEMPEST 1-13, RED/BLACK Separation documentation. In these cases contact Telecommunications Support Division G-6 MCIEAST-MCB CAMLEJ for additional guidance at (910) 451-9439 or (910) 451-3100.

Contact AHJ for special requirements on classified service, unofficial service, under slab cabling, using water block, and any item not covered

in this document.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-569, TIA-606 and IEEE 100 and herein.

1.3.1 Main Distribution Frame (MDF)

A physical structure at a central location for terminating permanent backbone cables to interconnect with service provider (SP) equipment at the activity minimum point of presence. The MDF generally includes vendor specific components to support voice and data circuits, building surge protector assemblies, main cross connect blocks, equipment support frames, and fire rated plywood backboard. Depending upon local site conditions, the MDF, BDF and EF may be the same space.

1.3.2 Building Distribution Frame (BDF)

A structure with terminations for connecting backbone, campus, and horizontal cabling. The BDF generally includes a cross connect, equipment support frame or lockable terminal cabinet, cable supports, and fire rated plywood backboard. The BDF shall include building protector assemblies when used for campus backbone or SP cabling. Also known as a (BD).

1.3.3 Intermediate Distribution Frame (IDF)

An intermediate termination point for horizontal wiring and cross connections within telecommunications rooms. Shall be connected to MDF with both fiber and copper. Secure Internet Protocol (SIPR) vault or cabinet is considered an IDF. Also known as a (FD).

1.3.4 Communications Room (CR)

An enclosed space for telecommunications equipment, terminations, and cross connect wiring for horizontal cabling. Also known as (TR), (CR), and IT Room. Terms are used interchangeably in this section and are considered to have the same meaning.

1.3.5 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect (MC). Also known as Central Office (CO) or Area Distribution Node (ADN)).

1.3.6 Building Distributor (BD)

A distributor in which the building backbone (customer owned outside plant) cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect (IC).)

1.3.7 Floor Distributor (FD)

A distributor used to connect horizontal cable and cabling subsystems or equipment. (International expression for horizontal cross-connect (HC)).

1.3.8 Telecommunications Room (TR)

An enclosed space for housing telecommunications equipment, cable, terminations, and cross-connects. The room is the recognized cross-connect between the backbone cable and the horizontal cabling. Also known as a (CR), and IT Room.

1.3.9 Entrance Facility (EF) (Telecommunications) (can be same as the MDF)

An entrance to the building for both private and public network service cables (including wireless) including the entrance point at the building wall and continuing to the equipment room.

1.3.10 Equipment Room (ER) (Telecommunications) (can be same as communications room)

An environmentally controlled centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity.

1.3.11 Open Cable

Cabling that is not run enclosed in a raceway as defined by NFPA 70. This refers to cabling that is "open" to the space in which the cable has been installed and is therefore exposed to the environmental conditions associated with that space, such as wire basket tray, cable tray, J-hooks, D-rings, or bridal rings. D rings should only be used in the communications room for cable management and J-hooks/bridal rings shall not be used.

1.3.12 Open Office

A floor space division provided by furniture, moveable partitions, or other means instead of by building walls, normally over 100 square feet.

1.3.13 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable. Also known as raceway.

1.4 SYSTEM DESCRIPTION

The building telecommunications cabling and pathway system shall include permanently installed backbone and horizontal cabling, horizontal and backbone pathways, service entrance facilities, work area pathways, telecommunications outlet assemblies, conduit, raceway, and hardware for splicing, terminating, and interconnecting cabling necessary to transport telephone data, and other communications systems (including LAN A/V, intercom, PA, CATV, CCTV, and WiFi) between equipment items in a building. The horizontal system shall be wired in a star topology from the telecommunications work area to the floor distributor/IDF or building distributor/MDF or campus distributor or communications room at the center or hub of the star. The backbone cabling and pathway system includes intrabuilding and interbuilding interconnecting cabling, pathway, and terminal hardware. The intrabuilding backbone provides connectivity from the floor distributors to the building distributors or to the campus distributor and from the building distributors to the campus distributor as required. The backbone system shall be wired in a star topology with

the campus distributor (Area Distribution Node) at the center or hub of the star. The interbuilding backbone system provides connectivity between the campus distributors and is specified in Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP). Provide telecommunications pathway systems referenced herein as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. The telecommunications contractor must coordinate with MCB CL Base Telephone (TSD) concerning access to and configuration of telecommunications spaces. The telecommunications contractor may be required to coordinate work effort within the telecommunications spaces with the electrical sub and general contractor, ROICC and MCI East G-6 Telecommunications Support Division (TSD).

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Telecommunications drawings; G

Telecommunications Space Drawings; G

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Telecommunications cabling (backbone and horizontal); G

Patch panels; G

Telecommunications outlet/connector assemblies; G

Equipment support frame; G

Connector blocks; G

Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Include performance and characteristic curves. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required in Section 01 33 00 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Telecommunications cabling testing; G

SD-07 Certificates

Telecommunications Contractor Qualifications; G

Key Personnel Qualifications; G

Manufacturer Qualifications; G

Test plan; G

SD-09 Manufacturer's Field Reports

Factory reel tests; G

SD-10 Operation and Maintenance Data

Telecommunications cabling and pathway system Data Package 5; G

SD-11 Closeout Submittals

Record Documentation; G

1.5.1 Additional Submittal Requirements

All submittals of material, equipment and design must be approved by the Telecommunications Support Division (TSD) prior to installing any telecommunications wiring, equipment, or power to support communications.

1.6 QUALITY ASSURANCE

1.6.1 Shop Drawings

In exception to Section 01 33 00 SUBMITTAL PROCEDURES, submitted plan drawings shall be a minimum of 11 by 17 inches in size using a minimum scale of 1/8 inch per foot. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

1.6.1.1 Telecommunications Drawings

Provide Registered Communications Distribution Designer (RCDD) approved, drawings in accordance with TIA-606. The identifier for each termination and cable shall appear on the drawings. Drawings shall depict final telecommunications installed wiring system infrastructure in accordance with TIA-606. The drawings should provide details required to prove that the distribution system shall properly support connectivity from the EF telecommunications and ER telecommunications, CD's, BD's, and FD's to the telecommunications work area outlets. Provide a plastic laminated schematic of the as-installed telecommunications cable system showing cabling, CD's, BD's, FD's, and the EF and ER for telecommunications keyed to floor plans by room number. Mount the laminated schematic in the EF telecommunications space as directed by the Contracting Officer. The following drawings shall be provided as a minimum:

- a. T1 - Layout of complete building per floor - Building Area/Serving Zone Boundaries, Backbone Systems, and Horizontal Pathways. Layout of

complete building per floor. The drawing indicates location of building areas, serving zones, vertical backbone diagrams, telecommunications rooms, access points, pathways, grounding system, and other systems that need to be viewed from the complete building perspective.

- b. T2 - Serving Zones/Building Area Drawings - Drop Locations and Cable Identification (ID'S). Shows a building area or serving zone. These drawings show drop locations, telecommunications rooms, dedicated electrical, access points and detail call outs for common equipment rooms and other congested areas.
- c. T4 - Typical Detail Drawings - Faceplate Labeling, Firestopping, Americans with Disabilities Act (ADA), Safety, Department of Transportation (DOT). Detailed drawings of symbols and typicals such as faceplate labeling, faceplate types, faceplate population installation procedures, detail racking, and raceways.

1.6.1.2 Telecommunications Space Drawings

Provide T3 drawings in accordance with TIA-606 that include telecommunications rooms plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and cabinet, rack, backboard and wall elevations. Drawings shall show layout of applicable equipment including incoming cable stub or connector blocks, building protector assembly, outgoing cable connector blocks, mechanical/electrical, patch panels and equipment spaces and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings.

1.6.2 Telecommunications Contractor Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, and the supervisor (if different from the installer). A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.2.1 Telecommunications Contractor

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems within the past 3 years of similar scope and size. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor. Also IAW Section on QC Specialists; a Telecommunications Systems QC Specialist may be required on site, full time with 10 years minimum experience in telecom installation and experience. Specialist shall be very familiar with UFGS Divisions 27, 28, 33 concerning communications systems work and installation.

1.6.2.2 Key Personnel

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

Supervisors and installers assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level. Submit documentation of current BICSI certification for each of the key personnel.

In lieu of BICSI certification, supervisors and installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the installation of the specified copper and fiber optic cable and components. They shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications systems and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons shall be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from The Contracting Officer.

1.6.2.3 Minimum Manufacturer Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of

components which comply with TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3.

1.6.3 Test Plan

Provide a complete and detailed test plan for the telecommunications cabling system including a complete list of test equipment for the components and accessories for each cable type specified, 60 days prior to the proposed test date. Include procedures for certification, validation, sample report, and testing.

1.6.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70, manufacturer recommendations/installation manual, best known industry practices, and industry standards, unless more stringent requirements are specified or indicated.

1.6.5 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section. Modification of manufacturer's standard products such as painting faceplates is not authorized.

1.6.5.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.6.5.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 year prior to date of delivery to site shall not be used, unless specified otherwise.

1.7 DELIVERY AND STORAGE

Provide protection from weather, moisture, extreme heat and cold, dirt, dust, and other contaminants for telecommunications cabling and equipment placed in storage.

1.8 ENVIRONMENTAL REQUIREMENTS

Connecting hardware shall be rated for operation under ambient conditions of 0 to 60 degrees C 32 to 140 degrees F and in the range of 0 to 95 percent relative humidity, noncondensing. All telecommunications spaces shall follow TIA-569 design.

1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.10 MAINTENANCE

1.10.1 Operation and Maintenance Manuals

Commercial off the shelf manuals shall be furnished for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications cabling and pathway system, Data Package 5. Submit operations and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein not later than 2 months prior to the date of beneficial occupancy. In addition to requirements of Data Package 5, include the requirements of paragraphs TELECOMMUNICATIONS DRAWINGS, TELECOMMUNICATIONS SPACE DRAWINGS, and RECORD DOCUMENTATION. Ensure that these drawings and documents depict the as-built configuration. Also provide copies of all telecommunications manuals to TSD.

1.10.2 Record Documentation

Provide T5 drawings including documentation on cables and termination hardware in accordance with TIA-606. T5 drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts and cover plate assignments, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided in hard copy format and on electronic media (PDF and AutoCAD 2016 format). Provide the following T5 drawing documentation as a minimum:

- a. Cables - A record of installed cable shall be provided in accordance with TIA-606. The cable records shall include only the required data fields in accordance with TIA-606. Include manufacture date of cable with submittal.
- b. Termination Hardware - A record of installed patch panels, cross-connect points, distribution frames, terminating block arrangements and type, and outlets shall be provided in accordance with TIA-606. Documentation shall include the required data fields as a minimum in accordance with TIA-606.

PART 2 PRODUCTS

2.1 COMPONENTS

Components shall be UL or third party certified. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations, submit proof of such compliance. The label or listing by the specified organization will be

acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard. Provide a complete system of telecommunications cabling and pathway components using star topology. Provide support structures and pathways, complete with outlets, cables, connecting hardware and telecommunications cabinets/racks. Cabling and interconnecting hardware and components for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70 and conform to the requirements specified herein.

2.2 TELECOMMUNICATIONS PATHWAY

Provide telecommunications pathways in accordance with TIA-569 and as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Provide system furniture pathways in accordance with UL 1286.

2.2.1 Pathways Aboard Camp Lejeune Greater Area, Including MCAS New River

Pathway shall be conduit, cable tray, or modular access flooring that provides protection for cabling. Under floor duct, free laying and wireway shall not be used. Cantilever-type center hung tray or Poke-Thru devices shall not be used. J-hooks/D-rings/bridal rings and other open face type cable pathways are not authorized except in minor renovations or to continue like existing system. Provide grounding and bonding as required by TIA-607. Cable tray wiring shall comply with NFPA 70. All conduits entering the communications room shall be grouped and consolidated. Conduits can be "Home Run" or stubbed to cable tray using approved pull boxes after every 180 degrees of bends or every 100 feet. All homerun conduits shall have insulated bonding bushings in the TR, and shall extend down from the ceiling to within 3 to 4 inches of the ladder rack, or 3 to 6 inches onto the backboard, and shall be bonded to the TMGB or TGB by a minimum 6 AWG green sheathed, copper stranded bonding conductor. All penetrations will be sealed in accordance with code (fire-stopping). A minimum of two 3 inch conduits overhead will be installed between the main communications room and other communication rooms (IDFs); if installed below slab they are considered OSP and will have a minimum of three 4-inch pathways; refer to Section 33 82 00 TELECOMMUNICATIONS, OUTSIDE PLANT (OSP). Distribution Enclosures shall not be used as a pull box and will only be approved for their intended use.

2.2.2 Work area Pathways

Comply with TIA-569, except minimum 1 1/4 inch diameter conduit shall be used. System furniture pathways shall comply with UL 1286. In system furniture that blocks access to or is distant from the communications wall outlets, each system furniture desk/cubical shall be equipped with listed manufacturer telecommunication raceway and outlets. All system furniture outlets shall be extended from a consolidation point (CP) to the system furniture outlet locations, and shall comply with TIA-568-C.1 through TIA-568-C.3. When office reconfiguration will be frequent, a multi-user terminal outlet assembly (MUTOA) may be used in lieu of a CP.

2.2.3 Pull Boxes

Pull boxes shall be constructed of galvanized sheet steel with

screw-fastened covers. Size pull boxes per TIA-569, except a 5 inches wide by 5 inches in length by 2 7/8 inches deep telecommunications box may be used for individual 1 1/4 inch diameter conduit runs. Provide pull boxes where length of conduit exceeds 100 feet or where more than 180 degree of cumulative bends occur. Align conduit ends on opposite sides of pull boxes as a straight pull through. Provide pull boxes in straight lengths of conduit only; direction changes in pull boxes are authorized. Electrical pull points, LC, LB, condulets, distribution enclosures, and splice boxes, are not pull boxes and are not authorized.

2.2.4 Consolidation Points

Consolidation Points (CP) shall be used when system furniture will be installed. CP's shall not support more than 12 work areas. CP's shall be centrally located permanent area, near the work area served, fully accessible, and should be located at least 50 feet from the FD when used for balanced twisted pair cabling. CP's shall be installed per TIA-569, except a S210 interface is required.

2.3 TELECOMMUNICATIONS OUTLET BOXES

Communications outlet boxes shall be placed in all work areas and any areas that can be converted to work areas. Work areas shall have an outlet connection within 6 feet'. Recommended practice is 6" to the left or right of (the outside edge of) each electrical outlet box in workable office areas or any area that could be converted into workable office area such as a large storage closet. Conference rooms should have one floor box and one box just above the ceiling. All administrative areas shall have a minimum of one ceiling mounted outlet box every 5,000 square feet of open administrative space for wireless LAN deployment. Additional boxes may be required where building composition prohibits wireless LAN coverage. Boxes shall be standard type 5 inches square by 2-7/8 inches deep with 1-1/4 inch diameter knock-outs, with a double gang to single gang reducer ring. Mount flush on finished walls/ceilings or just above ceiling tile for grid ceilings, height indicated by drawings. Outlet boxes for wall-mounted telephones shall be mounted at ADA required height. Outlet boxes for work counter area shall be mounted at a height 48 inches above finished floor, or other appropriate height as required. Install outlet boxes for security cameras, televisions, wall monitors, etc. at height indicated in drawings. Outlet boxes installed in floor shall be communications floor boxes large enough to support a surge of users with proper cable protection and ports that are in multiples of 4 and not parallel to the floor. For raised access flooring, boxes shall be below the floor with an access cover flush with the floor. Tombstones or boxes below floor that require removal of the floor panels to access are not allowed. Floor boxes and under slab cabling should not be used on the first floor or in wet areas; tele electric poles or furniture managed pathways fed from above the wet area should be used. Multi-user Telecommunications Outlet Assembly i.e. Multi-User Terminal Outlet Assemblies (MUTOA) should be placed where best suited for open office spaces may be frequently reconfigured.

2.4 TELECOMMUNICATIONS CABLING

Cabling shall be UL listed for the application and shall comply with TIA-568-C.0, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3 and NFPA 70. Provide a labeling system in accordance with the manufacturer and local AHJ guidance for cabling as required by TIA-606 and UL 969. Confirm labeling is compatible with Camp Lejeune requirements. Ship cable on reels or in

boxes bearing manufacture date for unshielded/shielded twisted pair (UTP/STP) in accordance with ICEA S-90-661 and optical fiber cables in accordance with ICEA S-83-596 for all cable used on this project. Cabling manufactured more than 12 months prior to date of installation shall not be used.

2.4.1 Backbone Cabling

2.4.1.1 Backbone Copper

Copper backbone and riser cable shall be solid conductor, 24 AWG, 100 ohm, 25 to 100 -pair, Category 3, UTP, in accordance with ICEA S-90-661, TIA-568-C.1, TIA-568-C.2 and UL 444, formed into 25 pair binder groups covered with a gray thermoplastic jacket and overall metallic shield if required for additional protection. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) at regular length marking intervals in accordance with ICEA S-90-661. Sufficient pair count of CAT 3 or 5, as required shall be installed between the MDF and each of the IDF's. Provide plenum (CMP), riser (CMR), or non-jell filled indoor/outdoor communications rated cabling in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70. If under slab it is considered Outside Plant shall be installed per Section 33 82 00 TELECOMMUNICATIONS, OUTSIDE PLANT (OSP) with proper surge protection at both ends.

2.4.1.2 Backbone Optical Fiber

Provide in accordance with ICEA S-83-596, TIA-568-C.3, UL 1666 and NFPA 70. Cable shall be imprinted with fiber count, fiber type and aggregate length at regular intervals not to exceed 40 inches.

Provide the number of strands indicated, (but not less than 12 strands between the main telecommunication room and each of the other telecommunication rooms or secure racks), of single-mode(OS1), tight buffered fiber optic cable.

Provide tight buffered fiber optic multimode, 62.5/125-um diameter(OM1) cable, conforming to TIA-492AAAA as indicated (but not less than 12 strands of multimode between the main communication room and each of the other communications rooms and secure racks).

Provide plenum (OFNP), riser (OFNR), or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70. The cable cordage jacket, fiber, unit, and group color shall be in accordance with TIA/EIA-598.

Provide plenum (OFNP), riser (OFNR), or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70. The cable cordage jacket, fiber, unit, and group color shall be in accordance with TIA/EIA-598.

2.4.2 Horizontal Cabling

Provide horizontal cable in compliance with NFPA 70 and performance characteristics in accordance with TIA-568-C.1.

2.4.2.1 Horizontal Copper

Provide a minimum of four horizontal copper cables to each work area outlet (faceplate), minimum size 24 AWG conductors, 100 ohm, Category 6 or 6A, with green thermoplastic jacket for all unclassified outlets (color and cable type for classified services shall be in accordance with current CNSSAM TEMPEST RED/BLACK Installation documentation including Table 1 below) in accordance with TIA-568-C.2, UL 444, ANSI/NEMA WC 66, ICEA S-90-661. Cable shall be imprinted with manufacturers name or identifier, flammability rating, gauge of conductor, transmission performance rating (category designation) and length marking at regular intervals in accordance with ICEA S-90-661. Provide plenum (CMP), riser (CMR), or general purpose (CM or CMG) communications rated cabling in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70. Cables installed in conduit within and under slabs are not recommended but can be used if approved by local AHJ and shall be UL listed and labeled for wet locations in accordance with NFPA 70. Contact AHJ for special requirements on classified service, unofficial service, under slab cabling, using water block, and any item not covered in this document.

Communications CAT 6 twisted pair shall have a minimum of 12 inches of available slack at the communications outlet boxes. Minimum manufacturer's bend radius for each type of cable shall be maintained. All communications work area outlet boxes should have 4 cables to a double gang box (no rough in or empty conduit for future use allowed).

Table 1 - (U/FOUO) Cable Color Scheme

<u>Classification Level</u>	<u>Cable Color</u>
Unclassified	Green
Collateral Confidential	Blue
Collateral Secret	Red
Collateral Top Secret	Orange
Special Category	Yellow

2.4.2.2 Horizontal Optical Fiber

Provide optical fiber horizontal cable in accordance with ICEA S-83-596 and TIA-568-C.3. Cable shall be tight buffered, multimode, 62.5.125-um diameter, OM1 or single-mode, 8/125-um diameter, OS1. Cable shall be imprinted with manufacturer, flammability rating and fiber count at regular intervals not to exceed 40 inches.

Provide plenum (OFNP), riser (OFNR), or general purpose (OFN or OFNG) rated non-conductive, fiber optic cable in accordance with NFPA 70. Substitution of a higher rated cable shall be permitted in accordance with NFPA 70. Cables installed in conduit within and under slabs shall be UL listed and labeled for wet locations in accordance with NFPA 70. The cable jacket shall be of single jacket construction with color coding of cordage jacket, fiber, unit, and group in accordance with TIA/EIA-598.

2.4.3 Work Area Cabling (Equipment Cables)

2.4.3.1 Work Area Copper

Provide work area copper cable in accordance with TIA-568-C.2, with a green thermoplastic jacket for unclassified services (classified color code shall be in accordance with current CNNSSAM TEMPEST RED/BLACK Installation documentation and Section 2.4.2.1 of this specification).

2.4.3.2 Work Area Optical Fiber

Provide optical work area cable in accordance with TIA-568-C.3.

2.5 TELECOMMUNICATIONS SPACES

Provide connecting hardware and termination equipment in the telecommunications entrance facility and telecommunication equipment rooms to facilitate installation as shown on design drawings for terminating and cross-connecting permanent cabling. Provide telecommunications interconnecting hardware color coding in accordance with TIA-606.

Space shall be a minimum 8' x 10' unless a local waiver is provided by the AHJ (authority having jurisdiction) which is the Telecommunications Support Division (TSD) aboard Camp Lejeune. Communications room could be much larger depending on building size, usable square footage served, and customer requirements. Communications rooms shall be centrally located unless there are multiple Communication rooms, and then each room should be centrally located within the area served. Communications Rooms shall not share or be on a wet wall. Generally, the space should be sized to approximately 1.1 percent of the area it serves. For example, a 10,000 sq feet (929 sq m) area should be served by a minimum of one 10 ft x 11 feet (3 m x 3.4 m) Communications room. Access to Rooms shall be from a common area such as a hallway and door shall swing out. Additional/Multiple communications rooms are required if the usable floor space to be served exceeds 10,000 square feet, or the cable length between the horizontal cross-connect and the communications outlet, including slack and vertical distance, exceeds 295 feet. Multiple communications rooms and IDFs shall be stacked and connected by a minimum of two way 3-inch conduits overhead. If under slab it is considered Outside Plant and 3 way 4" shall be used per Section 33 82 00 TELECOMMUNICATIONS, OUTSIDE PLANT (OSP) with proper surge protection at both ends. The minimum clear height in the room shall be 2.4 m (8 ft) without obstructions. The height between the finished floor and the lowest point of the ceiling should be a minimum of 3 m (10 ft) to accommodate overhead pathways. The flooring shall be sealed concrete to reduce dust and static electricity; no carpet or VCT tile. Two separate dedicated 20 amp electrical outlet will be installed above or behind but not attached to each communications equipment rack. Dedicated outlets and conduits shall be installed on the longest farthest wall from the door, same wall as the communications backboard. OSP conduits shall be to the far left of the communications backboard while facing it. There should not be an electrical panel within the communications room unless it serves only the room, and it should be located as close to the door as possible. The room requires a lockable door keyed or key padded to restrict access to MCIEAST-MCB G-6 personnel only. Room shall not have any windows or skylights. At least one wall, where the point of presence is located, and two adjacent walls should be

covered with fire rated plywood backboard for mounting equipment; additional boards may be needed for mounting additional equipment. Light, as measured within the communications room, should be a minimum of 500 lx (50 foot-candles). Lighting design should seek to minimize shadows within the telecommunications room (minimum two light fixtures). Equipment not related to the support of the communications room (e.g., piping, ductwork, pneumatic tubing) shall not be installed in, pass through, or enter the telecommunications room. Equipment related to the support of the telecommunications room (e.g., piping, ductwork, HVAC drains, dedicated power) shall be installed in support of the communications equipment and not pose a drip/moisture/trip hazard and be usable as intended.

2.5.1 Backboards

Provide void-free, interior grade A-C plywood 3/4 inch thick 4 by 8 feet as indicated. Backboards shall be fire rated by manufacturing process. Fire stamp shall be clearly visible. Backboards shall be provided on a minimum of one telecom wall, two adjacent walls, and anywhere mounting is needed in the telecommunication spaces.

2.5.2 Equipment Support Frame

Provide in accordance with ECIA EIA/ECA 310-E and UL 50. Steel construction shall be treated to resist corrosion.

- a. Bracket, wall mounted (for buildings with very low jack/pair count and no secured electronic equipment requirement), 8 gauge aluminum minimum. Provide hinged bracket compatible with 19 inches panel mounting and must be in a secured communications room.
- b. Racks, wall or floor mounted modular type, 16 gauge steel construction minimum, treated to resist corrosion. Provide rack with vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug and a surge protected power strip with 6 duplex 20 amp receptacles. Racks shall be large enough to support all telephone/data equipment required plus 25 percent spare and shall have a maximum of 7' height. Rack shall be compatible with 19 inches panel mounting and must be in a secured communications room.
- c. Cabinets, freestanding modular type, 16 gauge steel or 11 gauge aluminum construction minimum, treated to resist corrosion. Cabinet shall have removable and lockable side panels, front and rear doors, and have adjustable feet for leveling. All cabinets shall be keyed to current TSD key and large enough to support all telephone/data equipment required in the building plus 25% for future expansion. Dedicated electrical outlets should be installed within the cabinet. A backboard for mounting equipment is still needed when a cabinet is installed. Cabinet shall be mounted to the far right of the board to allow space for OSP cable, lightning protection, and bus bar to be installed on the board's far left. Dedicated power shall be within the cabinet on the backboard. Cabinet shall be vented in the roof and rear door. Cabinet shall have cable access in the roof and base and be compatible with 19 inches panel mounting. Provide cabinet with grounding bar, 550 CFM fan with filter and a surge protected power strip with 6 duplex 20 amp receptacles. All cabinets shall be keyed alike.
- d. Cabinets, wall-mounted modular type, 16 gauge steel or 11 gauge aluminum construction minimum, treated to resist corrosion. Cabinet

shall have lockable front and rear doors, louvered side panels, 250 CFM fan, ground lug, and top and bottom cable access. Cabinets shall be no smaller than 24"W X 48"H X 30"D, shall be keyed to current TSD key, and large enough to support all telephone/data equipment required in the building plus 25% for future expansion. Dedicated electrical outlets should be installed within the cabinet. A backboard for mounting equipment is still needed when a cabinet is installed. Cabinet shall be mounted to the far right of the board to allow space for OSP cable, lightning protection, and bus bar to be installed on the board's far left. Cabinet shall be compatible with 19 inches panel mounting. All cabinets shall be keyed alike. A surge protected power strip with 6 duplex 20 amp receptacles shall be provided within the cabinet.

2.5.3 Connector Blocks

Voice riser shall be terminated on angled insulation displacement connector (IDC), Type 110, 50 pair, 89D style mounted blocks, compatible with industry standard 110 blade punch down tool, designed for Category 3 and higher systems. Provide 50 pair blocks for the number of riser and backbone cables terminated plus 25 percent spare. Also provide sufficient blocks for cross connects for all IDFs. Blocks shall be mounted on an 89D style bracket on a frame, in rack or in cabinet.

2.5.4 Building Protector Assemblies

Building protector assembly is required on all OSP cables and shall have 710 type connector blocks for connection to the exterior cable at full capacity. M150-66 type IDC for connection to the voice cross connect blocks. 110 type IDC is not approved on building protector assembly. For Central office Area Distribution Nodes a R399 type central office protector shall be used.

2.5.5 Cable Guides

Provide cable guides specifically manufactured for the purpose of routing cables, wires and patch cords horizontally and vertically on 19 inches equipment racks, cabinets, and telecommunications backboards. Cable guides of ring or bracket type devices mounted on rack, cabinet, panels, and backboard for horizontal cable management and individually mounted for vertical cable management. Mount cable guides with screws, or nuts and lockwashers. Cable guides are not to be used outside of the communications room.

2.5.6 Patch Panels

Provide capacity for the number of horizontal and backbone cables terminated on the panel plus 25 percent spare. Provide factory terminated SC type SM optical fiber patch cables and factory terminated CAT 6 stranded copper patch cables for patch panels. Provide patch cords as complete assemblies of various appropriate lengths and with matching connectors and sheath color matched to network in Section 2.4.2.1. Provide fiber optic patch cables with crossover orientation in accordance with TIA-568-C.3. Patch cords shall meet minimum performance requirements specified in TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3 for cables, cable length and hardware specified. Classified service may require shielded jack sets and panels as approved by AHJ.

2.5.6.1 Modular to 110 Block Patch Panel

Provide in accordance with TIA-568-C.1 and TIA-568-C.2. Panels shall be third party verified and shall comply with ANSI/TIA Category 6/6A requirements. Panel shall be constructed of 0.09 inches minimum aluminum and shall be cabinet/rack mounted and compatible with an ECIA EIA/ECA 310-E 19 inches equipment rack. Panel shall support connectors that comply with ANSI/TIA-568-C.2, Category 6 UTP requirements Connectors/Outlets shall be UL2043 listed, non-keyed, compatible with RJ-45 and RJ-11 plugs, glass-reinforced nylon housing, pass through mounting from the front or rear of the patch panel, with enclosed IDC termination and color-coded for both T568A and T568B wiring. Connectors shall be color matched to network type in Section 2.4.2.1 unless specified otherwise and approved by AHJ Each outlet/connector shall be terminated T568A. The rear of each panel shall have incoming cable strain-relief and routing guides. DO NOT USE ZIP TIES ON STRAIN-RELIEF GUIDES. Panels shall have each port factory numbered and be equipped with laminated plastic nameplates above each port. Labeling shall comply with Section 3.2 of this specification.

2.5.6.2 Fiber Optic Patch Panel

Provide panel for maintenance and cross-connecting of optical fiber cables. Panel shall be constructed of 16 or 18 gauge steel or 11 gauge aluminum minimum and shall be cabinet/rack mounted and compatible with a ECIA EIA/ECA 310-E 19 inches equipment rack. Each panel shall provide multimode/single-mode adapters as required in duplex SC in accordance with TIA/EIA-604-3 with zirconia ceramic alignment sleeves. Provide dust cover for unused adapters. The rear of each panel shall have a cable management tray a minimum of 8 inches deep with removable cover, incoming cable strain-relief and routing guides. Panels shall have each adapter factory numbered and be equipped with laminated plastic nameplates above each adapter. When populating the panel working left to right start with OSP feed, SM ISO to IDF, MM ISO to IDF, lastly row to row within same comm room.

2.5.7 Optical Fiber Distribution Panel

Cabinet/rack mounted optical fiber distribution panel (OFDP) shall be constructed in accordance with ECIA EIA/ECA 310-E utilizing 16 or 18 gauge steel or 11 gauge aluminum minimum. Panel shall be divided into two sections, distribution and user. Distribution section shall have strain relief, routing guides, splice tray and shall be lockable. User section shall have a cover for patch cord protection. Each panel shall provide multimode and single-mode pigtails and adapters as required. Provide adapters as duplex SC with zirconia ceramic alignment sleeves. Provide dust covers for adapters. Provide patch cords as specified in the paragraph PATCH PANELS. When populating the panel working left to right start with OSP feed, SM ISO to IDF, MM ISO to IDF, lastly row to row within same communications room.

2.6 TELECOMMUNICATIONS OUTLET/CONNECTOR ASSEMBLIES

2.6.1 Outlet/Connector Copper

Outlet/connectors shall comply with FCC Part 68, TIA-568-C.1, and ANSI/TIA-568-C.2, Category 6 UTP requirements. Outlet/connectors shall be UL 2043 listed, non-keyed, compatible with RJ-45 and RJ-11 plugs, rated for 2500 plug mating cycles, glass-reinforced nylon housing, pass through mounting from the front or rear of the faceplate, with enclosed IDC

termination and color-coded for both T568A and T568B wiring. Connectors shall be color matched to network type in Section 2.4.2.1 unless specified otherwise and approved by AHJ. Each outlet/connector shall be terminated 568A. UTP outlet/connectors installed in outdoor or marine environments shall be rated for the environmental conditions.

2.6.2 Optical Fiber Adapters(Couplers)

Provide optical fiber adapters suitable for duplex SC in Accordance with TIA/EIA-604-3 with zirconia ceramic alignment sleeves, as indicated. Provide dust cover for adapters. Optical fiber adapters shall comply with TIA-455-21 for 500 mating cycles.

2.6.3 Optical Fiber Connectors

Provide in accordance with TIA-455-21. Optical fiber connectors shall be duplex SC in accordance with TIA/EIA-604-3 with zirconia ceramic ferrule, epoxyless crimp style compatible with 62.5/125 multimode and 8/125 single-mode fiber. The connectors shall provide a maximum attenuation of 0.3 dB at 850/1300 and 1310/1550 nm with less than a 0.2 dB change after 500 mating cycles.

2.6.4 Cover Plates

Telecommunications cover plates shall comply with UL 514C, and TIA-568-C.1, TIA-568-C.2, ; flush or oversized design constructed of high impact thermoplastic material, color to match the network color designation in Section 2.4.2.1, or as otherwise specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM and authorized by the AHJ.. Provide labeling in accordance with the paragraph LABELING in this section. Additionally, outlet cover plate coloring shall be specified in design, and may be required to match the network color designation in Section 2.4.2.1 of this specification.

2.7 MULTI-USER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

Provide MUTOA(s) in accordance with TIA-568-C.1. Ensure proper separation from other networks and power.

For Modular Furniture, provide horizontal cabling from the MUTOA to an adaptor plate in the Modular Furniture. The MUTOA should be limited to serving a maximum of six work areas with 2 cables each for a total of 12 cables.

2.8 TERMINAL CABINETS

Construct of zinc-coated sheet steel, 36 by 24 by 6 inches deep, as indicated. Trim shall be fitted with hinged door and locking latch. Doors shall be maximum size openings to box interiors. Boxes shall be provided with 5/8 inch backboard with two-coat varnish finish. Match trim, hardware, doors, and finishes with panelboards. Provide label and identification systems for telecommunications wiring and components consistent with TIA-606.

2.9 GROUNDING AND BONDING PRODUCTS

Provide in accordance with UL 467, TIA-607, and NFPA 70. Components shall be identified as required by TIA-606. Provide ground rods, bonding conductors, and grounding busbars as specified in Section 26 20 00

INTERIOR DISTRIBUTION SYSTEM. The preferred ground for the Telephone Main Grounding Bus (TMGB) bar will be to the Main electrical Distribution Panel (MDP) bus bar and building steel. In most cases, but not all; a #6 AWG bonding conductor is recommended for telecommunications. All grounding and bonding conductors within the Telecommunications room will be green sheathed copper conductor, stranded, and labeled as suitable for use as such and tagged "DO NOT REMOVE". All grounding and bonding conductors running out of the Telecommunications room should be protected in conduit or attached to the outside of the cable tray and sized according to references. The minimum size of the TMGB shall be no smaller than 4" by 10" by 1/4 inch thick; bus bar should be factory made and factory drilled, not fabricated or drilled onsite. All bonding and grounding terminations shall be irreversible and secured with a double hole crimp termination. Do not exceed minimum bend radius on bonding and grounding conductors. Mount Bus Bar to far left of telecom backboard at approximately 70" AFF.

2.10 FIRESTOPPING MATERIAL

Provide as specified in Section 07 84 00 FIRESTOPPING.

2.11 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.12 FIELD FABRICATED NAMEPLATES

ASTM D709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inches thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inches high normal block style.

2.13 TESTS, INSPECTIONS, AND VERIFICATIONS

2.13.1 Factory Reel Tests

Provide documentation of the testing and verification actions taken by manufacturer to confirm compliance with TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-526-7 for single mode optical fiber, and TIA-526-14 for multimode optical fiber cables.

PART 3 EXECUTION

3.1 INSTALLATION

Install telecommunications cabling and pathway systems, including the horizontal and backbone cable, pathway systems, telecommunications outlet/connector assemblies, and associated hardware in accordance with NECA/BICSI 568, TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-569, NFPA 70, manufacturer instructions, current industry best practices, and UL standards as applicable. Provide cabling in a star topology network. Provide residential cabling in a star wiring architecture from the distribution device as required by TIA-570. Pathways and outlet boxes

shall be installed as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Standard type 5" x 5" x 2 7/8" square boxes with a single gang plaster ring shall be used except in concrete or concrete masonry units where a standard 4 11/16" square or a floor box will be used. Mount flush in finished walls at height indicated by drawings and with proper clearances from other networks and power systems. Depth of boxes shall be large enough to allow manufacturer's recommended conductor bend radii, normally 2 7/8" depth. Install telecommunications cabling with copper media in accordance with the following criteria to avoid potential electromagnetic interference between power and telecommunications equipment. The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the telecommunications cabling (normal minimum clearance distances of 4 feet from motors, generators, frequency converters, transformers, x-ray equipment or uninterrupted power system, 300 mm (12 in) from power conduits and cable systems, 125 mm (5 inches) from fluorescent or high frequency lighting system fixtures). Cabling shall be run with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

3.1.1 Cabling

Install UTP/STP, and optical fiber telecommunications cabling system as detailed in TIA-568-C.1, TIA-568-C.2, TIA-568-C.3 and TIA-570 for residential cabling. Screw terminals shall not be used except where specifically indicated on plans. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations. Do not untwist Category 6 UTP cables more than 1/2" (12 mm) from the point of termination to maintain cable geometry. Provide service loop on each end of the cable, minimum 10' (3 meters) in the telecommunications room, 6" (150mm) in or close to the work area outlet for UTP. Do not exceed manufacturers' cable pull tensions for copper and optical fiber cables. Provide a device to monitor cable pull tensions. Do not exceed 25 pounds pull tension for four pair copper cables. Do not chafe or damage outer jacket materials. Use only lubricants approved by cable manufacturer. Do not over cinch cables, or crush cables with staples. Only hook and loop fasteners are allowed on Category 6/6A cable and optical fiber cable. DO NOT USE ZIP TIES. For UTP cable, bend radii shall not be less than four times the cable diameter. Cables shall be terminated; no cable shall contain unterminated elements (See NFPA 70 abandoned cabling). Cables shall not be spliced. Label cabling in accordance with paragraph LABELING in this section.

3.1.1.1 Open Cable

Use only where specifically indicated on plans or use in cable trays, or below raised floors in approved pathway (cable free laid on floor is not authorized). Install in accordance with TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3. Do not exceed cable pull tensions recommended by the manufacturer. Copper cable not in a wireway or pathway shall be suspended a minimum of 8 inches above ceilings by cable supports no greater than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided.

Plenum cable shall be used where open cables are routed through plenum areas. Cable routed exposed under raised floors shall be plenum rated.

Plenum cables shall comply with flammability plenum requirements of NFPA 70. Install cabling after the flooring system has been installed in raised floor areas. Cable 6 feet long shall be neatly coiled not less than 12 inches in diameter below each feed point in raised floor areas.

3.1.1.2 Backbone Cable

- a. Copper Backbone Cable. Install intrabuilding backbone copper cable, in minimum 2-way 3 inch overhead conduit or larger in indicated pathways, between the campus distributor, located in the telecommunications entrance facility or room, the building distributors and the floor distributors located in telecommunications rooms and telecommunications equipment rooms as indicated on drawings.
- b. Optical fiber Backbone Cable. Install intrabuilding backbone optical fiber in indicated pathways (normally in one of multiple inner ducts installed in conduit so as to maximize pathways). Do not exceed manufacturer's recommended bending radii and pull tension. Prepare cable for pulling by cutting outer jacket 10 inches leaving strength members exposed for approximately 10 inches. Twist strength members together and attach to pulling eye. Vertical cable support intervals shall be in accordance with manufacturer's recommendations.

3.1.1.3 Horizontal Cabling

Install horizontal cabling as indicated in the specification and on drawings. Do not untwist Category 6 UTP cables more than one half inch from the point of termination to maintain cable geometry. Provide slack cable in the form of a figure eight or large service loop on each end of the cable (prevent inductance caused by small coils), 10 feet in the telecommunications room, and 12 inches in the work area outlet.

3.1.2 Pathway Installations

Provide in accordance with TIA-569 and NFPA 70, except that 1 1/4 inch diameter conduit from cable tray or telecommunication room backboard to each work area outlet is required. Provide building pathway as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

Conceal conduit within finished walls, ceilings, and floors (not in wet areas). Keep conduit minimum 12 inches away from parallel runs of electrical power equipment, flues, steam, light ballast, and hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit is visible after completion of project. Run conduits in crawl spaces as if exposed. Install no more than two 90 degree bends for a single horizontal cable run. All bends/turns in conduits will be in straight runs of conduit; a pull box shall be installed after every 180 degrees of bends or 100'; in no case will a turn be made within a pull box. The minimum size for a pull box for a single 1 1/4" conduit will be 5" long by 5" wide by 2 7/8" deep, and for a 3" conduit 30"W x 54"L x 9"D. All conduits shall contain an insulated bushing at each end to protect the cable from damage and required bonding. Pull points, LC, LB, and condulets are not authorized.

Under floor cabling, under floor duct, and conduit under floor slabs should be avoided in the Camp Lejeune Greater area due to wet area close to coastal waters.

3.1.3 Service Entrance Conduit, Overhead

Provide service entrance overhead as specified in this section and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEMS.

Ensure entrance fitting or weather head is sized to ensure min bend radius for largest cable is maintained.

3.1.4 Service Entrance Conduit, Underground

Provide service entrance underground as specified in this section and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

Underground portion shall be encased in minimum of 3 inches of concrete extending from the building entrance to OSP demarcation point and shall be a minimum of 18 inches below slab or grade. Location of entrance conduit in communications room shall be to the left of the longest furthest wall from the door.

3.1.5 Cable Tray Installation

Install cable tray as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Only CMP and OFNP type cable shall be installed in a plenum.

A continuous stranded bonding conductor shall be run on the outside along the tray tapped to each section of tray with a listed connector to ensure bonding. Remove all sharps from cable tray and pathways. Ensure bonding is on the pathway so as not to obstruct horizontal cabling. Maintain proper clearance and work space per TIA-569 and TEMPEST.

3.1.6 Work Area Outlets

3.1.6.1 Terminations

Terminate UTP cable in accordance with TIA-568-C.1, TIA-568-C.2 and wiring configuration as specified. Terminate fiber optic cables in accordance with TIA-568-C.3.

All work areas will contain a minimum of two work area outlets . Any work area larger than 80 sq feet will require additional work area outlets to service any work location in the room within 6 feet of an electrical outlet. This also applies to any area that could be converted to work space in the future. Recommend one work area outlet box be placed 6" to the left or right of every electrical outlet in a usable space. All work area face plates shall contain four category 6 jacks as specified herein, terminated T568A configuration unless otherwise approved by AHJ. MUTOAs contain 12 cables and may require additional clearance and power. All other outlets shall contain a minimum of 2 Category six jacks, with the exception of single jack wall phone studded faceplates.

3.1.6.2 Cover Plates

As a minimum, each outlet/connector shall be labeled as to its function and a unique number to identify cable link in accordance with the paragraph LABELING in this section. (For secured networks contact AHJ as shielded twisted pair and color coded face plates may be necessary.)

3.1.6.3 Cables

Unshielded/shielded twisted pair and fiber optic cables shall have a minimum of 12 inches of available service slack loosely coiled into the telecommunications outlet boxes or in cable tray as close as possible to outlet box. Minimum manufacturer's bend radius for each type of cable shall not be exceeded.

3.1.6.4 Pull Cords

Pull cords shall be installed in conduit serving telecommunications outlets that do not have cable installed (this is not normal as all outlets should be cabled).

3.1.6.5 Multi-User Telecommunications Outlet Assembly (MUTOA)

Run horizontal cable per specifications and terminate cables in a MUTOA in each system furniture zone. MUTOAs shall not be located in ceiling spaces, or any obstructed area. MUTOAs shall not be installed in furniture unless that unit of furniture is permanently secured to the building structure. MUTOAs shall be located in an open work area so that each furniture cluster is served by at least one MUTOA. The MUTOA shall be limited to serving a maximum of six work areas with 2 cables each for a total of 12 cables/12 ports. Maximum work area cable length requirements shall also be taken into account. MUTOAs must be labeled to include the maximum length of work area cables. MUTOA labeling is in addition to the labeling described in TIA-606, or other applicable cabling administration standards. Work area cables extending from the MUTOA to the work area device must also be uniquely identified and labeled.

3.1.7 Telecommunications Space Termination

Install termination hardware required for Category 6 and optical fiber system. A single punch manufacture approved insulation displacement tool shall be used for terminating copper cable to insulation displacement connectors.

3.1.7.1 Connector Blocks

Connector blocks shall be cabinet/rack mounted, as approved by the AHJ, in orderly rows and columns. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks. Install in accordance with industry standard wire routing guides in accordance with TIA-569.

3.1.7.2 Patch Panels

Patch panels shall be mounted in equipment cabinets/racks with sufficient ports to accommodate the installed cable plant plus 25 percent spares.

- a. Copper Patch Panel. Copper cable entering a patch panel shall be secured to a rear cable manager with hook and loop ties as recommended by the manufacturer to prevent movement of the cable.
- b. Fiber Optic Patch Panel. Fiber optic cable loop shall be 3 feet in length provided as recommended by the manufacturer. The outer jacket of each cable entering a patch panel shall be secured to the panel to prevent movement of the fibers within the panel, using clamps or brackets specifically manufactured for that purpose.

3.1.7.3 Equipment Support Frames

Install in accordance with TIA-569:

- a. Bracket, wall mounted. Mount bracket to right on plywood backboard in accordance with manufacturer's recommendations. Mount rack so height of highest panel does not exceed 78 inches above floor. Mount so there is sufficient space remaining on backboard to mount lightning protection, bonding, and cable managers or install additional backboards.
- b. Racks, floor mounted modular type. Permanently anchor rack to the floor in accordance with manufacturer's recommendations. Install sections of ladder rack anchored to telephone rack/cabinet and at least two walls.
- c. Cabinets, freestanding modular type. Permanently anchor to the floor in accordance with manufacturer's recommendations. When cabinets are connected together, remove adjoining side panels for cable routing between cabinets. Mount rack mounted fan and 19" power/surge strip in cabinet. Install sections of ladder rack anchored to telephone rack/cabinet and at least two walls.
- d. Cabinets, wall-mounted modular type. Mount cabinet to right on plywood backboard in accordance with manufacturer's recommendations. Mount cabinet so height of highest panel does not exceed 78 inches above floor. Mount so there is sufficient space remaining on backboard to mount lightning protection, bonding, and cable managers or install additional backboards.

3.1.8 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings as specified in Section 07 84 00 FIRESTOPPING.

3.1.9 Grounding and Bonding

Provide in accordance with TIA-607, NFPA 70 and as specified in this section and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM except only two hole irreversible compression lugs will be accepted.

3.2 LABELING

3.2.1 Labels

Provide labeling in accordance with TIA-606 except jacks will be numbered in a logical, sequential, clockwise numbering system from 1 to X with a closet designator. Example would be 145 C 146, would be the 145th & 146th jacks from the C telecom room. All labels shall be numbered with manufacturer's labeling system (not fabricated) and be equipped with laminated plastic cover. All terminations that are not to work area outlets should be in the last patch panel locations and labeled accordingly i.e. DDC, FACP, Elevator, Wall phones, or Wireless access points.

3.2.2 Cable

Cables shall be labeled using color labels on both ends with identifiers

in accordance with TIA-606.

3.2.3 Termination Hardware

Workstation outlets and patch panel connections shall be labeled using manufacturing labeling system, color coded labels with identifiers in accordance with this section and TIA-606. Coordinate with Base Telephone.

3.3 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.3.1 Painting Backboards

Camp Lejeune no longer paints backboards as fire rated plywood is available. Manufactured fire retardant backboard shall be used, so as not to increase flame spread and smoke density and must be appropriately labeled.

3.4 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.5 TESTING

3.5.1 Telecommunications Cabling Testing

Perform telecommunications cabling inspection, verification, and performance tests on both Backbone and Horizontal cabling in accordance with TIA-568-C.1, TIA-568-C.2, TIA-568-C.3 and AHJ local guidance. Test equipment shall conform to TIA-1152. Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.

3.5.1.1 Inspection

Visually inspect all telecommunications cabling jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568A pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, and TIA-570 for residential cabling. Visually confirm Category 6 marking of outlets, cover plates, outlet/connectors, cable physical damage, and patch panels.

3.5.1.2 Verification Tests

Backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after all terminations are complete but prior to being cross-connected.

For multimode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with TIA-568-C.3 and TIA-526-14 using Tier 1 Option

with power meter and light source for optical fiber. Validate/troubleshoot failures with Tier 2 Option. For single-mode optical fiber of sufficient distance (normally OSP), perform optical fiber end-to-end attenuation tests in accordance with TIA-568-C.3 and TIA-526-7 using Tier 2 Option, OTDR for single-mode optical fiber. Perform verification acceptance tests.

3.5.1.3 Performance Tests

Provide summary in .pdf (hard and soft copy) detailed tester results in test format .flw (soft copy only), and fiber power meter/OTDR reports (summary hard copy and detailed soft copy). All Test reports should have a building or project number on it. The final QC and certification of installation will be performed by TSD after the contractor has provided passing and acceptable test results matching work area outlet labels, as-built drawings showing all telecommunications outlets and their labeled designator to include any empty conduit or ports coiled in overhead for future use and all building automated system ports such as DDC, Elevator, FACP, or WAPs. Test results that are marginal may not be accepted. Also fiber tests that pass the link budget but exceed tolerance on any connector or splice are considered a failure. All discrepancies must be repaired and retested.

Perform testing for each outlet and MUTOA as follows:

- a. Perform Category 6 link tests in accordance with TIA-568-C.1 and TIA-568-C.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.
- b. Optical fiber Links. Perform optical fiber end-to-end link tests in accordance with TIA-568-C.3.

3.5.1.4 Final Verification Tests

Perform verification tests for all copper and optical fiber systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

- a. Voice Tests. These tests assume that dial tone service has been installed (normally only done for FACP, Elevator, or emergency phones). Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and DSN telephone call.
- b. Data Tests. These tests assume the Information Technology Staff has a network installed and are available to assist with testing (normally this is only done for VTC, CCTV). Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

-- End of Section --

SECTION 28 31 76.00 22

INTERIOR COMBINATION EMERGENCY COMMUNICATIONS SYSTEMS
04/16

PART 1 GENERAL

1.1 RELATED SECTIONS

Refer to the following sections for related work and coordination:

Section 21 13 13 WET PIPE SPRINKLER SYSTEMS, FIRE PROTECTION
07 84 00 FIRESTOPPING for additional work related to firestopping.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S3.2 (2009; R 2014) Method for Measuring the
Intelligibility of Speech Over
Communication Systems (ASA 85)

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide
<http://www.approvalguide.com/>

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1 (2002; R 2008) Guide on the Surges
Environment in Low-Voltage (1000 V and
Less) AC Power Circuits

IEEE C62.41.2 (2002) Recommended Practice on
Characterization of Surges in Low-Voltage
(1000 V and Less) AC Power Circuits

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 60268-16 (2003; ED 4.0) Sound System Equipment -
Part 16: Objective Rating Of Speech
Intelligibility By Speech Transmission
Index

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 7240-16 (2007) Fire Detection And Alarm Systems -
Part 16: Sound System Control And
Indicating Equipment

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 170	(2015) Standard for Fire Safety and Emergency Symbols
NFPA 241	(2013; Errata 2015) Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 72	(2019; TIA 19-1; ERTA 2019) National Fire Alarm and Signaling Code
NFPA 90A	(2015) Standard for the Installation of Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 1480	(2003; Reprint Oct 2012) Standard for Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
UL 1971	(2002; Reprint Oct 2008) Signaling Devices for the Hearing Impaired
UL 2017	(2008; Reprint May 2011) General-Purpose Signaling Devices and Systems
UL 268	(2009) Smoke Detectors for Fire Alarm Systems
UL 464	(2009; Reprint Apr 2012) Standard for Audible Signal Appliances
UL 521	(1999; Reprint Apr 2015) Heat Detectors for Fire Protective Signaling Systems
UL 864	(2014) Standard for Control Units and Accessories for Fire Alarm Systems
UL Electrical Constructn	(2015) Electrical Construction Equipment Directory
UL Fire Prot Dir	(2015) Fire Protection Equipment Directory

1.3 DEFINITIONS

Wherever indicated in this specification or on the contract drawings, the equipment, devices, and functions shall be defined as follows:

- a. COMBINATION EMERGENCY COMMUNICATIONS SYSTEM: NFPA 72 terminology describing a combination fire alarm and mass notification system where the building mass notification system is integrated with the building fire alarm control unit to form one combined system that performs both functions.

- b. COMBINATION EMERGENCY COMMUNICATIONS SYSTEM PANELS (CECP): Combination Emergency Communications System Panel may consist of separate autonomous control unit and fire alarm control unit supplied from the same or different manufacturers, or a single panel supplied by one manufacturer. Where the term "COMBINATION EMERGENCY COMMUNICATIONS SYSTEM PANEL" or "CECP" is utilized the intent is NOT to limit the designer to one manufacturer or a single enclosure. HOWEVER; whether installed as combined or separate panels or provided by one or separate manufacturers, the panels shall be integrated in their controls and performance to meet the requirements of this section and NFPA 72.
- c. AUTONOMOUS CONTROL UNIT (ACU): The primary control unit for the building mass notification system portion of the CECP. ACU may be physically separate from, or a integral part, of the FACU
- d. FIRE ALARM CONTROL UNIT (FACU): Fire alarm system component portion of the CECP, provided with primary and secondary power sources, which receives signals from initiating devices or other fire alarm control units, and processes these signals to determine part or all of the required fire alarm system output function(s). FACU may be separate from or a portion of the ACU. Where more than one fire alarm control unit is installed in the building, one panel shall be designated as the Master Fire Alarm Control Unit.
- e. SUPPLEMENTARY FIRE ALARM CONTROL PANELS: When necessary multiple interconnected fire alarm control units may be utilized to create a networked system consisting of a master fire alarm control unit and one or more supplementary fire alarm control panels capable of peer to peer communications. Networked panels shall be UL Listed as compatible. Interconnecting separate manufacturers' fire alarm panels or fire alarms panels not capable of peer-to-peer communications is prohibited. The term "supplementary fire alarm control panel" does not refer to releasing service fire alarm panels.
- f. LOCAL OPERATING CONSOLE (LOC): Equipment used by authorized personnel and emergency responders to make live voice building-wide mass notification system messages
- g. SUPPLEMENTARY NOTIFICATION APPLIANCE CIRCUIT(SNAC)and AUXILIARY POWER SUPPLY PANELS: A panel separate from the "combination emergency communications system panel"(s), usually located remote from the main panel(s). SNAC's are utilized to power visual notification appliance circuits and auxiliary power supplies provide supplementary power to devices or functions requiring power in addition to that available from the SLC.
- h. MONITOR MODULE: Term utilized to describe a Signaling Line Circuit Interface as defined by NFPA 72.
- i. CONTROL MODULE AND RELAY MODULE: Terms utilized to describe an "Emergency Control Function Interface" as defined in NFPA 72.
- j. TERMINAL CABINET: A steel cabinet with locking, hinge-mounted door that terminal strips are securely mounted inside. Utilizing tape or glue is not an acceptable means of mounting terminal strips.
- k. TEXTUAL AUDIBLE APPLIANCES: Term utilized by NFPA 72 to describe

speaker appliances. The term "textual audible appliance" is utilized because the term "speaker" might also refer to a person who is speaking.

1.4 SYSTEM DESCRIPTION

1.4.1 Scope

This work includes completion of design and providing a new, complete, modifying the existing combination emergency communications system as described herein and on the contract drawings for BEQ FC530. (one system)

Fire Alarm Control Unit portion shall be an analog/addressable system. Include in the system all necessary wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm, and supervisory signal initiating devices, alarm notification appliances, supervising station fire alarm system transmitter, and other accessories and miscellaneous items required for a complete operating system even though each item is not specifically indicated or described. Provide system complete and ready for operation.

a. Provide equipment, materials, inspection, and testing in strict accordance with the required and advisory provisions of NFPA 72, ISO 7240-16, and IEC 60268-16 except as modified herein. The system layouts on the contract drawings show the intent of coverage and are shown in suggested locations. Final quantity, system layout, and coordination are the responsibility of the Contractor.

1.4.2 Technical Data and Computer Software

Computer software and technical data relating to computer software that are specifically identified in this project, and may be defined/required in other specifications, shall be delivered in accordance with the CONTRACT CLAUSES. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of the contract. The data package shall also include the following listed. Failure to fully comply with the following stipulations shall result in the removal and replacement of the combination emergency communications system at no cost to the Government. Requests for extension of time for any delay to the completion of the project due to the removal, redesign, resubmittal process, and replacement of the original system will not be considered. Liquidated damages shall apply and will be assessed in accordance with the contract clauses.

a. Identification of programmable portions of system equipment and capabilities.

b. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.

c. Provision of operational software data on all modes of programmable portions of the combination emergency communications system.

d. Description of Fire Alarm Control Unit equipment operation.

e. Description of auxiliary and remote equipment operations.

- f. Library of application software.
- g. Operation and maintenance manuals.

1.4.3 Keys

Keys and locks for equipment, panels and devices shall be identical. Provide the Contracting Officer with no less than six (6) keys of each type required. Direct requests for keys from all Government personnel to the Contracting Officer. Under no circumstances shall the contractor provide any keys to the building occupants. If any portion of building is occupied during construction or occupants begin moving into the building prior to project completion, the fire alarm contractor shall remove and secure all keys to the combination emergency communications system. All keys and locks shall be mastered to a single key as required by the AHJ. Keys shall be CAT 60.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for the Prime Contractor Quality Control approval. The Camp LeJeune Fire Protection Engineer shall review and approve all submittals requiring Government approval.

Provide electronic submittals. File format of electronic submittal materials shall be portable document format. No other electronic formats shall be accepted. Catalog data shall be first generation scans or manufacturer's originals. Shop drawings shall be plotted to scale. Scale all line weights. Submittals consisting of illegible pdf's shall be returned disapproved without review. One hard copy review set of the entire package, including full scale shop drawings, shall accompany each submittal for use by the Camp LeJeune Fire Protection Engineer. The single hard copy review set shall be retained by the Government reviewer. The Government reviewer shall digitally stamp, sign and lock the electronic submittal package prior to returning the electronic copy to the Contracting Officer.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Within 36 days of contract award but no less than 14 days prior to commencing any work on site, the Prime Contractor shall submit the following for review and approval:

Qualifications for Fire Alarm System Subcontractor; G

On Staff Fire Alarm System Designer(s); G

Supervising Fire Alarm Technician; G

Installing Technicians; G

Testing Personnel; G

Contractor SD-02,SD-03 & SD-05 submittals received prior to the review and approval of the Qualifications of the Fire Alarm Subcontractor shall be returned Disapproved Without Review. All resultant delays shall be the sole responsibility of the Prime

Contractor.

Contract requirements for the Fire Alarm Contractor to have NICET Certified Fire Alarm Technicians on staff are NOT negotiable. The Prime Contractor's Quality Control Manager shall not endorse nor submit the qualifications for the fire alarm system subcontractor if fire alarm contractor does not have the required NICET Technicians on staff. All resultant delays shall be the sole responsibility of the Prime Contractor.

SD-02 Shop Drawings

Include Annotated catalog data, in table format on the drawings, showing manufacturer's name, model, voltage, and catalog numbers for equipment and components. Submitted shop drawings shall not be smaller than ANSI D (22 in x 34 in).

Wiring Diagrams; G

Provide point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems that are supervised or controlled by the system. Diagrams shall show connections from field devices to the CECP and remote fire alarm control units, initiating circuits, switches, relays and terminals. Point-to-point wiring diagrams shall be job specific. Point-to-point wiring diagrams shall not indicate connections or circuits not being utilized.

Provide complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment. Include a color-code schedule for the wiring. Include floor plans showing the locations of devices, appliances, and equipment.

System Layout; G

Plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, conduit sizes, wire counts, wire color-coding, circuit identification in each conduit, and circuit layouts for all floors. Drawings shall comply with the requirements of NFPA 170, and NFPA 72. Indicate candela rating of each visual notification appliance. Indicate the wattage of each speaker. Clearly identify the locations of isolation modules. Indicate the addresses of all devices, modules, relays, etc.

System Operation; G

A complete list of device addresses, corresponding messages.

Provide a complete description of the system operation in matrix format.

Notification Appliances; G

Provide data on each circuit to indicate that there is at least 25 percent spare capacity on each notification appliance circuit, a 25 percent spare capacity for each supplementary notification appliance circuit panel and auxiliary power supply panel, and 25

percent spare capacity for each signaling line circuit. Annotate data for each circuit on the drawings.

Amplifiers; G

Provide data to indicate the amplifiers have sufficient capacity to simultaneously drive all notification speakers at the wattage setting required to meet intelligibility requirements while maintaining a minimum 25 percent spare capacity. Annotate data for each circuit on the drawings. Contractor shall be responsible for additional and/or larger amplifiers if adjustments during testing to meet intelligibility requirements reduces the spare capacities to less than 25 percent.

As-Built Drawings

Provide four sets of detailed as-built drawings. Furnish four sets of CD or DVD discs containing software backup with CAD-based drawings in latest version of AutoCAD *.dwg format of as-built drawings and schematics. Discs shall also include as-built drawings plotted to scale in *.pdf format along with *.pdf copies of the manufacturer's data, and calculations. The drawings shall include complete wiring diagrams showing point-to-point connections between devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as-built location of devices and equipment. The drawings shall show the system as installed, including deviations from both the contract drawings and the approved shop drawings. These drawings shall be submitted within 14 days after the final acceptance test of the system. At least one copy of the as-built (red-lined) drawings shall be provided at the time of, or prior to, the final acceptance test.

SD-03 Product Data

Provide UL or FM listing cards for equipment provided. Include annotated catalog data, in table format, showing manufacturer's name, model, voltage and catalog numbers for all equipment and components.

Technical Data And Computer Software; G

Fire alarm control unit (FACU); G
Autonomous control unit (ACU); G
Local operating consoles (LOC); G
Amplifiers; G
Digitalized voice generators; G
Supplementary notification appliance circuit panel; G
Auxiliary power supply panel; G
Digital alarm communicator transmitter (DACT); G
Batteries; G
Battery chargers; G
Wiring and cable; G
Surge protection; G
Ceiling bridges for ceiling mounted appliances; G
Back boxes and conduit; G
Notification appliances; G
Addressable monitor module; G
Addressable control/relay module; G
Manual stations; G

Smoke detectors; G
Heat detector; G
Waterflow switches; G
Tamper switches; G
Environmental enclosures or guards; G

Manufacturer's installation and maintenance manuals; G
Provide one copy of the most recent Manufacturer's installation and maintenance manuals for each piece of equipment being installed. This data is necessary for use by Camp LeJeune Fire Protection Engineering when reviewing the contractor's submittal. Manual may be submitted in *.pdf format and submitted directly to Camp LeJeune Fire Protection Engineering.

SD-05 Design Data

System Operation; G

Provide a complete description of the system operation, in matrix format, on the shop drawings.

- a. Verify battery capacity exceeds supervisory and alarm power requirements.
 - 1). Substantiate the battery calculations for alarm, alert, and supervisory power requirements. Ampere-hour requirements for each system component and each panel component, and the battery-recharging period, shall be included.
 - 2). Provide complete battery calculations for both the alarm, alert, and supervisory power requirements. Ampere-hour requirements for each system component shall be submitted with the calculations.
- b. For battery calculations, use the following assumptions: Assume a starting voltage of 24 VDC for starting the calculations to size the batteries. Calculate the required Ampere-hour for the specified standby time, and then calculate the required Ampere-hour for the specified alarm time. Calculate the nominal battery voltage after operation on batteries for the specified time period.

Voltage Drop Calculations; G

Provide voltage drop calculations to indicate sufficient voltage is available for proper operation of the system and all components, at the minimum rated voltage of the system operating on batteries.

Utilize the lump sum method for voltage drop calculations. Assume the entire appliance load is at the end of the circuit (lump sum). Utilize 16 VDC as the operating voltage of the appliances and 21.6 VDC as the voltage at the circuit terminals.

Spare Capacity Calculations; G

Provide calculations verifying the contract stipulated 25 spare capacity is provided for each notification appliance circuit, FACU/ACU, SNAC panel, and auxiliary power supply panel. Also provide a calculation indicating a 25 percent spare capacity is maintained for each SLC.

SD-06 Test Reports

Field Quality Control
Testing Procedures; G
Smoke detector testing procedures; G
Heat detector testing procedures; G

SD-07 Certificates

Installer

SD-09 Manufacturer's Field Reports

Combination emergency communications system panel (CECP)

Provide reports on preliminary tests, include printer information. Include the NFPA 72 Record of Completion and NFPA 72 Inspection and Testing Form, with the appropriate test reports. printer generated data shall consist of a unique identifier for each device, combination emergency communications system panel, initiating device and notification appliance, with an indication of test results, and signature of the factory-trained technician of the control panel manufacturer and equipment installer.

SD-10 Operation and Maintenance Data

Operation and Maintenance (O&M) Instructions; G

Provide one copies of the Operation and Maintenance Instructions, indexed and in booklet form. The Operation and Maintenance Instructions shall be a single volume or in separate volumes, and may be submitted as a Technical Data Package. Manuals shall be approved prior to training.

Original and backup copies of all software delivered for this contract on each type of CD/DVD media utilized.

Provide Operation and Maintenance (O&M) Instructions in electronic format. File format of electronic submittal materials shall be portable document format. No other electronic formats shall be accepted.

Instruction of Government Employees

The installers training history for the employees involved with this contract.

1.6 QUALITY ASSURANCE

1.6.1 Qualifications

1.6.1.1 Qualifications for Fire Alarm System Subcontractor

The Prime Contractor shall be responsible for obtaining the services of a qualified fire alarm system subcontractor for the design and installation of the combination emergency communications system. The firm designated by the Prime Contractor as their qualified fire alarm system subcontractor:

- a. Shall have been in existence a minimum of four years prior to contract award.
- b. Shall provide proof of previous experience installing a system of equal or greater complexity, utilizing the same equipment to be provided under this contract.
- c. Shall provide proof of adequate qualified staffing to meet all of the following requirements:

1.6.1.1.1 On-Staff Fire Alarm System Designer(s)

A qualified fire alarm contractor shall have at least one on staff NICET Level IV SET, (Senior Engineering Technician) fire alarm technician. This technician shall also have proof of factory certified training for the design of the systems utilizing the equipment being installed. The NICET Level IV technician(s) shall be the lead technician responsible for the contractor's design of the combination emergency communications system, including, but not limited to, the selection and design of necessary equipment, battery, power and circuit calculations, provision of the required manufacturers data and the creation and completion of the shop drawings. The submittal materials (drawings, calculations & manufacturer's data) shall bear the stamp and signature of the NICET Level IV technician. RFI's pertaining to the combination emergency communications system shall be reviewed and signed by the NICET Level IV technician prior to submission to the Contracting Officer.

A NICET Level III, ET (Engineering Technician) fire alarm technician may be utilized to create the shop drawings, calculations and submittal material provided the Level III technician is directly supervised by the NICET Level IV technician. The NICET Level IV technician remains responsible for the system design and submittal materials. Both technicians' signatures and stamps shall be included on the submittal material.

1.6.1.1.2 Supervising Fire Alarm Technician

A NICET Level II, AET (Associate Engineering Technician) fire alarm technician with a minimum of 8 years experience shall supervise the installation of the combination emergency communications system. The fire alarm technicians supervising the installation of equipment shall also be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the approved shop drawings. Supervising technician shall be a direct employee of the firm designated by the Prime Contractor as their qualified fire alarm system subcontractor.

1.6.1.1.3 Installing Technicians

The installing Contractor shall provide fire alarm technicians with a minimum of four years of experience utilized to assist in the installation and termination devices, appliances, cabinets and panels. The fire alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the approved shop drawings. Technicians with minimum NICET Level I or II Certification are preferred. Installing technicians shall be direct employees of the firm designated by the Prime Contractor as their qualified fire alarm system subcontractor.

1.6.1.1.4 Testing Personnel

The installing Contractor shall provide Fire Alarm Technicians with a minimum of eight years of experience utilized to test and certify the installation of the combination emergency communications system devices, appliances, cabinets and panels. The fire alarm technicians testing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the approved shop drawings. Testing personnel shall be direct employees of the firm designated by the Prime Contractor as their qualified fire alarm system subcontractor.

1.6.2 Regulatory Requirements

1.6.2.1 Requirements for Fire Protection Service

Equipment and material shall be Listed by UL and listed in UL Fire Prot Dir, UL Electrical Constructn or Approved by FM and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, they shall mean listed in UL Fire Prot Dir or FM APP GUIDE. The omission of these terms under the description of any item of equipment described shall not be interpreted as waiving this requirement. All listings or approval by testing laboratories shall be from an existing ANSI or UL published standard.

1.7 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity, and temperature variation, dirt and dust, and other contaminants.

1.8 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

The combination emergency communications system Operation and Maintenance Instructions shall include:

- a. "Manufacturer Data Package 5" as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. Provide an electronic copy of the OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS
- b. Manufacturer's installation and maintenance manuals outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features.
- c. Maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed.
- d. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements.
- e. Software delivered for this project shall be provided, on CD or DVD discs.
- f. Printouts of configuration settings for all devices.
- g. Routine maintenance checklist. The routine maintenance checklist

shall be arranged in columnar format. The first column shall list all installed devices, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.

1.9 WARRANTY PERIOD REPAIR SERVICE, MAINTENANCE AND ADJUSTMENTS

During guarantee period, the service technician shall be on-site within 24 hours after notification. All repairs shall be completed within 24 hours of arrival on-site. During the guarantee period, the installing fire alarm contractor is responsible for conducting all required testing and maintenance in accordance with the requirements and recommended practices of NFPA 72 and the system manufacturer. Installing fire alarm contractor is NOT responsible for any damage resulting from abuse, misuse or neglect of equipment by the end user

1.10 EXTRA MATERIALS

1.10.1 Repair Service/Replacement Parts

Repair services and replacement parts for the system shall be available for a period of ten years after the date of final acceptance of this work by the Contracting Officer.

1.10.2 Interchangeable Parts

Spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the Contracting Officer at the time of the final acceptance testing.

1.10.3 Spare Parts

Furnish the following spare parts and accessories:

- a. Four fuses for each fused circuit
- b. Two smoke detectors
- c. Two thermal detectors

1.10.4 Special Tools

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Manufacturer

Components shall be of current design and shall be in regular and recurrent production at the time of installation. Provide design, materials, and devices for a combination emergency communications system, complete, conforming to NFPA 72, except as otherwise or additionally

specified herein. Equipment must be compatible with base-wide fire alarm system.

2.1.2 Standard Products

Provide materials, equipment, and devices that are UL Listed or FM Approved for fire protection service when so required by NFPA 72 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for any particular classification of materials. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least two years prior to bid opening.

2.1.3 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new plate permanently affixed to the item or equipment. Major components include, but are not limited to, the following:

- a. CECP (includes component panels)
- b. Automatic transmitters (for both the installation-wide fire alarm reporting system and installation-wide mass notification systems)

Furnish nameplates to obtain approval by the Contracting Officer before installation. Obtain approval by the Contracting Officer for installation locations. Nameplates shall be etched metal or plastic, permanently attached by screws to panels or adjacent walls.

2.2 GENERAL PRODUCT REQUIREMENT

All combination emergency communications system equipment shall be listed for use under the applicable reference standards.

2.3 FIRE ALARM CONTROL UNIT(FACU) AND AUTONOMOUS CONTROL UNIT(ACU)

Provide a complete control panel fully enclosed in a lockable steel enclosure as specified herein. At the designer's discretion, the FACU and ACU may be housed in separate panels that contain independent power supplies and batteries or the ACU may be housed in the same panel with the FACU as a combination emergency communications system panel (CECP). Operations required for testing or for normal care and maintenance of the systems shall be performed from the front of the FACU enclosure. If more than a single unit is required at a location to form a complete control panel, the unit enclosures shall match exactly.

- a. Each control unit shall provide power, supervision, control, and logic for the entire system, utilizing solid state, modular components, internally mounted and arranged for easy access. Each control unit shall be suitable for operation on a 120 Volt, 60 Hertz, normal building power supply. Provide each panel with supervisory functions for power failure, internal component placement, and operation.
- b. Visual indication of alarm, supervisory, or trouble initiation on the fire alarm control unit shall be by liquid crystal display or similar means with a minimum of 80 characters, that at least 32 are

field changeable. The ACU shall have the capability of temporarily deactivating the fire alarm messages while delivering voice messages. Provide conductor integrity monitoring for strobe, display, temporary deactivation of fire alarm audible notification appliances and speaker wiring.

c. Provide secure operator console with a microphone for delivering live voice messages. Provide adequate discrete outputs to temporarily deactivate fire alarm audible notification, and initiate/synchronize strobes. Provide a complete set of self-diagnostics for controller and appliance network. Provide local diagnostic information display and local diagnostic information and system event log file.

2.3.1 Cabinet

Install control panel components in cabinets large enough to accommodate all components and also to allow ample gutter space for interconnection of panels as well as field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall say "Fire Alarm and Mass Notification Control Panel" and shall not be less than one inch high. Provide prominent rigid plastic or metal identification plates for lamps, circuits, meters, fuses, and switches. The cabinet shall be provided in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.

2.3.2 Control Modules

Provide power and control modules to perform all functions of the FACU. Provide audible signals to indicate any alarm, supervisory, or trouble condition. The alarm signals shall be different from the trouble signal. Connect circuit conductors entering or leaving the panel to screw-type terminals with each terminal marked for identification. Locate diodes and relays, if any, on screw terminals in the FACU. Circuits operating at 24 VDC shall not operate at less than 21.6 Volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10 percent of nominal voltage.

2.3.3 Voice Notification System

The Voice Notification System shall comply with the requirements of NFPA 72 for Emergency Voice/Alarm Communications System requirements ISO 7240-16, IEC 60268-16, except as specified herein.

Tones and voice messages shall repeat until the control panel is reset or silenced. A live voice message shall override the automatic audible output through use of a microphone input at the control panel.

a. The system shall be a single channel voice notification system incorporating user selectability of a minimum 8 distinct sounds for tone signaling, and the incorporation of a voice module for delivery of prerecorded messages.

b. The digitalized voice message shall consist of a non-volatile (EPROM) microprocessor based input to the amplifiers. The microprocessor shall actively interrogate circuitry, field wiring, and digital coding necessary for the immediate and accurate rebroadcasting of the stored voice data into the appropriate amplifier input. Loss of operating power, supervisory power, or any other malfunction that could render the digitalized voice module inoperative shall automatically cause the three tone temporal signal to take over all

functions assigned to the failed unit.

c. When using the microphone, live messages shall be broadcast through all speakers. The system shall be capable of operating all speakers at the same time. The Voice Notification System shall support Public Address (PA) paging for the facility.

d. The Mass Notification functions shall override the manual or automatic fire alarm notification or Public Address (PA) functions. The system shall have the capability of utilizing a remote microphone station with redundant controls of the notification system control panel. A hand held microphone shall be provided and, upon activation, shall take priority over any tone signal, recorded message or PA microphone operation in progress, while maintaining the strobe Notification Appliance Circuits activation.

Where the Combined Emergency Communications System consists of separate autonomous control and fire alarm control units, a Class X pathway shall be provided as the means for activating the strobe appliances.

The activation of the strobe circuits shall follow the operation of the speaker notification appliance circuits.

Audio output shall be selectable for line level (600 ohms), 25 or 70.7 volt output.

The audio amplifier outputs shall be not greater than 100 watts RMS output.

The strobe notification appliance circuits shall provide at least 2 amps of 24 VDC power to operate strobes and have the ability to synchronize all strobes.

All outputs and operational modules shall be fully supervised with on-board diagnostics and trouble reporting circuits.

Form "C" contacts shall be provided for system alarm and trouble conditions.

Circuits shall be provided for operation of auxiliary appliances during trouble conditions.

During a Mass Notification event the panel shall not generate nor cause any trouble alarms to be generated with the fire alarm portion of the combination emergency communications system.

Mass Notification functions shall take precedence over all other function performed by the Voice Notification System.

Messages shall be recorded professionally utilizing standard industry methods and be recorded utilizing a professional female voice. Message and tone volumes shall both be at the same decibel level. Messages recorded from the system microphone shall not be accepted. Messages shall be the following:

- 1) FIRE ALARM MESSAGE: Three Tone Temporal Pattern (0.5 sec on, 0.5 second off, 0.5 second on, 0.5 second off, 0.5 second on, 1.5 second off.) The alarm signal shall be a square wave. The wave shall have a

fundamental frequency of 520 Hz \pm 10 percent followed by:

"May I have your attention, please. May I have your attention, please. A fire has been reported in the building. Please leave the building by the nearest exit. Provide a 2 second pause. Repeat the tones and message.

2.3.4 Memory

Provide each control unit with non-volatile memory and logic for all functions. The use of long-life batteries, capacitors, or other age-dependent devices shall not be considered as equal to non-volatile processors, PROMS, or EPROMS.

2.3.5 Field Programmability

Provide control units and control panels that are fully field-programmable for control, initiation, notification, supervisory, and trouble functions of both input and output. The system program configuration shall be menu driven. System changes shall be password protected and shall be accomplished using personal computer-based equipment. Any proprietary equipment and proprietary software needed by qualified technicians to implement future changes to the combination emergency communications system shall be provided as part of this contract. Passwords for all levels of access shall be the manufacturer's default password and be provided to the Contracting Officer.

2.3.6 Input/Output Modifications

The FACU shall contain features allowing the bypass of input devices from the system or the modification of system outputs. These control features shall consist of a panel mounted keypad. Any bypass or modification to the system shall indicate a trouble condition on the FACU.

2.3.7 Resetting

Provide the necessary controls to prevent the resetting of any alarm, supervisory, or trouble signal while the alarm, supervisory or trouble condition exists on the system.

2.3.8 Instructions

Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic cover in a stainless steel or aluminum frame. Install the instructions on the interior of the FACU. The card shall show those steps to be taken by an operator when a signal is received, as well as the functional operation of the system under all conditions; normal, alarm, supervisory, and trouble. The instructions shall be approved by the Contracting Officer before being posted.

2.3.9 Walk Test

The FACU shall have a walk test feature. When using this feature, operation of initiating devices shall result in limited system outputs, so that the notification appliances operate for only a few seconds and the event is indicated on the system printer, but no other outputs occur.

2.3.10 History Logging

In addition to the required printer output, the control panel shall have

the ability to store a minimum of 400 events in a log. These events shall be stored in a battery-protected memory and shall remain in the memory until the memory is downloaded or cleared manually. Resetting of the control panel shall not clear the memory.

2.3.11 RS-232-C Output

Each local control panel shall be capable of operating remote service type printers, and/or modems. The output shall be paralleled ASCII from an EIA RS-232-C connection with a baud rate of 1200 or 2400 to allow use of any commonly available CRT, printer, or modem.

2.4 LOCAL OPERATING CONSOLES(LOC)

Provide a LOC at the location indicated on the contract drawings. The LOC shall consist of a Remote Microphone station incorporating a Push-To-Talk (PTT) hand held microphone and system status indicators of/for the system. Using the console, personnel in the building can, provide live voice messages and instructions. The LOC shall NOT have the capability of being utilized to activate any pre-recorded messages. The unit shall incorporate microphone override of any tone generation or prerecorded messages. The unit shall be fully supervised from the FACU. The housing for the LOC shall not be lockable.

2.5 AMPLIFIERS PREAMPLIFIERS, DIGITALIZED VOICE GENERATORS

Any amplifiers, preamplifiers, digitalized voice generators, and other hardware necessary for a complete, operational, textual audible circuit conforming to NFPA 72 shall be housed within panels. The system shall automatically operate and control all building fire alarm speakers. Each amplifier shall be single output channel. The provision of backup amplifiers is not a contract requirement.

2.5.1 Construction

Amplifiers shall utilize computer-grade, solid-state components and shall be provided with output protection devices sufficient to protect the amplifier against any transient voltage up to ten times the highest rated voltage in the system.

2.5.2 Inputs

Each system shall be equipped with separate inputs from the tone generator, digitalized voice driver and panel mounted microphone. Microphone inputs shall be of the low impedance, balanced line type. Both microphone and tone generator input shall be operational on any amplifier.

2.5.3 Message Tones

Message tones shall be stored digitally. Tones shall be either attached to the recorded message or be able to be programmed via the system software or by selector programming switches within the main control unit.

2.5.4 Protection Circuits

Each amplifier shall be constantly supervised for any condition that could render the amplifier inoperable at its maximum output. Failure of any component shall cause, illumination of a visual "amplifier trouble" indicator on the CECP,

2.6 SUPPLEMENTARY NOTIFICATION APPLIANCE CIRCUIT PANEL(SNAC)

Provide SNAC panels as necessary to power and control visual notification appliance circuits in addition to those connected to the main FACU. Trouble contacts of SNAC panel shall be individually monitored for trouble conditions on the panel.

2.7 AUXILIARY POWER SUPPLY PANEL

Provide auxiliary power supply panels as necessary to power combination emergency communications system devices, relays and control modules where power requirements exceed the capacity of the FACU. Trouble contacts of auxiliary power supply panels shall be individually monitored for trouble conditions.

2.8 AUTOMATIC FIRE TRANSMITTERS

2.8.1 Digital Alarm Communicator Transmitter (DACT)

Provide DACT that is integral to the fire alarm control panel and incompatible with the existing supervising station fire alarm system (SurGard System III receiver in BEQ FC530). Transmitter shall have a means to transmit alarm, supervisory, and trouble conditions via a single transmitter. Transmitter shall have a source of power for operation that conforms to NFPA 72. Transmitter shall be capable of initiating a test signal daily at any selected time. Transmitter shall be arranged to seize telephone circuits in accordance with NFPA 72.

2.8.2 Signals to Be Transmitted to the Installation Receiving Station

The following signals shall be sent to the installation's receiving station:

- a. Fire alarm
- b. Supervisory
- c. Trouble

2.9 EMERGENCY POWER SUPPLY

Provide emergency power for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.

2.9.1 Batteries

Provide sealed, maintenance-free, lead-calcium batteries as the source for emergency power to the CECs. Batteries shall contain suspended electrolyte. The battery system shall be maintained in a fully charged condition by means of a solid-state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power.

2.9.1.1 Capacity

Provide the batteries with sufficient capacity to operate the system under

the most demanding of the following conditions.

- a. Under supervisory and trouble conditions, including audible trouble signal devices for 48 hours and audible and visual signal appliances under alarm conditions for an additional 60 minutes.

2.9.2 Battery Chargers

Provide a solid-state, fully automatic, variable charging rate battery charger. The charger shall be capable of providing 150 percent of the connected system load and shall maintain the batteries at full charge. In the event the batteries are fully discharged (18 Volts DC), the charger shall recharge the batteries back to 95 percent of full charge within 48 hours. Provide pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided.

2.9.3 Battery Cabinets

Locate battery cabinets below the FACU. Battery cabinets shall be installed at an accessible location when standing at floor level. Battery cabinets shall not be installed lower than 12 inches above finished floor. Installing batteries above drop ceilings or in inaccessible locations is prohibited. Battery cabinets shall be large enough to accommodate batteries and also to allow ample gutter space for interconnection of panels as well as field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall indicate the panel(s) the batteries power and shall not be less than one inch high. The cabinet shall be provided in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.

2.10 WIRING

Provide wiring materials under this section as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM with the additions and modifications specified herein.

2.10.1 Alarm Wiring

The SLC wiring shall be solid copper cable in accordance with the manufacturers requirements. Copper signaling line circuits and initiating device circuit field wiring shall be No. 16 AWG size conductors at a minimum. Notification appliance circuit conductors, other than speakers, shall be solid copper No. 14 AWG size conductors at a minimum. Speaker circuits shall be copper No. 16AWG size conductors at a minimum. Wire size shall be sufficient to prevent excessive voltage drop. Circuits operating at 24 VDC shall not operate at less than 21.6 volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10 percent of nominal voltage. Power wiring, operating at 120 VAC minimum, shall be a minimum No. 12 AWG solid copper having similar insulation.

2.11 OVERVOLTAGE AND SURGE PROTECTION

2.11.1 Signaling Line Circuit Surge Protection

For systems having circuits located outdoors, communications equipment shall be protected against surges induced on any signaling line circuit and shall comply with the applicable requirements of IEEE C62.41.1 and

IEEE C62.41.2. Cables and conductors, that serve as communications links, shall have surge protection circuits installed at each end that meet the following waveform(s):

- a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Protection shall be provided at the equipment. Additional triple electrode gas surge protectors, rated for the application, shall be installed on each wireline circuit within 3 feet of the building cable entrance. Fuses shall not be used for surge protection.

2.11.2 Wiring Surge Protection

Digital and analog inputs and outputs shall be protected against surges induced by sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested with the following waveform:

- a. A 10 by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Fuses shall not be used for surge protection.

2.12 CEILING BRIDGES

Provide ceiling bridges for ceiling-mounted appliances. Ceiling bridges shall be as recommended/required by the manufacturer of the ceiling-mounted notification appliance.

2.13 BACK BOXES AND CONDUIT

In addition to the requirements of SPECIFICATION SECTION 26 20 00 INTERIOR DISTRIBUTION SYSTEM; provide all wiring in rigid metal conduit or intermediate metal conduit unless specifically indicated otherwise. Minimum conduit size shall be 3/4 inch in diameter except for 1/2 inch drops to individual devices. Do not use electrical non-metallic tubing (ENT) or flexible non-metallic tubing and associated fittings.

Provide rigid metal back boxes of adequate size and depth as recommended by the manufacturer of the appliance or device installed.

2.14 NOTIFICATION APPLIANCES

2.14.1 Audio Notification Appliance Network

The notification appliance network consists of textual audible appliances (speakers) located to provide intelligible instructions at all locations in the building.

2.14.2 Fire Alarm/Mass Notification Speakers

Audible appliances shall conform to the applicable requirements of UL 464. Appliances shall be connected into notification appliance circuits. Surface mounted audible appliances shall be painted white. Recessed audible appliances shall be installed with a grill that is painted white

with a factory finish to match the surface to which it is mounted.

a. Textual audible appliances (speakers) shall conform to the applicable requirements of UL 1480. Speakers shall have six different sound output levels and operate with audio line input levels of 70 Volts AC, and 25 Volts AC, by means of selectable tap settings.

Speaker tap settings shall include taps of 1/4, 1/2, 1, and 2. Speakers shall incorporate a high efficiency speaker for maximum output at minimum power across a frequency range of 400Hz to 4000Hz. Speakers shall have a sealed back construction.

Where speakers and strobes are provided in the same location, they may be combined into a single unit. All inputs shall be polarized for compatibility with standard reverse polarity supervision of circuit wiring via the Fire Alarm Control Unit.

b. Provide speaker mounting plates constructed of cold rolled steel having a minimum thickness of 16 gauge and equipped with mounting holes and other openings as needed for a complete installation. Fabrication marks and holes shall be ground and finished to provide a smooth and neat appearance for each plate. Each plate shall be primed and painted.

Speakers mounted on the exterior of the building, within unconditioned spaces or in the vicinity of showers shall be Listed weather-proof appliances.

2.14.3 Visual Notification Appliances

Visual notification appliances shall conform to the applicable requirements of UL 1971 and conform to the Americans With Disabilities Act (ADA). Fire Alarm/Mass Notification Appliances shall have clear high intensity optic lens, xenon flash tubes, and output white light and be marked "ALERT" in red letters. Appliances with decals or adhesive labels, whether factory or field applied, are prohibited. The light pattern shall be disbursed so that it is visible above and below the strobe and from a 90 degree angle on both sides of the strobe. Strobe flash rate shall be one flash per second and a minimum of 15 candela based on the UL 1971 test. Strobes shall be surface mounted. Provide synchronized operation.

2.14.4 Fire Alarm Bells

Bells shall be surface mounted with the matching mounting back box surface mounted suitable for use in an electrically supervised circuit. Bells shall be suitable for use in an electrically supervised circuit. Bells shall be the underdome type producing a minimum output rating of 90 dBA at 10 feet. Bells used in exterior locations shall be specifically listed or approved for outdoor use and be provided with metal housing and protective grilles. Single stroke, electrically operated, supervised, solenoid bells shall be used for coded applications.

2.14.5 Connections

Provide screw terminals for each notification appliance. Terminals shall be designed to accept the size conductors used in this project without modification.

2.15 ADDRESSABLE MONITOR MODULE

The initiating device being monitored shall be configured as a Class B initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm, trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling such as waterflow switches, valve supervisory switches, fire pump monitoring, independent smoke detection systems, relays for output function actuation, and other similar functions. The module shall be UL or FM listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED. Existing fire alarm system initiating device circuits shall be connected to a single module to power and supervise the circuit. LED shall be visible without needing to remove the backbox cover plate.

2.16 ADDRESSABLE CONTROL/RELAY MODULE

The control module shall be capable of operating as a relay (form C contacts) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL or FM listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Class B Pathway. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a short on the supervised circuit and shall prevent power from being applied to the circuit. Circuit between the module and the equipment/feature controls is permitted be configured as Class D pathways. The pathway is unsupervised but has a fail-safe operation that performs the intended function when the connection is lost. The control module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled. Control Modules shall be located in environmental areas that reflect the conditions to which they were listed. LED shall be visible without needing to remove the backbox cover plate.

2.17 MANUAL STATIONS

Provide addressable manual pull stations. Manual pull stations shall be metal or plastic, semi-flush mounted, double action, addressable manual stations, that are not subject to operation by jarring or vibration. Stations shall be equipped with screw terminals for each conductor. Stations that require the replacement of any portion of the device after activation are not permitted. Stations shall be finished in fire-engine red with molded raised lettering operating instructions of contrasting color. The use of a key or wrench shall be required to reset the station. Manual stations shall be mounted at 48 inches. Stations shall have a separate screw terminal for each conductor.

2.18 SMOKE DETECTORS

2.18.1 Photoelectric Smoke Detectors

Provide addressable photoelectric smoke detectors as follows:

a. Provide analog/addressable photoelectric smoke detectors utilizing the photoelectric light scattering principle for operation in accordance with UL 268. Smoke detectors shall be listed for use with the fire alarm control unit.

B. Components shall be rust and corrosion resistant. Vibration shall have no effect on the detector's operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen shall not inhibit the movement of smoke particles into the chamber.

V. Provide twist lock bases for the detectors. The detectors shall maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. The detector shall have a visual indicator to show actuation.

e. The detector address shall identify the particular unit, its location within the system, and its sensitivity setting. detectors shall be of the low voltage type rated for use on a 24 VDC system.

f. An operator at the control panel, having a proper access level, shall have the capability to manually access the following information for each initiating device.

- (1) Primary status
- (2) Device type
- (3) Present average value
- (4) Present sensitivity selected
- (5) detector range (normal, dirty, etc.)

2.18.2 Smoke Detector Testing

Smoke detectors shall be tested in accordance with NFPA 72 and the manufacturer's recommended calibrated test method.

2.19 Heat detector

2.19.1 Spot Type Heat Detectors

Heat detectors shall be combination fixed temperature and rate-of-rise (ROR-FT) type. The alarm condition shall be determined by comparing detector value with the stored values. Heat detector spacing shall be rated in accordance with UL 521. Spot type heat detectors shall be listed for 50 by 50 feet spacing. Detectors located in areas subject to moisture, exterior atmospheric conditions, or hazardous locations as defined by NFPA 70 and as shown on the contract drawings, shall be types approved for such locations.

2.19.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors shall be designed for surface outlet box mounting and supported independently of wiring connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature

actuation, the detector shall have a permanent external indication that is readily visible. Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes shall operate on fixed temperature principle only. The UL 521 test rating for the fixed temperature portion shall be 135 degrees F as shown on the contract drawings.

2.19.2 Heat Sensing

A moving average of the detectors heat sensing value to automatically compensate for conditions that could affect detection operations. System shall automatically maintain a constant heat sensing sensitivity from each detectors by compensating for environmental factors.

2.19.3 Self-Test Routines

Automatic self-test routines shall be performed on each detectors that will functionally check detectors sensitivity electronics and ensure the accuracy of the value being transmitted. Any detectors that fails this test shall indicate a trouble condition with the detectors location at the fire alarm control unit.

2.19.4 Operator Access

An operator at the CECP, having the proper access level, shall have the capability to manually access the following information for each heat detectors:

- a. Primary status
- b. Device type
- c. Present average value
- d. detectors range

2.19.5 Operator Control

An operator at the CECP with proper access, shall have the capability to manually control the following information for each heat detector:

- a. Alarm detection sensitivity values
- b. Enable or disable the point/device
- c. Control detector relay driver output

2.19.6 Heat detector testing

Heat detectors shall be tested in accordance with NFPA 72 and the manufacturer's recommended calibrated test method.

2.20 Waterflow switches

- a. Provide vane-type waterflow switches for wet pipe sprinkler systems. The device shall contain double pole, double throw contacts. Equip the detector with a pneumatic time delay, field adjustable from 0 to 90 seconds. The time delay shall be set initially to 30 seconds. Waterflow switches shall be a UL Listed

extinguishing system attachments rated for the particular pressure and location that it is installed. Flow switches shall be equipped with screw terminals for each conductor.

b. Provide pressure type waterflow switches for dry pipe sprinkler systems, pre-action, and deluge systems. The device shall contain double pole, double throw contacts. Equip the detector with a pneumatic time delay, field adjustable from 0 to 90 seconds. The time delay shall be set initially to 30 seconds. Waterflow switches shall be a UL Listed extinguishing system attachments rated for the particular pressure and location that it is installed. Flow switches shall be equipped with screw terminals for each conductor.

The Prime Contractor is responsible for coordination between their sub-tier contractors. Flow switches are provided by the sprinkler contractor but shall be included in the submittal package required by this section.

2.21 VALVE MONITOR SWITCHES (TAMPER SWITCHES)

Provide a tamper switch for each fire protection system control valve. Tamper switches shall be a UL Listed extinguishing system attachments for the location and type of valve supervised. The device shall contain double pole, double throw contacts. Operation of the switch shall cause a supervisory signal to be transmitted to the FACU upon not more than two complete turns of the valve wheel or a closure of 10 percent, whichever is less. Tamper switches shall be equipped with screw terminals for each conductor.

The Prime Contractor is responsible for coordination between their sub-tier contractors. Tamper switches are provided by the sprinkler contractor but shall be included in the submittal package required by this section.

2.22 ENVIRONMENTAL ENCLOSURES OR GUARDS

Environmental enclosures shall be provided to permit Fire Alarm or Mass Notification components to be used in areas that exceed the environmental limits of the listing. The enclosure shall be listed for the device or appliance as either a manufactured part number or as a listed compatible accessory for the UL category the component is currently listed. Guards required to deter mechanical damage shall be either a listed manufactured part or a listed accessory for the category of the initiating device or notification appliance.

2.23 SYSTEM OPERATION

The combination emergency communications system shall be a complete, supervised, noncoded, analog/addressable fire alarm and mass notification system conforming to NFPA 72, UL 864, and UL 2017. The system shall be activated into the alarm mode by actuation of any fire alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. The system may be placed in the alert mode by local microphones or remotely from authorized locations/users.

2.23.1 Fire Alarm and Supervisory Initiating Devices

Connect alarm initiating devices to Class B signal line circuit (SLC)

pathways, and install in accordance with NFPA 72.

The contract required 25 percent spare capacity per SLC limits the design to 38 addresses per Class B SLC.

a. The system shall operate in the alarm mode upon activation of any fire alarm initiating device. The system shall remain in alarm mode until initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal. Audible and visual appliances and systems shall comply with NFPA 72. Fire alarm system/mass notification system components requiring power, except for the control panel power supply, shall operate on 24 VDC.

2.23.2 Functions and Operating Features

The system shall provide the following functions and operating features:

a. The Combination Emergency Communications System Panels (CECP) whether separate or combined Fire Alarm Control Units (FACU) and Autonomous Control Units (ACU), shall provide power, annunciation, supervision, and control for the system. Systems shall be microcomputer (microprocessor or microcontroller) based addressable systems with a minimum word size of eight bits with sufficient memory to perform as specified.

b. Provide Class B initiating device circuit pathways for conductor lengths of 10 feet or less.

c. Provide Class B signaling line circuit pathways

d. Provide Class B control circuits. Class D control circuits are permissible when the intended operation has fail-safe operation. Fail-safe operation is when the intended operation is performed in the event of a pathway failure.

e. Provide Class B notification appliance circuit pathways. Visual alarm notification appliances shall have the flash rates synchronized.

f. Provide alarm verification capability for smoke detectors. Alarm verification shall initially be set for 20 seconds.

G Alarm, supervisory, and trouble signals shall be automatically transmitted to the SurGard System II receiver in BEQ FC530.

H. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.

I. Programmed information shall be stored in non-volatile memory.

J. The system shall be capable of operating, supervising, and/or monitoring both addressable and non-addressable alarm and supervisory devices.

K. There shall be no limit, other than maximum system capacity, as to the number of addressable devices, that may be in alarm simultaneously.

L. An alarm signal shall automatically initiate the following functions:

- (1) Transmission of an alarm signal to the SurGard System III receiver in BEQ FC530.
- (2) Visual indication of the device operated on the FACU.
- (3) Continuous actuation of all alarm notification appliances.
- (4) Recording of the event electronically in the history log of the FACU.

p. A supervisory signal shall automatically initiate the following functions:

- (1) Visual indication of the device operated on the FACU.
- (2) Sound the audible alarm at the respective panels.
- (3) Transmission of a supervisory signal to the SurGard System III receiver in BEQ FC530.
- (4) Recording of the event electronically in the history log of the FACU.
- (5) Supervisory signals shall be non-latching.
- (4) Operation of a duct smoke detectors shall shut down the appropriate air handler in accordance with NFPA 90A in addition to other requirements of this paragraph.

q. A trouble condition shall automatically initiate the following functions:

- (1) Visual indication of the system trouble on the FACU.
- (2) Transmission of a trouble signal to the SurGard System III receiver in BEQ FC530.
- (3) Recording of the event electronically in the history log of the fire control system unit.
- (4) Trouble conditions shall be non-latching.

2.24 ELECTRIC POWER

Primary power to combination emergency communications system panels and equipment

Primary power shall be 120 VAC service for the CECPs and equipment. Primary power shall be supplied from the AC service to the building. Provide dedicated branch circuit(s) supplying all CECPs & equipment including but not limited to FACU's, ACU's, supplementary power supplies, SNAC panels, LED message control/interface panels, LED Text signs, etc. Branch circuits shall supply no loads other than those associated with the combination emergency communications system. The circuit disconnecting means and all branch-circuit overcurrent protective devices shall be located within a single panel located in the building's main electrical room. The location of the branch-circuit overcurrent protective device shall be permanently identified at the combination emergency communications system panels/enclosures. The circuit disconnecting means

shall have red identification, shall be accessible only to qualified personnel, and shall be identified as "FIRE ALARM CIRCUIT." The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings. This branch circuit shall not be supplied through ground-fault circuit interrupters or arc-fault circuit-interrupters.

Combination emergency communications system panels and equipment(s) includes, but is not limited to; fire alarm control units (FACU), autonomous control units (ACU), local operating consoles (LOC), supplementary fire alarm control units, supplementary notification appliance circuit panels, auxiliary power supply panels, fire alarm system printers, mass notification system transceivers, fire alarm reporting system transmitters, LED text displays, LED text display control panels, circuits powering the elevator power shunt trip feature, circuits powering computer room power shunt trip feature and circuits powering 120VAC door holders.

PART 3 EXECUTION

3.1 INSTALLATION OF COMBINATION EMERGENCY COMMUNICATIONS SYSTEM EQUIPMENT DEVICES AND APPLIANCES

- a. Locate the panels associated with the COMBINATION EMERGENCY COMMUNICATIONS SYSTEM (FACU, ACU, LOC, Amplifiers, SNAC & Auxiliary power supply panels, MNS transmitter and Fire alarm transmitter) where indicated on the contract drawings. Recessed panels with the top of the cabinet 6 feet above the finished floor or center the panels at 5 feet, whichever is lower. Conductor terminations shall be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection shall be permanently mounted inside the panels.
- b. Manual Stations: Locate manual stations where shown on the contract drawings. Mount stations so the operating handles are 4 feet above the finished floor. Mount stations so they are located no more than 5 feet from the exit door they serve, measured horizontally.
- c. Notification Appliances: Locate notification appliances where shown on the contract drawings. Mount assemblies on walls 90 inches above the finished floor or 6 inches below the ceiling whichever is lower. Ceiling mounted speakers shall conform to NFPA 72. Provide additional speakers as necessary to meet the intelligibility requirements indicated on the contract drawings.
- d. Smoke and Heat detectors: Locate detectors as required by NFPA 72 and their listings on a 4 inch mounting box. Detectors located on the ceiling shall be installed not less than 4 inches from a side wall to the near edge. Those located on the wall shall have the top of the detector at least 4 inches below the ceiling, but not more than 12 inches below the ceiling. In raised floor spaces, the smoke detectors shall be installed to protect 225 square feet per detector. Install smoke detectors no closer than 5 feet from air handling supply outlets.
- e. Waterflow Switches and Tamper Switches: Locate waterflow switches and tamper switches where shown on the contract drawings.
- i. The modification of any fire alarm system and the procedures shall comply with the requirements of NFPA 241.

3.2 SYSTEM FIELD WIRING

3.2.1 Wiring within Cabinets, Enclosures, and Boxes

Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of any box, enclosure, or cabinet. Conductors that are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting, or junction box shall be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make connections with approved pressure type terminal blocks, that are securely mounted. The use of wire nuts or similar devices shall be prohibited. Wiring shall conform to NFPA 70.

3.2.2 Conduit

Minimum conduit size shall be 3/4 inch in diameter except for 1/2 inch drops to individual devices. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. Run conduit or tubing concealed unless specifically shown otherwise on the drawings. Provide an insulated green grounding conductor for all circuit(s) installed in conduit.

- a. Galvanized rigid steel (GRS) conduit shall be utilized where exposed to weather, where subject to physical damage, and where exposed on exterior of buildings. Intermediate Metal Conduit (IMC). IMC may be used in lieu of GRS as allowed by NFPA 70.
- b. Electrical Metallic Tubing (EMT) is permitted above suspended ceilings or exposed where not subject to physical damage. EMT shall have a factory applied red exterior coating. Do not use EMT underground, encased in concrete, mortar or grout, in hazardous locations, where exposed to physical damage, outdoors or in fire pump rooms. Use die-cast compression connectors.
- c. Flexible metal conduit is permitted for initiating device circuits 6 ft length in length or less. Flexible metal conduit is prohibited for notification appliance circuits and signaling line circuits. Use liquidtight flexible metal conduit in damp and wet locations.
- d. Schedule 40 (minimum) Polyvinyl Chloride (PVC) is permitted where conduit is routed underground below floor slabs. Convert nonmetallic conduit, other than PVC Schedule 40 or 80, to plastic-coated rigid, or IMC, steel conduit before turning up through floor slab.

3.2.3 Wire

Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring, the shield shall be grounded at only one point, that shall be in or adjacent to the FACU. Pigtail or T-tap connections to signal line circuits, initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. Pull all conductors splice free. Color coding is required for circuits and shall be maintained throughout the circuit. Conductors used for the same functions shall be similarly color coded. Wiring shall conform to NFPA 70.

3.2.4 Conductor Terminations

Label all conductor terminations in panels and equipment associated with the combination emergency communications system (FACU, ACU, LOC, Amplifiers, SNAC & Auxiliary power supply panels, MNS transmitter and Fire alarm transmitter) Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each combination emergency communications system cabinet and panel shall contain a laminated drawing that indicates each conductor, its label, circuit, and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

3.3 FIRESTOPPING

Provide firestopping for conduit penetrations through fire rated floor slabs, walls, partitions, and shaft enclosures in accordance with Section 07 84 00 FIRESTOPPING.

3.4 PAINTING

Paint exposed electrical, fire alarm conduit, and surface metal raceway to match adjacent finishes in exposed areas. In lieu of painting conduit, the contractor may utilize red conduit with a factory applied finish. Paint junction boxes, conduit, and surface metal raceways red in unfinished areas. Painting shall comply with Section 09 90 00 PAINTS AND COATINGS.

In unfinished areas, paint all fire alarm conduit, junction boxes and covers red. In lieu of painting conduit, the contractor may utilize red conduit with a factory applied finish.

In finished areas, paint exposed fire alarm conduit, surface metal raceways, junction boxes, and electrical boxes to match adjacent finishes. The inside cover of the junction box must be identified as "Fire Alarm" and the conduit must have painted red bands 3/4 inch wide at 10 foot centers and at each side of a floor, wall, or ceiling penetration.

3.5 FIELD QUALITY CONTROL

3.5.1 Testing Procedures

Submit detailed test procedures prepared and signed by a registered professional engineer (P.E.) who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveys (NCEES). Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, and signed by representative of the installing company, for the fire detection and alarm system 60 days prior to performing system tests. Detailed test procedures shall list all components of the installed system such as initiating devices and circuits, notification appliances and circuits, signaling line devices and circuits, control devices/equipment, batteries, transmitting and receiving equipment, power sources/supply, annunciators, special hazard equipment, emergency communication equipment, interface equipment, and transient (surge) suppressors. Test procedures shall include sequence of testing, time estimate for each test, and sample test data forms. The test data forms shall be in a check-off format (pass/fail with space to add applicable test data) and shall be used for the preliminary testing and the acceptance testing. The test data forms shall record the test

results and shall:

- a. Identify the NFPA Class of pathways for all Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), Voice Notification System, and Signaling Line Circuits (SLC).
- b. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how this test shall be performed.
- c. Identify each component and circuit as to type, location within the facility, and unique identity within the installed system. Provide necessary floor plan sheets showing each component location, test location, and alphanumeric identity.
- d. Identify all test equipment and personnel required to perform each test (including equipment necessary for testing smoke detectors using real smoke).
- e. Provide space to identify the date and time of each test.
- f. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

3.5.2 Tests Stages

- a. Preliminary Testing: Conduct preliminary tests to ensure devices and circuits are functioning properly. Tests shall meet the requirements of paragraph entitled "Minimum System Tests." After preliminary testing is complete, provide a letter certifying the installation is complete and fully operable. The letter shall state each initiating and indicating device was tested in place and functioned properly. The letter shall also state that panel functions were tested and operated properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.
- b. Request for Formal Inspection and Tests: Requests for Formal Inspection and Tests shall not be submitted until after the connections to the installation-wide fire reporting system and the installation-wide mass notification system have been completed and fully functional. When preliminary tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Camp LeJeune, Fire Protection Engineer.
- c. Final Testing: Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 15 calendar days prior to the test date. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. Furnish instruments and personnel required for the tests. A final acceptance test will not be scheduled until the operation and maintenance (O&M) manuals are furnished to the Contracting Officer and the following are provided at the project site:

- (1) The systems manufacturer's technical representative

- (2) As-built (red-lined) drawings of the system as actually installed
- (3) Megger test results
- (4) Loop resistance test results
- (5) Complete program printout including input/output addresses

The final tests shall be witnessed by the Camp LeJeune Fire Protection Engineer. At this time, any and all required tests shall be repeated at their discretion. Following acceptance of the system, as-built drawings and O&M manuals shall be delivered to the Contracting Officer for review and acceptance.

3.5.3 Minimum System Tests

Test the system in accordance with the procedures outlined in NFPA 72, ISO 7240-16, IEC 60268-16. The required tests are as follows:

Demonstrate communications with the supervising station as specified by the Contracting Officer. As a minimum, verify all points are correctly received at the supervising station receiver and automated software system.

Demonstrate communications with the installation-wide mass notification system as specified by the Contracting Officer.

a. Megger Tests: After wiring has been installed, and prior to making any connections to panels or devices, wiring shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors with 300 volt rated insulation shall be tested at a minimum of 250 VDC. Conductors with 600 volt rated insulation shall be tested at a minimum of 500 VDC. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.

b. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.

c. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.

d. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.

e. Test each initiating and indicating device and circuit for proper operation and response at the control unit. Smoke detectors shall be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors shall comply with the requirements of NFPA 72.

f. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.

g. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.

h. Determine that the system is operable under trouble conditions as specified.

i. Visually inspect wiring.

j. Test the battery charger and batteries.

k. Verify that software control and data files have been entered or programmed into the FACU. Hard copy records of the software shall be provided to the Contracting Officer.

l. Verify that red-line drawings are accurate.

m. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.

n. Measure voltage readings for circuits to ensure that voltage drop is not excessive.

o. Disconnect the verification feature for smoke detectors during tests to minimize the amount of smoke needed to activate the detector. Testing of smoke detectors shall be conducted using real smoke. The use of canned smoke is prohibited.

p. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.

q. Audibility Intelligibility testing of the Voice Evacuation Notification System shall be accomplished in accordance with NFPA 72 for Voice Evacuation Systems, IEC 60268-16, and ASA S3.2.

r. Opening the circuit at not less than all alarm initiating devices and notification appliances to test the wiring supervisory feature.

s. Demonstrate modem communications with remote sites as specified by the Contracting Officer. Dial in capability shall also, be demonstrated, using specified security.

t. Demonstrate fiber optic communications with remote sites as specified by the Contracting Officer. Dial in capability shall also, be demonstrated, using specified security.

3.6 INSTRUCTION OF GOVERNMENT EMPLOYEES

Provide 2 days (16 hours) of onsite instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

3.6.1 Instructor

Include in the project the services of an instructor, who has received specific training from the manufacturer for the training of other persons

regarding the inspection, testing, and maintenance of the system provided. The instructor shall train the Government employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm system. Each instructor shall be thoroughly familiar with all parts of this installation. The instructor shall be trained in operating theory as well as in practical O&M work.

3.6.2 Required Instruction Time

Provide 2 days (16 hours) of onsite instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

3.6.3 Technical Data and Computer Software

Provide, in manual format, lesson plans, operating instructions, maintenance procedures, and training data for the training courses. The operations training shall familiarize designated government personnel with proper operation of the installed system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

Any proprietary equipment and proprietary software needed by qualified technicians to implement future changes to the fire alarm system shall be provided as part of this contract. Maintenance software required and provided as part of this contract shall not require any type of annual license agreement or annual cost to continue use of the software. The software that is provided will continue to operate during the entire lifetime of the installed equipment without any additional cost to the Government.

-- End of Section --

SECTION 31 11 00
CLEARING AND GRUBBING
11/18

PART 1 GENERAL

1.1 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Tree Wound Paint

SD-04 Samples

Tree Wood Paint

1.2 DELIVERY, STORAGE, AND HANDLING

Deliver materials to the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Tree Wound Paint

Use bituminous based paint from standard manufacture specially formulated for tree wounds.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

3.1.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.1.2 Trees, Shrubs, and Existing Facilities

Protect trees and vegetation to be left standing from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the circumstances require.

3.1.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor is responsible for the repair of damage to existing utility lines that are indicated or made

known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, notify the Contracting Officer in ample time to minimize interruption of the service. Refer to Section 01 30 00 ADMINISTRATIVE REQUIREMENTS and Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS for additional utility protection.

3.2 CLEARING

Clearing consists of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Clearing also includes the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Cut off flush with or below the original ground surface trees, stumps, roots, brush, and other vegetation in areas to be cleared, except such trees and vegetation as may be indicated or directed to be left standing.

3.2.1 Tree Removal

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work includes the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Dispose of trees as specified in paragraph DISPOSAL OF MATERIALS.

3.2.2 Pruning

Trim trees designated to be left standing within the cleared areas of dead branches 1-1/2 inches or more in diameter; and trim branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1-1/4 inches in diameter with an approved tree wound paint.

3.2.3 Grubbing

Grubbing consists of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Remove material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Fill depressions made by grubbing with suitable material and compact to make the surface conform with the original adjacent surface of the ground.

3.3 DISPOSAL OF MATERIALS

All wood or wood like materials, except for salable timber, remaining from clearing, pruning or grubbing such as limbs, tree tops, roots, stumps, logs, rotten wood, and other similiar materials shall become the property of the Contractor and disposed of as specified. All non-saleable timber and wood or wood like materials remaining from timber harvesting such as limbs, tree tops, roots, stumps, logs, rotten wood, and other similiar materials shall become the property of the Contractor and disposed as specified.

20-0075 Repair BEQ FC530

-- End of Section --

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SECTION 31 23 00.00 20

EXCAVATION AND FILL

02/11, CHG 2: 08/15

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600 (2017) Installation of Ductile-Iron Mains and Their Appurtenances

ASTM INTERNATIONAL (ASTM)

ASTM C33/C33M (2018) Standard Specification for Concrete Aggregates

ASTM C136/C136M (2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM D698 (2012; E 2014; E 2015) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

ASTM D1140 (2017) Standard Test Methods for Determining the Amount of Material Finer than 75- μ m (No. 200) Sieve in Soils by Washing

ASTM D1556/D1556M (2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method

ASTM D1557 (2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2700 kN-m/m³)

ASTM D2216 (2019) Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM D2321 (2020) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

ASTM D2487 (2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D4318 (2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM D6938 (2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846.3-3 (1999, Third Edition, Update III-A) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

1.2 DEFINITIONS

1.2.1 Capillary Water Barrier

A layer of clean, poorly graded crushed rock, stone, or natural sand or gravel having a high porosity which is placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below a slab.

1.2.2 Degree of Compaction

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D698, for general soil types, abbreviated as percent laboratory maximum density.

1.2.3 Hard Materials

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.3 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Shoring and Sheeting Plan

Dewatering work plan

Submit 15 days prior to starting work.

SD-06 Test Reports

Borrow Site Testing

Fill and backfill test

Select material test

Porous fill test for capillary water barrier

Density tests

Moisture Content Tests

Off-Site Soil

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

1.5 CRITERIA FOR BIDDING

Base bids on the following criteria:

- a. Surface elevations are as indicated.
- b. Pipes or other artificial obstructions, except those indicated, will not be encountered.
- c. Ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.
- d. Material character is indicated by the boring logs.
- e. Hard materials and rock will not be encountered.
- f. Borrow material, suitable backfill and bedding material in the quantities required is not available on Government property.
- g. Blasting will not be permitted. Remove material in an approved manner.

1.6 REQUIREMENTS FOR OFF SITE SOIL

Soils brought in from off site for use as backfill shall be tested for petroleum hydrocarbons, BTEX, PCBs and HW characteristics (including toxicity, ignitability, corrosivity, and reactivity). Backfill shall not contain concentrations of these analytes above the appropriate State and/or EPA criteria, and shall pass the tests for HW characteristics. Determine petroleum hydrocarbon concentrations by using appropriate State protocols. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5035/8260B. Perform complete TCLP in accordance with EPA SW-846.3-3 Method 1311. Perform HW characteristic tests for ignitability, corrosivity, and reactivity in accordance with accepted standard methods. Perform PCB testing in accordance with accepted standard methods for sampling and analysis of bulk solid samples. Provide borrow site testing for petroleum hydrocarbons and BTEX from a grab sample of material from the area most likely to be contaminated at the borrow site (as indicated by visual or olfactory evidence), with at least one test from each borrow site. For each borrow site, provide borrow site testing for HW characteristics from a composite sample of material, collected in accordance with standard soil sampling techniques. Do not bring material onsite until tests results have been received and approved by the Contracting Officer.

1.7 QUALITY ASSURANCE

1.7.1 Shoring and Sheet piling Plan

Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of excavations. Drawings shall include material sizes and types, arrangement of members, and the sequence and method of installation and removal. Calculations shall include data and references used.

The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer shall update the excavation, sheet piling and dewatering plans as construction progresses to reflect changing conditions and shall submit an updated plan if necessary. A written report shall be submitted, at least monthly, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Geotechnical Engineer shall be available to meet with the Contracting Officer at any time throughout the contract duration.

1.7.2 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

1.7.3 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

2.1.1 Satisfactory Materials

Any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 2 inches. The Contracting Officer shall be notified of any contaminated materials.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM, GP-GM, GW-GM, SW-SM, SP-SM, and SM shall be identified as cohesionless only when the fines are nonplastic (plasticity index equals zero). Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity index greater than zero.

2.1.4 Common Fill

Approved, unclassified soil material with the characteristics required to compact to the soil density specified for the intended location.

2.1.5 Backfill and Fill Material

ASTM D2487, classification GW, GP, GM, SW, SP, SM with a maximum ASTM D4318 liquid limit of 35, maximum ASTM D4318 plasticity index of 12, and a maximum of 25 percent by weight passing ASTM D1140, No. 200 sieve.

2.1.6 Select Material

Provide materials classified as GW, GP, SW, SP, by ASTM D2487 where indicated. The liquid limit of such material shall not exceed 35 percent when tested in accordance with ASTM D4318. The plasticity index shall not be greater than 12 percent when tested in accordance with ASTM D4318, and not more than 35 percent by weight shall be finer than No. 200 sieve when tested in accordance with ASTM D1140.

2.1.7 Topsoil

Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

2.2 POROUS FILL FOR CAPILLARY WATER BARRIER

ASTM C33/C33M or coarse aggregate Size 57 and conforming to the general soil material requirements specified in paragraph entitled "Satisfactory Materials."

2.3 UTILITY BEDDING MATERIAL

Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide ASTM D2321 materials as follows:

- a. Class I: Angular, 0.25 to 1.5 inches, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
- b. Class II: Coarse sands and gravels with maximum particle size of 1.5 inches, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

2.3.1 Sand

Clean, coarse-grained sand classified as SW or SP by ASTM D2487 for bedding.

2.3.2 Gravel

Clean, coarsely graded natural gravel, crushed stone or a combination thereof having a classification of GW or GP in accordance with ASTM D2487 for bedding. Maximum particle size shall not exceed 3 inches.

2.4 BORROW

Obtain borrow materials required in excess of those furnished from excavations from sources outside of Government property.

2.5 MATERIAL FOR RIP-RAP

Bedding material and rock conforming to these requirements for construction indicated.

2.5.1 Rock

Rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Rock fragments shall be free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. The size of the fragments shall be such that no individual fragment exceeds a weight of 150 pounds and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 2 pounds or less each. Specific gravity of the rock shall be a minimum of 2.50. The inclusion of more than trace 1 percent quantities of dirt, sand, clay, and rock fines will not be permitted.

2.6 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes	
Red:	Electric
Yellow:	Gas, Oil; Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Potable Water Systems
Green:	Sewer Systems
White:	Steam Systems
Gray:	Compressed Air
Purple:	Non Potable, Reclaimed Water, Irrigation and Slurry lines

2.6.1 Warning Tape for Metallic Piping

Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.6.2 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.7 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water encountered during construction.

3.1.1.1 Drainage

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and

throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils, prevent erosion and undermining of foundations. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

3.1.1.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 2 feet below the working level.

3.1.2 Underground Utilities

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall scan the construction site with electromagnetic and sonic equipment and mark the surface of the ground where existing underground utilities are discovered.

3.1.3 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.2 SURFACE PREPARATION

3.2.1 Clearing and Grubbing

Unless indicated otherwise, remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations within the clearing limits. Remove stumps entirely. Grub out matted roots and roots over 2 inches in diameter to at least 18 inches below existing surface.

3.2.2 Stripping

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material

unsuitable for use as topsoil shall be wasted. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

3.2.3 Unsuitable Material

Remove vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish underneath paved areas or concrete slabs.

3.3 EXCAVATION

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed. Refill with select material and compact to 95 percent of ASTM D698 maximum density. Unless specified otherwise, refill excavations cut below indicated depth with select material and compact to 100 percent of ASTM D698 maximum density. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced with satisfactory materials to the indicated excavation grade; except as specified for spread footings. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.3.1 Structures With Spread Footings

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Fill over excavations with concrete during foundation placement.

3.3.2 Pipe Trenches

Excavate to the dimension indicated. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement. Tamp if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 6 inches below the bottom of the pipe.

3.3.3 Excavated Materials

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Paragraph "DISPOSITION OF SURPLUS MATERIAL."

3.4 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by

the Contracting Officer. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified herein.

3.4.1 Proof Rolling

Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. After stripping, proof roll the existing subgrade of the building with six passes of a 15 ton, pneumatic-tired roller. Operate the roller in a systematic manner to ensure the number of passes over all areas, and at speeds between 2 1/2 to 3 1/2 miles per hour. When proof rolling under buildings, the building subgrade shall be considered to extend 5 feet beyond the building lines, and one-half of the passes made with the roller shall be in a direction perpendicular to the other passes. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the Contracting Officer. Rutting or pumping of material shall be undercut as directed by the Contracting Officer select material.

3.5 FILLING AND BACKFILLING

Fill and backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.

3.5.1 Common Fill Placement

Provide for general site. Use satisfactory materials. Place in 6 inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content. Finish to a smooth surface by blading, rolling with a smooth roller, or both.

3.5.2 Backfill and Fill Material Placement

Provide for paved areas and under concrete slabs, except where select material is provided. Place in 6 inch lifts. Do not place over wet or frozen areas. Place backfill material adjacent to structures as the structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against the structure.

3.5.3 Select Material Placement

Provide under structures not pile supported. Place in 6 inch lifts. Do

not place over wet or frozen areas. Backfill adjacent to structures shall be placed as structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against structure.

3.5.4 Porous Fill Placement

Provide under floor and area-way slabs on a compacted subgrade. Place in 4 inch lifts with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.5.5 Trench Backfilling

Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under structures and paved areas in 6 inch lifts to top of trench and in 6 inch lifts to one foot over pipe outside structures and paved areas.

3.6 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved borrow materials shall be obtained as specified herein.

3.7 BURIED WARNING AND IDENTIFICATION TAPE

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.8 BURIED DETECTION WIRE

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

3.9 COMPACTION

Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade will be required. Density requirements specified herein are for cohesionless materials. When cohesive materials are encountered or used, density requirements may be reduced by 5 percent.

3.9.1 General Site

Compact underneath areas designated for vegetation and areas outside the 5 foot line of the paved area or structure to 90 percent of ASTM D698.

3.9.2 Structures, Spread Footings, and Concrete Slabs

Compact top 12 inches of subgrades to 95 percent of ASTM D1557. Compact

select material to 95 percent of ASTM D1557.

3.9.3 Adjacent Area

Compact areas within 5 feet of structures to 95 percent of ASTM D1557.

3.9.4 Paved Areas

Compact top 12 inches of subgrades to 95 percent of ASTM D698. Compact fill and backfill materials to 95 percent of ASTM D698.

3.10 RIP-RAP CONSTRUCTION

Construct rip-rap on filter fabric in the areas indicated.

3.10.1 Preparation

Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 0.1 foot.

3.10.2 Bedding Placement

Spread filter fabric on prepared subgrade as indicated. Compaction of bedding is not required. Finish bedding to present even surface free from mounds and windrows.

3.10.3 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above.

3.11 FINISH OPERATIONS

3.11.1 Grading

Finish grades as indicated within one-tenth of one foot. Grade areas to drain water away from structures. Maintain areas free of trash and debris. For existing grades that will remain but which were disturbed by Contractor's operations, grade as directed.

3.11.2 Topsoil and Seed

Provide as specified in Section 02 82 30 RE-ESTABLISHING VEGETATION.

3.11.3 Protection of Surfaces

Protect newly backfilled, graded, and topsoiled areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

3.12 DISPOSITION OF SURPLUS MATERIAL

Remove from Government property surplus or other soil material not required or suitable for filling or backfilling, and brush, refuse,

stumps, roots, and timber.

3.13 FIELD QUALITY CONTROL

3.13.1 Sampling

Take the number and size of samples required to perform the following tests.

3.13.2 Testing

Perform one of each of the following tests for each material used. Provide additional tests for each source change.

3.13.2.1 Fill and Backfill Material Testing

Test fill and backfill material in accordance with ASTM C136/C136M for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D4318 for liquid limit and for plastic limit; ASTM D698 or ASTM D1557 for moisture density relations, as applicable.

3.13.2.2 Select Material Testing

Test select material in accordance with ASTM C136/C136M for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the No. 200 sieve; ASTM D698 or ASTM D1557 for moisture density relations, as applicable.

3.13.2.3 Porous Fill Testing

Test porous fill in accordance with ASTM C136/C136M for conformance to gradation specified in ASTM C33/C33M.

3.13.2.4 Density Tests

Test density in accordance with ASTM D1556/D1556M, or ASTM D6938. When ASTM D6938 density tests are used, verify density test results by performing an ASTM D1556/D1556M density test at a location already ASTM D6938 tested as specified herein. Perform an ASTM D1556/D1556M density test at the start of the job, and for every 10 ASTM D6938 density tests thereafter. Test each lift at randomly selected locations every 2000 square feet of existing grade in fills for structures and concrete slabs, and every 2500 square feet for other fill areas and every 2000 square feet of subgrade in cut. Include density test results in daily report.

Bedding and backfill in trenches: One test per 50 linear feet in each lift.

3.13.2.5 Moisture Content Tests

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required

during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D2216. Include moisture content test results in daily report.

-- End of Section --

SECTION 32 31 13.53

HIGH-SECURITY FENCES (ORNAMENTAL) AND GATES
02/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM C94/C94M	(2020) Standard Specification for Ready-Mixed Concrete
ASTM F567	(2014a) Standard Practice for Installation of Chain Link Fence
ASTM F2408	(2016) Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets
ASTM F2814	(2009; R 2015) Standard Guide for Design and Construction of Ornamental Steel Picket Fence Systems for Security Purposes

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fence Installation Drawings

SD-03 Product Data

Posts

Sleeves

Latches

Hinges

Stops

Keepers

Ornamental Fence Systems

Swing Gates

SD-07 Certificates

Gate Hardware and Accessories

Concrete

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials elevated off of the ground to protect against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 COMPONENTS

2.1.1 Ornamental Fence Systems

Submit manufacturer's catalog data. Provide ASTM F2814 structural components consisting of tubular steel ornamental pickets and rails.

Provide ASTM F2408 industrial class pickets with a minimum cross-sectional area of 1 sq in and a minimum wall thickness of 14 gal. Provide pickets with spear-pointed tips extending a minimum of 6 in above the top rail of the fence. Mount pickets to a top and bottom rail spaced a maximum of 80 in apart. Space pickets along rails with a maximum gap not to exceed 2.25 in. Secure pickets to rails by welding. Provide all items and accessories finished by powder-coating in black.

2.1.2 Ornamental Fence Gates

2.1.2.1 Swing Gates

Submit manufacturer's catalog data. Fabricate swing gates by welding 2 sq in tubular steel ends and rails. Use pickets that match the adjacent fence construction. Reinforce gates to ensure assembly sags no more than 1% of the gate leaf width or 2 in, whichever is less. Size gate posts to accommodate the weight and width of each gate leaf. Mount gates to posts with weldable steel plates or blocks, pressed steel, or malleable iron hinges. Hot-dip galvanize all hinges with a minimum zinc weight of 1.20 oz/sq ft. Secure all tamper points by welding or peening the threads. Use swing gate latches and drop bar guides manufactured of pressed steel, hot-dipped galvanized with a minimum zinc weight of 1.20 oz/sq ft. Finish all gate hardware in the same color/coating as the fence system.

2.2 MATERIALS

2.2.1 Concrete

ASTM C94/C94M, using 3/4 inch maximum size aggregate, and having minimum compressive strength of 3000 psi at 28 days. Use grout consisting of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

PART 3 EXECUTION

3.1 PREPARATION

Perform complete installation conforming to ASTM F567.

3.1.1 Line and Grade

Install fence to the lines and grades indicated. Clear the area on either side of the fence line to the extent indicated. Space line posts equidistant at intervals not exceeding 10 feet. Set terminal (corner, gate, and pull) posts whenever abrupt changes in vertical and horizontal alignment are encountered. Provide continuous fabric between terminal posts; however, ensure runs between terminal posts do not exceed 500 feet. Repair any damage to galvanized surfaces, including welding, with paint containing zinc dust in accordance with ASTM A780/A780M.

3.1.2 Excavation

Excavate holes to depths indicated. Clear all post holes of loose material and spread waste material where directed. Eliminate ground surface irregularities along the fence line to the extent necessary to maintain a 2 inch clearance between the bottom of the fabric and finish grade.

3.2 INSTALLATION

3.2.1 Installation Drawings

Submit complete Fence Installation Drawings for review and approval by the Contracting Officer prior to shipment. Submit drawing details that include, but are not limited to the following information: Fence Installation Drawings, Location of gate, corner, end, and pull posts, Gate Assembly, Turnstiles, and Gate Hardware and Accessories. Install fence system per approved drawings.

3.2.2 Security Fencing

Install new security fencing, remove existing security fencing, and perform related work to provide continuous security for facility. Schedule and fully coordinate work with Contracting Officer.

3.2.3 Posts

3.2.3.1 Earth and Bedrock

- a. Set posts plumb and in alignment. Except where solid rock is encountered, set posts in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, set posts to a minimum depth of 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, set posts to the minimum depth indicated on the drawing unless a penetration of 18 inches in solid rock is achieved before reaching the indicated depth, in which case terminate depth of penetration. Grout all portions of posts set in rock.
- b. Set portions of posts not set in rock in concrete from the rock to ground level. Set posts in holes not less than the diameter shown on the drawings. Make diameters of holes in solid rock at least 1 inch

greater than the largest cross section of the post. Thoroughly consolidate concrete and grout around each post, free of voids and finished to form a dome. Allow concrete and grout to cure for 72 hours prior to attachment of any item to the posts. Group II line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Set driven posts to a minimum depth of 3 feet and protect with drive caps when setting.

- c. Test fence post rigidity by applying a 50 pound force on the post, perpendicular to the fabric, at 5 feet above ground. Ensure post movement measured at the point where the force is applied is less than or equal to 3/4 inch from the relaxed position. Test every tenth post for rigidity. When a post fails this test, make further tests on the next four posts on either side of the failed post. Remove, replace, and retest all failed parts at the Contractor's expense.

3.2.3.2 Concrete Slabs and Walls

When installed in concrete slabs or walls, set posts in zinc-coated sleeves, to a minimum depth of 12 inches. Fill sleeve joint with lead, nonshrink grout, or other approved material. Set posts for support of removable fence sections in sleeves that provide a tight sliding joint and hold posts aligned and plumb without use of lead or setting material.

3.2.4 Gate Installation

- a. Install gates at the locations shown. Mount gates to swing as indicated. Install latches, stops, and keepers as required

3.2.5 Grounding

- a. Provide ground conductor consisting of No. 8 AWG solid copper wire. Use grounding electrodes that measures 3/4 inch by 10 foot long and are a copper-clad steel rod. Drive electrodes into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable, bury electrodes a minimum of 12 inches deep and radially from the fence. Install the top of the electrode to be less than 2 feet or more than 8 feet from the fence. Clamp ground conductor to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. Measure total resistance of the fence to ground and ensure it is not greater than 25 ohms.

3.3 CLOSEOUT ACTIVITIES

3.3.1 Cleanup

Remove waste fencing materials and other debris from the work site each workday.

-- End of Section --

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING
02/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.1	(2020) Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
ASME B16.26	(2018) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B18.2.2	(2015) Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B18.5.2.1M	(2006; R 2011) Metric Round Head Short Square Neck Bolts
ASME B18.5.2.2M	(1982; R 2010) Metric Round Head Square Neck Bolts

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2018) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C104/A21.4	(2016) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C105/A21.5	(2018) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2017) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	(2020) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151/A21.51	(2017) Ductile-Iron Pipe, Centrifugally Cast
AWWA C153/A21.53	(2019) Ductile-Iron Compact Fittings for Water Service
AWWA C213	(2015) Fusion-Bonded Epoxy Coating for the

	Interior and Exterior of Steel Water Pipelines
AWWA C500	(20019) Metal-Seated Gate Valves for Water Supply Service
AWWA C508	(2017) Swing-Check Valves for Waterworks Service, 2 In. Through 48-In. (50-mm Through 1,200-mm) NPS
AWWA C509	(2015) Resilient-Seated Gate Valves for Water Supply Service
AWWA C515	(2015) Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
AWWA C550	(2017) Protective Interior Coatings for Valves and Hydrants
AWWA C600	(2017) Installation of Ductile-Iron Mains and Their Appurtenances
AWWA C605	(2014) Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVC0) Pressure Pipe and Fittings
AWWA C651	(2014) Standard for Disinfecting Water Mains
AWWA C655	(2009) Field Dechlorination
AWWA C700	(2015) Cold-Water Meters - Displacement Type, Metal Alloy Main Case
AWWA C701	(2015) Cold-Water Meters - Turbine Type for Customer Service
AWWA C800	(2014) Underground Service Line Valves and Fittings
AWWA C900	(2016) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm)
AWWA M6	(2012) Water Meters - Selection, Installation, Testing, and Maintenance
AWWA M9	(2008; Errata 2013) Manual: Concrete Pressure Pipe
AWWA M23	(2020) Manual: PVC Pipe - Design and Installation - Third Edition
AWWA M41	(2009; 3rd Ed) Ductile-Iron Pipe and Fittings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1060	(2017) Performance Requirements For Outdoor Enclosures For Fluid Conveying Components
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ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2018; E 2018) Standard Specification for Ferritic Malleable Iron Castings
ASTM A48/A48M	(2003; R 2016) Standard Specification for Gray Iron Castings
ASTM A307	(2014; E 2017) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM B61	(2015) Standard Specification for Steam or Valve Bronze Castings
ASTM B62	(2017) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B209	(2014) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C94/C94M	(2020) Standard Specification for Ready-Mixed Concrete
ASTM D1784	(2020) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D1785	(2015; E 2018) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2466	(2017) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2015) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2774	(2012) Underground Installation of

	Thermoplastic Pressure Piping
ASTM D2855	(2015) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D3139	(2019) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F402	(2005; R 2012) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F477	(2014) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F1674	(2011) Standard Test Method for Joint Restraint Products for Use with PVC Pipe
ASTM F2164	(2018) Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure
FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)	
FCCCHR List	(continuously updated) List of Approved Backflow Prevention Assemblies
FCCCHR Manual	(1988e9) Manual of Cross-Connection Control
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-80	(2019) Bronze Gate, Globe, Angle and Check Valves
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 24	(2019; TIA 19-1) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NSF INTERNATIONAL (NSF)	
NSF 372	(2016) Drinking Water System Components - Lead Content
NSF/ANSI 14	(2019) Plastics Piping System Components and Related Materials
NSF/ANSI 61	(2020) Drinking Water System Components - Health Effects
UNDERWRITERS LABORATORIES (UL)	
UL 262	(2004; Reprint Oct 2011) Gate Valves for

Fire-Protection Service

UL 312 (2010; Reprint Mar 2018) UL Standard for
Safety Check Valves for Fire-Protection
Service

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-PUB-08 (2016) Tapping Guide for PVC Pressure Pipe

1.2 DEFINITIONS

1.2.1 Water Transmission Mains

Water transmission mains include water piping having diameters greater than 14 inch, specific materials, methods of joining and any appurtenances deemed necessary for a satisfactory system.

1.2.2 Water Mains

Water mains include water piping having diameters 4 through 14 inch, specific materials, methods of joining and any appurtenances deemed necessary for a satisfactory system.

1.2.3 Water Service Lines

Water service lines include water piping from a water main to a building service at a point approximately 5 feet from building or the point indicated on the drawings, specific materials, methods of joining and any appurtenances deemed necessary for a satisfactory system.

1.2.4 Additional Definitions

For additional definitions refer to the definitions in the applicable referenced standard.

1.3 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Connections

SD-03 Product Data

Pipe, Fittings, Joints and Couplings

Valves

Valve Boxes

Pipe Restraint

Corporation Stops

Backflow Preventer

Disinfection Procedures

Service Saddle

Enclosure

Meters

SD-06 Test Reports

Backflow Preventer Tests

Bacteriological Samples

Leakage Test

Hydrostatic Test

SD-07 Certificates

Pipe, Fittings, Joints and Couplings

Shop-Applied Lining

Lining

Lining for Fittings

Valves

Backflow Prevention Training Certificate

Backflow Tester Certification

Turbine Type Meters

Backflow Certificate

SD-08 Manufacturer's Instructions

Ductile Iron Piping

PVC Piping

PVC Piping For Service Lines

1.4 QUALITY CONTROL

1.4.1 Regulatory Requirements

Comply with NSF/ANSI 14 or NSF/ANSI 61 and NSF 372 for materials for potable water systems; comply with lead content requirements for "lead-free" plumbing as defined by the U.S. Safe Drinking Water Act effective January 2014. Provide materials bearing the seal of the National Sanitation Foundation (NSF) for potable water service.

Comply with NFPA 24 for materials, installation, and testing of fire main piping and components.

1.4.2 Qualifications

1.4.2.1 Backflow Preventers

1.4.2.1.1 Backflow Preventer Certificate

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval will not be acceptable.

1.4.2.1.1.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency.

1.4.2.1.1.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling and in accordance with manufacturer's instructions. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves, fire hydrants, and other accessories free of dirt and debris.

1.5.2 Handling

Handle pipe, fittings, valves, fire hydrants, and other accessories in accordance with manufacturer's instructions and in a manner to ensure delivery to the trench in sound undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place other material, hooks, or pipe inside a pipe or fitting after the coating has been applied. Inspect the pipe for defects before installation. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. Clean the interior of pipe and accessories of foreign matter before being lowered into the trench and keep them clean during laying operations by plugging. Replace defective material without additional expense to the Government. Store rubber gaskets, not immediately installed, under cover or out of direct sunlight.

Handle ductile iron pipe, fittings, and accessories in accordance with AWWA C600 and AWWA M41. Handle PVC pipe, fittings, and accessories in accordance with AWWA C605.

PART 2 PRODUCTS

2.1 MATERIALS

Provide all materials in accordance with AWWA C800 and as indicated herein. Provide valves and fittings with pressure ratings equivalent to the pressure ratings of the pipe.

2.1.1 Pipe, Fittings, Joints And Couplings

Submit manufacturer's standard drawings or catalog cuts, except submit both drawings and cuts for push-on and rubber-gasketed bell-and-spigot joints. Include information concerning gaskets with submittal for joints and couplings.

2.1.1.1 Ductile-Iron Piping

2.1.1.1.1 Pipe and Fittings

Pipe, AWWA C151/A21.51, Pressure Class 350. Flanged pipe, AWWA C115/A21.15. Fittings, AWWA C110/A21.10 or AWWA C153/A21.53; fittings with push-on joint ends are to meet the same requirements as fittings with mechanical-joint ends, except for the factory modified bell design. Provide fittings with pressure ratings equivalent to that of the pipe. Provide compatible pipe ends and fittings for the specified joints. Provide cement-mortar lining, AWWA C104/A21.4, standard thickness on pipe and fittings.

2.1.1.1.2 Joints and Jointing Material

Provide push-on joints for pipe and fittings unless otherwise indicated. Provide mechanical joints where indicated. Provide flanged joints where indicated. Provide insulating joints where indicated.

- a. Push-On Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly as recommended in AWWA C111/A21.11.
- b. Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets as recommended in AWWA C111/A21.11.
- c. Flanged Joints: Bolts, nuts, and gaskets for flanged connections as recommended in Appendix A of AWWA C115/A21.15. Provide AWWA C115/A21.15 ductile iron flanges and conform to ASME B16.1, Class 125.
- d. Insulating Joints: Designed to prevent metal-to-metal contact at the joint between adjacent sections of piping. Provide flanged type joint with insulating gasket, insulating bolt sleeves, and insulating washers. Provide full face dielectric type gaskets, as recommended in the Appendix to AWWA C115/A21.15. Bolts and nuts, as recommended in the Appendix to AWWA C115/A21.15.

2.1.1.2 Plastic Piping

2.1.1.2.1 PVC Piping

2.1.1.2.1.1 PVC Piping

AWWA C900 plain end or gasket bell end pipe meeting or exceeding ASTM D1784 cell class 12454, with a minimum Pressure Class 235 (DR 18) with ductile iron outside diameter (DIOD).

2.1.1.2.1.2 Fittings for PVC Pipe

Gray iron or ductile iron fittings, AWWA C110/A21.10 with special fittings in accordance with Appendix B or AWWA C153/A21.53, with cement-mortar lining for fittings, AWWA C104/A21.4, standard thickness. Fittings with push-on joint ends are to conform to the same requirements as fittings with mechanical-joint ends, except for the factory modified bell design compatible for use with PVC pipe as specified.

2.1.1.2.1.3 Joints and Jointing Material for PVC Piping

- a. Push-on joints: Use jointing material in accordance with ASTM D3139 and AWWA C111/A21.11 between pipes, pipes and metal fittings, valves, and other accessories or compression-type joints/mechanical joints. Provide each joint connection with an elastomeric gasket compatible for the bell or coupling used. Gaskets for push-on joints for pipe, ASTM F477. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories, AWWA C111/A21.11, respectively, for push-on joints and mechanical joints.
- b. Mechanical Joint: Use mechanically coupled joints having a sleeve-type mechanical coupling, as specified in the paragraph SLEEVE-TYPE MECHANICAL COUPLINGS, as an optional jointing method for plain-end PVC pipe, subject to the limitations specified for mechanically coupled joints using a sleeve-type mechanical coupling as specified for compression-type joints in ASTM D3139. Provide jointing material in accordance with AWWA C111/A21.11 between pipe and sleeve-type mechanical couplings.

2.1.1.2.2 PVC Piping for Service Lines

2.1.1.2.2.1 Pipe and Fittings

Provide ASTM D1784 cell class 12454 pipe and fittings of the same PVC material.

- a. ASTM D1785, Schedule 40 with ASTM D2466 Schedule 40 or ASTM D2467 Schedule 80 fittings.
- b. ASTM D2241 pipe and fittings with SDR as necessary to provide 150 psi minimum pressure rating with ASTM D2466 Schedule 40 or ASTM D2467 Schedule 80 fittings.

2.1.1.2.2.2 Joints and Connections

Fittings may be joined by the solvent-cement method or threading.

2.1.1.2.2.3 Solvent Joining

Provide solvent joints in accordance with ASTM D2855.

2.1.2 Valves

Provide a protective interior coating in accordance with AWWA C550.

2.1.2.1 Gate Valves 3 Inch Size and Larger on Buried Piping

AWWA C500, AWWA C509, AWWA C515, or UL 262 and:

- a. AWWA C500: nonrising stem type with double-disc gate and mechanical-joint ends or push-on joint ends compatible for the adjoining pipe
- b. AWWA C509 or AWWA C515: nonrising stem type with mechanical-joint ends

Gate valves open by counterclockwise rotation of the valve stem. Stuffing boxes have O-ring stem seals. Stuffing boxes are bolted and constructed so as to permit easy removal of parts for repair. Where an indicator post are shown, provide an indicator post flange for AWWA C500, AWWA C509, or AWWA C515 gate valves conforming to the requirements of UL 262. Gate valves have ends compatible with joining to the pipe used. Provide all valves from one manufacturer.

2.1.2.2 Reduced Pressure Check Valve Assembly

The reduced pressure backflow preventer shall consist of two independently operating, spring loaded cam-check valves with a hydraulically operated differential pressure relief valve located between and below the cam-checks, required test cocks and inlet and outlet resilient seat shut off valves. When normal flow exists, both check valves are open and the pressure in the area between the checks, called the zone, is at least 2 psi lower than the inlet pressure. The differential pressure relief valve is closed during normal flow.

If cessation of normal flow occurs, the differential pressure relief valve will automatically open and discharge to maintain the zone at least 2 psi lower than the inlet pressure. This action will prevent a backflow or backsiphonage condition. After the required differential is established, the differential pressure relief valve again closes.

The cam-checks include a stainless steel spring and cam-arm, rubber faced disc and a replaceable seat. The body shall be manufactured from 300 series stainless steel, lead free, with a single two-bolt grooved style access cover. No special tools shall be required for servicing. The relief valve shall be compact with a rolling diaphragm and no sliding seals. The relief valve shall discharge in a 360 degree radius.

The assembly shall have a rated working pressure of 175 psi and a rated hydrostatic pressure of 350 psi.

The assembly shall meet the American Society of Sanitary Engineering (ASSE) Standard and carry the ASSE seal or appear on the University of California approval list.

2.1.2.3 Check Valves

Provide a protective interior coating in accordance with AWWA C550. Swing-check type, AWWA C508 or UL 312 and:

- a. AWWA C508: Iron or steel body and cover and flanged ends
- b. UL 312: Cast iron or steel body and cover, flanged ends, and designed for a minimum working pressure of 150 psi.

Materials for UL 312 check valves are to match the reference standards specified in AWWA C508. Provide check valves with a clear port opening. Provide spring-loaded check valves. Provide all check valves from one manufacturer.

2.1.2.4 Water Service Valves

2.1.2.4.1 Gate Valves Smaller than 3 Inch in Size on Buried Piping

Gate valves smaller than 3 inch size on Buried Piping MSS SP-80, Class 150, solid wedge, nonrising stem, with flanged or threaded end connections, a union on one side of the valve, and a handwheel operator.

2.1.2.4.2 Gate Valves Smaller Than 3 Inch Size in Valve Pits

MSS SP-80, Class 150, solid wedge, inside screw, rising stem. Provide valves with flanged or threaded end connections, a union on one side of the valve, and a handwheel operator.

2.1.2.4.3 Check Valves Smaller than 2 Inch in Size

Provide check valves with a minimum working pressure of 150 psi or as indicated with a clear waterway equal to the full nominal diameter of the valve. Valves open to permit flow when inlet pressure is greater than the discharge pressure, and close tightly to prevent return flow when discharge pressure exceeds inlet pressure. Cast the size of the valve, working pressure, manufacturer's name, initials, or trademark on the body of each valve.

Provide valves for screwed fittings, made of lead-free bronze and in conformance with MSS SP-80, Class 150, Types 3 and 4 compatible for the application.

2.1.2.5 Valve Boxes

Provide a valve box for each gate valve on buried piping, except where indicator post is shown. Construct adjustable valve boxes manufactured from cast iron of a size compatible for the valve on which it is used. Provide cast iron valve boxes with a minimum cover and wall thickness of 3/16 inch and conforming to ASTM A48/A48M, Class 35B. Coat the cast-iron box with a heavy coat of bituminous paint. Provide a round head. Cast the word "WATER" on the lid. The minimum diameter of the shaft of the box is 5 1/4 inches.

2.1.3 Meters

Submit certificates certifying all required and recommended tests set forth in the referenced standard and AWWA M6 have been performed and comply with all applicable requirements of the referenced standard and

AWWA M6 within the past three years. Include certification that each meter has been tested for accuracy of registration and that each meter complies with the accuracy and capacity requirements of the referenced standard when tested in accordance with AWWA M6.

Include a register with all meters whether.

2.1.3.1 Turbine Type Meters

Provide AWWA C701 Advanced Metering Infrastructure (AMI) and Direct Digital Communication (DDC) compatible meter with a strainer screen. Main casing constructed of copper alloy containing not less than 75 percent copper with protective coating in accordance with AWWA C213 or AWWA C550.

2.1.3.2 Register

Provide AWWA C700 permanently sealed straight-reading register supplied by the meter manufacturer. Equip register with U.S. gallons readings.

2.1.3.3 Strainers

Provide AWWA C701 strainer recommended and supplied by the meter manufacturer. Provide strainer of the same material as the meter body (i.e., bronze, ductile, or stainless).

2.1.3.4 Meter Connections

Provide flanged main case connection fittings. Provide connections compatible with the type of pipe and conditions encountered.

2.1.4 Backflow Preventers

2.1.4.1 Backflow Preventer Enclosure

Provide an insulated enclosure with heat conforming to ASSE 1060.

2.1.4.1.1 Materials of Fabrication

- a. Materials for exterior walls shall be 5052-H32 aluminum (0.50/18 gauge and shall comply with ASTM B209. The aluminum shall have a factory mill finish.
- b. Insulation shall be a closed cell polyisocyanurate foam core laminated to heavy black glass fiber reinforced facers on each side. The insulation shall have the following properties:
 - R-Value - 9.0
 - Dimensional Stability - 2% Linear Change
 - Compressive Strength - 20 psi and 25 psi
 - Product density - Nominal 2.0 pcf
 - Water Absorption - < 1% By Volume
 - Service Temperature - (-100°F to +250°F)
 - Moisture Vapor Transmission - < One (1) Perm
 - Flame Spread - 25
 - Insulation shall be 1.5 inches thick

2.1.4.1.2 Components

- a. The roof, walls and access panels shall be constructed of 5052-H32

(0.50/18 gauge) mill finish marine grade aluminum ASTM B209 outside with insulation 1.5 inches thick (9.0 "R" value) in the walls and access panels and 3 inches thick (18.0 "R" value) in the roof panel.

- b. The above components shall be securely bonded to form a composite panel.
- c. The exterior of the panels shall have a protective PVC masking to protect the finish. The protective masking shall be removed by the customer immediately after installation of the enclosure.
- d. The roof and wall panels shall be fastened together with self-tapping stainless steel screws through holes provided in panels.
- e. The roof panel shall be secured to the wall panels by stainless steel screws on the outside and security clips on the inside.
- f. Access panels shall be (2) total in number (1) per side and shall be 39 inches W x 55 inches H.
- g. Each access panel shall have factory installed locks with master keys provided.
- h. Drain relief panel for the enclosure shall be constructed of same said materials as wall panels and be located in one or more of the access panels.
- i. Drain relief panel shall have a stainless steel hinge and stainless steel spring as a positive means of closure after water discharge to prevent the intrusion of outside air, debris, and small animals.

2.1.4.1.3 Heating Equipment

- a. Enclosure with heating equipment provided by manufacturer will maintain an interior temperature of +40°F with an external temperature of -30°F.
- b. Enclosure without heating equipment are designated for climates where the ambient temperature does not go below 33°F for long periods of time.
- c. Heater shall be ETL, UL, or CSA certified.
- d. Heating equipment shall be installed above the level of RPZ discharge.
- e. Electrical power source for heater shall be designated circuit with G.F.I. protection and a minimum of 8 inches clearance from receptacle base to top of slab.

2.1.4.1.4 Installation Hardware

- a. Threaded fasteners shall be stainless steel and provided by the manufacturer.
- b. Concrete anchors shall be metal hit type and provide by the manufacturer. Optional anchors with Florida Building Code High-velocity Hurricane Zone approval available.
- c. Masonry drill bit and screw chuck shall be provided by the

manufacturer.

2.1.5 Disinfection

Chlorinating materials are to conform to: Chlorine, Liquid: AWWA B301; Hypochlorite, Calcium and Sodium: AWWA B300.

2.2 ACCESSORIES

2.2.1 Pipe Restraint

2.2.1.1 Thrust Blocks

Use ASTM C94/C94M concrete having a minimum compressive strength of 2,500 psi at 28 days.

2.2.1.2 Joint Restraint

Provide restrained joints in accordance with NFPA 24, Chapter 10 and in accordance with ASTM F1674.

Provide mechanical joint restraint or metal harness fabricated by the pipe manufacturer.

2.2.2 Sleeve-Type Mechanical Couplings

Use couplings to join plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling consists of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the follower rings toward each other to compress the gaskets. Provide true circular middle ring and the follower rings sections free from irregularities, flat spots, and surface defects; provide for confinement and compression of the gaskets. For ductile iron and PVC pipe, the middle ring is cast-iron or steel; and the follower rings are malleable or ductile iron. Malleable and ductile iron are to meet the requirements of ASTM A47/A47M and ASTM A536, respectively. Steel is to have a strength not less than that of the pipe. Use gaskets for resistance to set after installation and to meet the requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Provide track-head type bolts ASTM A307, Grade A, with nuts, ASTM A563, Grade A; or round-head square-neck type bolts, ASME B18.5.2.1M and ASME B18.5.2.2M with hex nuts, ASME B18.2.2. Provide 5/8 inch diameter bolts; minimum number of bolts for each coupling is 5 for 6 inch pipe, 7 for 10 inch pipe, and 8 for 12 inch pipe. Shape bolt holes in follower rings to hold fast to the necks of the bolts used. Do not use mechanically coupled joints using a sleeve-type mechanical coupling as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint. Provide a tight flexible joint with mechanical couplings under reasonable conditions, such as pipe movements caused by expansion, contraction, slight settling or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Match coupling strength to that of the adjoining pipeline.

2.2.3 Insulating Joints

Provide a rubber-gasketed insulating joint or dielectric coupling between pipe of dissimilar metals which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.2.4 Dielectric Fittings

Install dielectric fittings between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains to prevent metal-to-metal contact of dissimilar metallic piping elements and compatible with the indicated working pressure.

2.2.5 Tracer Wire for Nonmetallic Piping

Provide a continuous bare copper or aluminum wire not less than 0.10 inch in diameter in sufficient length over each separate run of nonmetallic pipe.

2.2.6 Water Service Line Appurtenances

2.2.6.1 Corporation Stops

Ground key type; lead-free bronze, ASTM B61 or ASTM B62; compatible with the working pressure of the system and solder-joint, or flared tube compression type joint. Threaded ends for inlet and outlet of corporation stops, AWWA C800; coupling nut for connection to flared copper tubing, ASME B16.26.

2.2.6.2 Curb or Service Stops

Ground key, round way, inverted key type; made of lead-free bronze, ASTM B61 or ASTM B62; and compatible with the working pressure of the system. Provide compatible ends for connection to the service piping. Cast an arrow into body of the curb or service stop indicating direction of flow.

2.2.6.3 Service Clamps

Provide single or double flattened strap type service clamps used for repairing damaged cast-iron, steel or PVC pipe with a pressure rating not less than that of the pipe being repaired. Provide clamps with a galvanized malleable-iron body with cadmium plated straps and nuts and a rubber gasket cemented to the body.

2.2.6.4 Curb Boxes

Provide a curb box for each curb or service stop manufactured from cast iron, size capable of containing the stop where it is used. Provide a round head. Cast the word "WATER" on the lid. Factory coat the box with a heavy coat of bituminous paint.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Connections to Existing System

Perform all connections to the existing water system in the presence of the Contracting Officer.

3.1.2 Operation of Existing Valves

Do not operate valves within or directly connected to the existing water

system unless expressly directed to do so by the Contracting Officer.

3.1.3 Earthwork

Perform earthwork operations in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

3.2 INSTALLATION

Install all materials in accordance with the applicable reference standard, manufacturers instructions and as indicated herein.

3.2.1 Piping

3.2.1.1 General Requirements

Install pipe, fittings, joints and couplings in accordance with the applicable referenced standard, the manufacturer's instructions and as specified herein.

3.2.1.1.1 Termination of Water Lines

Terminate the work covered by this section at a point approximately 5 feet from the building, unless otherwise indicated.

Do not lay water lines in the same trench with gas lines, fuel lines, electric wiring, or any other utility. Do not install copper tubing in the same trench with ferrous piping materials. Where nonferrous metallic pipe (i.e., copper tubing) crosses any ferrous piping, provide a minimum vertical separation of 12 inches between pipes.

3.2.1.1.2 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Under no circumstances is it permissible to drop or dump pipe, fittings, valves, or other water line material into trenches. Cut pipe cleanly, squarely, and accurately to the length established at the site and work into place without springing or forcing. Replace a pipe or fitting that does not allow sufficient space for installation of jointing material. Blocking or wedging between bells and spigots is not permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at the design elevation and grade. Secure firm, uniform support. Wood support blocking is not permitted. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports for fastening work into place. Make provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been assembled. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Provide a minimum of 3 feet depth of cover over top of pipe.

3.2.1.1.3 Tracer Wire

Install a continuous length of tracer wire for the full length of each run

of metallic and nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.2.1.1.4 Connections to Existing Water Lines

Make connections to existing water lines after coordination with the facility and with a minimum interruption of service on the existing line. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped and as indicated, except as otherwise specified, tap concrete pipe in accordance with AWWA M9 for tapping concrete pressure pipe.

3.2.1.1.5 Sewer Manholes

No water piping is to pass through or come in contact with any part of a sewer manhole.

3.2.1.1.6 Water Piping Parallel With Sewer Piping

Lay water piping at least 10 feet horizontally from a sewer or sewer manhole whenever possible. Measure the distance edge-to-edge.

Unusual Conditions: When local conditions or barriers prevent a 10-foot lateral separation, then:

- (1) The water main shall be laid in a separate trench and the bottom (invert) of the water piping shall be at least 18 inches above the top (crown) of the sewer piping. The water main can be laid in the same trench; however, the water main shall be laid on the opposite side of the trench on an undisturbed bench constructed 18-inches above the top of the sewer pipe.
- (2) Where the horizontal separation cannot be obtained, the sewer and water piping shall be constructed of AWWA-ferrous pipe. All pipe shall be pressure tested in place without leakage prior to backfilling.
- (3) The sewer manhole shall be of watertight construction and tested in place.

3.2.1.1.7 Water Piping Crossing Sewer Piping

- (1) Normal Conditions: Water piping shall be laid to cross above sewer piping with a separation of at least 18 inches between the bottom of the water piping and the top of the sewer piping.
- (2) Unusual Conditions: When local conditions prevent a vertical separation as described above, use the following construction:
 - (a) Water piping passing over sewer piping without a vertical separation of at least 18 inches between the top of the sewer piping and the bottom of the water piping; the provide adequate structural support for the water piping to prevent excessive deflection of the joints and the settling on and breaking of the sewer piping; and both the water piping and sewer piping shall be constructed of AWWA ferrous materials with joints equivalent to water main standards for a minimum distance of 10 feet on each side of the point of crossing. For water and sewer mains, a 20 foot minimum section of AWWA ferrous piping shall be centered at

the point of crossing so that joints shall be equidistant and as far as possible from the sewer piping.

(b) Water piping passing under sewer piping shall, in addition, be protected by providing a vertical separation of at least 18 inches between the bottom of the sewer piping and the top of the water piping; providing adequate structural support for the sewer piping to prevent excessive deflection of the joints and the settling on and breaking of the water piping; and both the water piping and sewer piping shall be constructed of AWWA ferrous materials with joints equivalent to water main standards for a minimum distance of 10 feet on each side of the point of crossing. For water and sewer mains, a 20 foot minimum section of AWWA ferrous piping shall be centered at the point of crossing that joints shall be equidistant and as far as possible from the sewer piping.

(c) Sewer Piping or Sewer Manholes: No water piping shall pass through or come in contact with any part of a sewer manhole.

3.2.1.1.8 Penetrations

Provide ductile-iron or Schedule 40 steel wall sleeves for pipe passing through walls of valve pits and structures. Fill annular space between walls and sleeves with rich cement mortar. Fill annular space between pipe and sleeves with mastic.

3.2.1.1.9 Flanged Pipe

Only install flanged pipe aboveground or with the flanges in valve pits.

3.2.1.2 Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

- a. Jointing: Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 and AWWA M41 for joint assembly. Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 and AWWA M41 for joint assembly and the recommendations of Appendix A to AWWA C111/A21.11. Make flanged joints with the gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When flanged pipe or fitting has dimensions that do not allow the making of a flanged joint as specified, replace it. Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves are to be full size for the bolt holes. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

- b. Allowable Deflection: Follow AWWA C600 and AWWA M41 for the maximum allowable deflection. If the alignment requires deflection in excess of the above limitations, provide special bends or a sufficient number of shorter lengths of pipe to achieve angular deflections within the limit set forth.
- c. Exterior Protection: Completely encase buried ductile iron pipelines using Method C, with polyethylene film, in accordance with AWWA C105/A21.5.

3.2.1.3 PVC Water Main Pipe

Unless otherwise specified, install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS and with the requirements of AWWA C605 for laying of pipe, joining PVC pipe to fittings and accessories, setting of fire hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

- a. Jointing: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use a lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of AWWA C605 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories and with the requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories, with the requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.
- b. Joint Offset: Construct joint offset in accordance AWWA C605. Do not exceed the minimum longitudinal bending as indicated by AWWA C605.
- c. Fittings: Install in accordance with AWWA C605.

3.2.1.4 Plastic Service Piping

Install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS and with the applicable requirements of ASTM D2774 and ASTM D2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F402.

3.2.1.4.1 Jointing

Make solvent-cemented joints for PVC piping using the solvent cement previously specified for this material; assemble joints in accordance with ASTM D2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.2.1.4.2 Plastic Pipe Connections to Appurtenances

Connect plastic service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

3.2.1.5 Water Service Piping

3.2.1.5.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the points indicated; close such water service lines with plugs or caps.

3.2.1.5.2 Water Service Line Connections to Water Mains

Connect water service lines to the main with a rigid connection and install a gate valve on service line below the frostline as indicated. Connect water service lines to ductile-iron water mains in accordance with AWWA C600 for service taps. Connect water service lines to PVC water mains in accordance with UBPPA UNI-PUB-08 and the recommendations of AWWA M23, Chapter 9, "Service Connections."

3.2.2 Meters

Install meters and meter boxes at the locations shown on the drawings. Center meters in the boxes to allow for reading and ease of removal or maintenance. Set top of box or vault at finished grade.

3.2.3 Backflow Preventers

Install backflow preventers of type, size, and capacity indicated a minimum of 12 inch and a maximum of 36 inch above concrete base. Include valves and test cocks. Install according to the manufacturers requirements and the requirements of plumbing and health department and authorities having jurisdiction. Support NPS 2 1/2 inch and larger backflow preventers, valves, and piping near floor with 12 inch minimum air gap, and on concrete piers or steel pipe supports. Do not install backflow preventers that have a relief drain in vault or in other spaces subject to flooding. Do not install by-pass piping around backflow preventers.

3.2.4 Disinfection

Prior to disinfection, provide disinfection procedures, proposed neutralization and disposal methods of waste water from disinfection as part of the disinfection submittal. Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Disinfect new water piping using the AWWA C651 continuous-feed method of chlorination. Ensure a free chlorine residual of not less than 10 parts per million after 24 hour holding period and

prior to performing bacteriological tests.

3.2.5 Flushing

Perform bacteriological tests prior to flushing. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 to 0.5 parts per million, the residual chlorine content of the distribution system, or acceptable for domestic use. Use AWWA C655 neutralizing chemicals. Water generated from the flushing of lines after disinfection or disinfection with hydrostatic testing must be land-applied in accordance with federal, state and local laws and regulations for land application. **No water used for disinfection and testing shall be allowed to enter the domestic water or sewer systems.**

3.2.6 Pipe Restraint

3.2.6.1 Concrete Thrust Blocks

Install concrete thrust blocks where indicated.

3.2.6.2 Restrained Joints

Install restrained joints in accordance with the manufacturer's instructions where indicated. For metal harness use tie rods and clamps as shown in NFPA 24. Provide metal harness fabricated by the pipe manufacturer and furnished with the pipe.

3.2.7 Valves

3.2.7.1 Gate Valves

Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves, AWWA C509 or AWWA C515, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509 or AWWA C515. Install gate valves on PVC and PVC-O water mains in accordance with the recommendations for appurtenance installation in AWWA M23, Chapter 7, "Installation." Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

3.2.7.2 Check Valves

Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated. Make and assemble joints to check valves as specified for making and assembling the same type joints between pipe and fittings.

3.2.7.3 Air Release, Air/Vacuum, and Combination Air Valves

Install pressure vacuum assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to the requirements of plumbing and health department and authorities having jurisdiction. Do not install pressure vacuum breaker assemblies in vault or other space subject to flooding.

3.3 FIELD QUALITY CONTROL

3.3.1 Tests

Notify the Contracting Officer a minimum of five days in advance of hydrostatic testing. Coordinate the proposed method for disposal of waste water from hydrostatic testing. Perform field tests, and provide labor, equipment, and incidentals required for testing. Provide documentation that all items of work have been constructed in accordance with the Contract documents.

3.3.1.1 Hydrostatic Test

Test water mains and water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test ductile-iron water mains and water service lines in accordance with the requirements of AWWA C600 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints or push-on joints shall not exceed the amounts given in AWWA C600; no leakage will be allowed at joints made by any other method.

The maximum allowable leakage shall be as determined by the following formula:

$$L = (S \times D \times (P)^{\frac{1}{2}}) / 148,000$$

Where L = allowable leakage over the two hour test period in gallons per hour, S = length of the tested section in feet, D = diameter of the pipe in inches, and P = test pressure in psi.

3.3.1.1.1 Special Testing Requirements

For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

3.3.1.2 Hydrostatic Sewer Test

The hydrostatic pressure sewer test will be performed in accordance with the applicable AWWA standard for the piping material or AWWA C600.

3.3.1.3 Leakage Test

For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

For PE perform leak testing in accordance with ASTM F2164.

3.3.1.4 Bacteriological Testing

Perform bacteriological tests in accordance with AWWA C651. For new water

mains use Option A and obtain two sets of samples for coliform analysis, each sample being collected at least 16 hours apart. Take samples every 1,200 ft plus one set from the end of the line and at least one from each branch greater than one pipe length. Analyze samples by a North Carolina certified laboratory, and submit the results of the bacteriological samples.

3.3.1.5 Backflow Preventer Tests

After installation conduct Backflow Preventer Tests and provide test reports verifying that the installation meets the FCCCHR Manual Standards.

3.3.1.6 Special Testing Requirements for Fire Service

Test water mains and water service lines providing fire service or water and fire service in accordance with NFPA 24. The additional water added to the system must not exceed the limits given in NFPA 24

3.3.1.7 Tracer Wire Continuity Test

Test tracer wire for continuity after service connections have been completed and prior to final pavement or restoration. Verify that tracer wire is locatable with electronic utility locating equipment. Repair breaks or separations and re-test for continuity.

3.4 SYSTEM STARTUP

Water mains and appurtenances must be completely installed, disinfected, flushed, and satisfactory bacteriological sample results received prior to permanent connections being made to the active distribution system. Obtain approval by the Contracting Officer prior to the new water piping being placed into service.

3.5 CLEANUP

Upon completion of the installation of water lines and appurtenances, remove all debris and surplus materials resulting from the work.

-- End of Section --

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SECTION 33 30 00

SANITARY SEWERAGE
05/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C94/C94M	(2020) Standard Specification for Ready-Mixed Concrete
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM D2321	(2020) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D3034	(2016) Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	(2007; R 2020) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F477	(2014) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F949	(2020) Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Contractor's License

SD-02 Shop Drawings

Installation Drawings

SD-03 Product Data

Pipeline Materials

Gravity Pipe

SD-07 Certificates

Portland Cement

1.3 QUALITY CONTROL

1.3.1 Installer Qualifications

Install specified materials by a licensed underground utility Contractor licensed for such work in the state where the work is to be performed. Verify installing Contractor's License is current and state certified or state registered.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.

1.4.1.1 Piping

Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.

1.4.1.2 Cement, Aggregate, and Reinforcement

As specified in Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE **(SIDEWALKS ONLY)**.

1.4.2 Handling

Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. Take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Sanitary Sewer Gravity Pipeline

Provide mains and laterals of polyvinyl chloride (PVC) plastic pipe. Provide building connections of polyvinyl chloride (PVC) plastic pipe. Provide new and modify existing exterior sanitary gravity sewer piping and appurtenances. Provide each system complete and ready for operation. The exterior sanitary gravity sewer system includes equipment, materials, installation, and workmanship as specified herein more than 5 feet outside of building walls.

2.2 MATERIALS

Provide materials conforming to the respective specifications and other requirements specified below. Submit manufacturer's product specification, standard drawings or catalog cuts.

2.2.1 Gravity Pipe

2.2.1.1 PVC Gravity Sewer Piping

2.2.1.1.1 PVC Gravity Pipe and Fittings

ASTM D3034, SDR 35, or ASTM F949 with ends suitable for elastomeric gasket joints.

2.2.1.1.2 PVC Gravity Joints and Jointing Material

Provide joints conforming to ASTM D3212. Gaskets are to conform to ASTM F477.

2.2.2 Portland Cement

Submit certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings, septic tanks, and precast manholes. Provide portland cement conforming to ASTM C150/C150M, Type II for concrete used in concrete pipe, concrete pipe fittings, septic tanks, and manholes and type optional for cement used in concrete cradle, concrete encasement, and thrust blocking.

2.2.3 Portland Cement Concrete

Provide portland cement concrete conforming to ASTM C94/C94M, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement is to have a compressive strength of 2500 psi minimum at 28 days. Protect concrete in place from freezing and moisture loss for 7 days.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Installation Drawings

Submit Installation Drawings showing complete detail, both plan and side view details with proper layout and elevations.

3.2 INSTALLATION

Backfill after inspection by the Contracting Officer. Before, during, and after installation, protect plastic pipe and fittings from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer.

3.2.1 General Requirements for Installation of Pipelines

These general requirements apply except where specific exception is made

in the following paragraphs entitled "Special Requirements."

3.2.1.1 Earthwork

Perform earthwork operations in accordance with Section 31 23 00.00 20 EXCAVATION AND FILL.

3.2.1.2 Pipe Laying and Jointing

Inspect each pipe and fitting before and after installation; replace those found defective and remove from site. Provide proper facilities for lowering sections of pipe into trenches. Lay nonpressure pipe with the bell ends in the upgrade direction. Adjust spigots in bells to give a uniform space all around. Blocking or wedging between bells and spigots or tongues and grooves will not be permitted. Replace by one of the proper dimensions, pipe or fittings that do not allow sufficient space for installation of joint material. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads.

3.2.2 Special Requirements

3.2.2.1 Installation of PVC Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" of this section and with the requirements of ASTM D2321 for laying and joining pipe and fittings. Make joints with the gaskets specified for joints with this piping and assemble in accordance with the requirements of ASTM D2321 for assembly of joints. Make joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.

3.3 FIELD QUALITY CONTROL

The Contracting Officer will conduct field inspections and witness field tests specified in this section. Be able to produce evidence, when required, that each item of work has been constructed in accordance with the drawings and specifications.

-- End of Section --

SECTION 33 40 00

STORM DRAINAGE UTILITIES

02/10, CHG 6: 02/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C270	(2019) Standard Specification for Mortar for Unit Masonry
ASTM C443	(2020) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C828	(2011) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C969	(2019) Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C990	(2009; R 2014) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM C1103	(2019) Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³) (2700 kN-m/m ³)
ASTM D1751	(2004; E 2013; R 2013) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

ASTM D1784	(2020) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D2167	(2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2321	(2020) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM F679	(2016) Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

1.2 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Pipe

SD-07 Certificates

Resin Certification

Leakage Test

Hydrostatic Test on Watertight Joints

Determination of Density

SD-08 Manufacturer's Instructions

Placing Pipe

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall

be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR CULVERTS AND STORM DRAINS

Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Poly Vinyl Chloride (PVC) Pipe

Submit the pipe manufacturer's resin certification, indicating the cell classification of PVC used to manufacture the pipe, prior to installation of the pipe.

2.1.1.1 Smooth Wall PVC Pipe

ASTM F679 produced from PVC certified by the Manufacturer as meeting the requirements of ASTM D1784, minimum cell class 12454-B.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 3,000 psi concrete under Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE (**SIDEWALKS ONLY**). The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C231/C231M. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to ASTM D1751, or ASTM D1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D1752.

2.2.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of harmful acids, alkalis, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily

cured.

2.2.3 Joints

2.2.3.1 PVC Plastic Pipes

Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

2.3 EROSION CONTROL RIP RAP

Provide non-erodible rock not exceeding 15 inches in its greatest dimension and choked with sufficient small rocks to provide a dense mass with a minimum thickness of as indicated.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 23 00.00 20 EXCAVATION AND FILL and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 36 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheet piling and bracing, where required, shall be placed within the trench width as specified, without any overexcavation. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 8 inches or 1/2 inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Section 31 23 00.00 20 EXCAVATION AND FILL .

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheet piling, water removal, or other specified requirements, such removal and replacement shall be performed at no

additional cost to the Government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Plastic Pipe

Bedding for PVC, PE, SRPE and PP pipe shall meet the requirements of ASTM D2321. Use Class IB or II material for bedding, haunching, and initial backfill. Use Class I, II, or III material for PP pipe bedding, haunching and initial backfill.

3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.

3.3.1 PVC Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.4 BACKFILLING

3.4.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation equal to the midpoint (spring line) of concrete pipe or has reached an elevation of at least 12 inches above the top of the pipe for flexible pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 6 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.4.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material

shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 6 inches. Use select granular material for this entire region of backfill for flexible pipe installations.

3.4.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.4.4 Compaction

3.4.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.4.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

- a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 100 percent of maximum density for cohesive material and 100 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.
- b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.
- c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.5 FIELD QUALITY CONTROL

3.5.1 Tests

Testing is the responsibility of the Contractor. Perform all testing and retesting at no additional cost to the Government.

3.5.1.1 HYDROSTATIC TEST ON WATERTIGHT JOINTS

Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C443. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed.

3.5.1.1.1 PVC Pipe

A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced pipe shall conform to ASTM C990 or ASTM C443.

3.5.1.2 Leakage Test

Lines shall be tested for leakage by low pressure air or water testing or exfiltration tests, as appropriate, prior to completing backfill. Low pressure air testing for vitrified clay pipes shall conform to ASTM C828. Low pressure air testing for concrete pipes shall conform to ASTM C969. Testing of individual joints for leakage by low pressure air or water shall conform to ASTM C1103. Prior to exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 2 feet or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. An exfiltration test shall be made by filling the line to be tested with water so that a head of at least 2 feet is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be reestablished. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by the exfiltration test shall not exceed 0.2 gallons per inch in diameter per 100 feet of pipeline per hour.

3.5.1.3 Determination of Density

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D2167 or ASTM D6938. When ASTM D6938 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications.

ASTM D6938 results in a wet unit weight of soil and ASTM D6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D6938. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

3.5.2 Repair Of Defects

3.5.2.1 Leakage Test

When leakage exceeds the maximum amount specified, correct source of excess leakage by replacing damaged pipe and gaskets and retest.

3.6 PROTECTION

Protect storm drainage piping and adjacent areas from superimposed and external loads during construction.

3.7 WARRANTY PERIOD

Pipe segments found to have defects during the warranty period must be replaced with new pipe and retested.

-- End of Section --

SECTION 33 71 02

UNDERGROUND ELECTRICAL DISTRIBUTION

12/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS8 (2000) Extruded Dielectric Shielded Power Cables Rated 5 Through 46 kV

ASTM INTERNATIONAL (ASTM)

ASTM B1 (2013) Standard Specification for Hard-Drawn Copper Wire

ASTM B3 (2013) Standard Specification for Soft or Annealed Copper Wire

ASTM B8 (2011; R 2017) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

ASTM F 512 (2006) Smooth-Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

IEEE C37.20.3 (2001; R 2006) Metal-Enclosed Interrupter Switchgear

IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

IEEE 386 (2016) Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV

IEEE Std 400.2 (2004) Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF)

IEEE Std 404 (2006) Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V Through

500 000 V

IEEE Std 48 (2009) Test Procedures and Requirements
for Alternating-Current Cable Terminations
2.5 kV through 765 kV

IEEE Std 81 (1983) Guide for Measuring Earth
Resistivity, Ground Impedance, and Earth
Surface Potentials of a Ground System
(Part 1) Normal Measurements

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-94-649 (2004) Standard for Concentric Neutral
Cable Rated 5 Through 46 KV

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS (2017; Errata 2017) Standard for
Acceptance Testing Specifications for
Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C119.1 (2006) Sealed Insulated Underground
Connector Systems Rated 600 Volts

NEMA RN 1 (2005) Standard for Polyvinyl Chloride
(PVC) Externally Coated Galvanized Rigid
Steel Conduit and Intermediate Metal
Conduit

NEMA TC 6 & 8 (2003) Standard for Polyvinyl Chloride PVC
Plastic Utilities Duct for Underground
Installations

NEMA TC 9 (2004) Standard for Fittings for Polyvinyl
Chloride (PVC) Plastic Utilities Duct for
Underground Installation

NEMA WC 71 (1999) Standard for Nonshielded Cables
Rated 2001-5000 Volts for use in the
Distribution of Electric Energy

NEMA WC 74 (2006) Standard for 5-46 kV Shielded Power
Cable for use in the Transmission and
Distribution of Electric Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA
20-1; TIA 20-2; TIA 20-3; TIA 20-4)
National Electrical Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-758-A (2004) Customer-Owned Outside Plant
Telecommunications Cabling Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS Bull 1751F-644 (2002) Underground Plant Construction

UNDERWRITERS LABORATORIES (UL)

UL 1072	(2006; Rev thru Sep 2007) Medium-Voltage Power Cables
UL 1242	(2006; Reprint Mar 2014) Standard for Electrical Intermediate Metal Conduit -- Steel
UL 44	(2018) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 467	(2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment
UL 486A-486B	(2003; Rev thru Apr 2009) Standard for Wire Connectors
UL 510	(2017) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2013; Reprint Aug 2017) UL Standard for Safety Metallic Outlet Boxes
UL 514B	(2012; Reprint Nov 2014) Conduit, Tubing and Cable Fittings
UL 6	(2007; Reprint Nov 2014) Electrical Rigid Metal Conduit-Steel
UL 651	(2011; Reprint Nov 2018) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 83	(2017) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 854	(2004; Rev thru Oct 2007) Service-Entrance Cables

1.2 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.
- b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.
- c. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

SD-03 Product Data

Medium voltage cable; G

Medium voltage cable joints; G

Medium voltage cable terminations; G

Precast concrete structures; G

Cable supports (racks, arms and insulators); G

SD-06 Test Reports

Arc-proofing test for cable fireproofing materials

Medium voltage cable qualification and production tests

Field Acceptance Checks and Tests

Arc-proofing test for cable fireproofing tape

Cable Installation Plan and Procedure

Six copies of the information described below in 8-1/2 by 11 inch binders having a minimum of three rings from which material may readily be removed and replaced, including a separate section for each cable pull. Sections shall be separated by heavy plastic dividers with tabs, with all data sheets signed and dated by the person supervising the pull.

- a. Site layout drawing with cable pulls numerically identified.
- b. A list of equipment used, with calibration certifications. The manufacturer and quantity of lubricant used on pull.
- c. The cable manufacturer and type of cable.
- d. The dates of cable pulls, time of day, and ambient temperature.
- e. The length of cable pull and calculated cable pulling tensions.
- f. The actual cable pulling tensions encountered during pull.

SD-07 Certificates

Cable splicer/terminator

Cable Installer Qualifications

1.4 QUALITY ASSURANCE

1.4.1 Certificate of Competency for Cable Splicer/Terminator

Certification of the qualification of the cable splicer/terminator shall be submitted, for approval, 30 days before splices or terminations are to be made in medium voltage (5 kV to 35 kV) cables. The certification shall include the training, and experience of the individual on the specific type and classification of cable to be provided under this contract. The certification shall indicate that the individual has had three or more years recent experience splicing and terminating medium voltage cables. The certification shall also list a minimum of three splices/terminations that have been in operation for more than one year. In addition, the individual may be required to perform a dummy or practice splice/termination in the presence of the Contracting Officer, before being approved as a qualified cable splicer. If that additional requirement is imposed, the Contractor shall provide short sections of the approved types of cables along with the approved type of splice/termination kit, and detailed manufacturer's instructions for the cable to be spliced. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for certification of an alternate cable splicer.

1.4.2 Cable Installer Qualifications

Provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. Provide a resume showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers.

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

PART 2 PRODUCTS

2.1 CONDUIT, DUCTS, AND FITTINGS

2.1.1 Rigid Metal Conduit

UL 6, galvanized steel, threaded type.

2.1.1.1 Rigid Metallic Conduit, PVC Coated

UL 6, galvanized steel, threaded type, coat with polyvinyl chloride (PVC) sheath bonded to galvanized exterior surface, nominal 40 mil thick conforming to NEMA RN 1, Type A40, except that hardness shall be nominal 85 Shore A durometer, dielectric strength shall be minimum 400 volts per mil at 60 Hz, and tensile strength shall be minimum 3500 psi and aging shall be minimum 1000 hours in an Atlas Weatherometer.

2.1.2 Intermediate Metal Conduit

UL 1242, galvanized steel, threaded type..

2.1.2.1 Intermediate Metal Conduit, PVC Coated

UL 1242, galvanized steel, threaded type, coated with polyvinyl chloride (PVC) sheath bonded to the galvanized exterior surface, nominal 40 mil thick, conforming to NEMA RN 1, Type A40, except that hardness shall be nominal 85 Shore A durometer, dielectric strength shall be minimum 400 volts per mil at 60 Hz, and tensile strength shall be minimum 3500 psi and aging shall be minimum 1000 hours in an Atlas Weatherometer.

2.1.3 Plastic Conduit for Direct Burial

UL 651, Schedule 40.

2.1.4 Plastic Duct for Concrete Encasement

NEMA TC 6 & 8 and ASTM F 512, UL 651, EPC-40-PVC.

2.1.5 Conduit Sealing Compound

Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F, shall neither slump at a temperature of 300 degrees F, nor harden materially when exposed to the air. Compounds shall adhere to clean surfaces of fiber or plastic ducts; metallic conduits or conduit coatings; concrete, masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal

without dissolving, noticeably changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials. Inflatable bladders may be used as an option.

2.1.6 Fittings

2.1.6.1 Metal Fittings

UL 514B, threaded type.

2.1.6.2 PVC Conduit Fittings

UL 514B, UL 651.

2.1.6.3 PVC Duct Fittings

NEMA TC 9.

2.1.6.4 Outlet Boxes for Steel Conduit

Outlet boxes for use with rigid or flexible steel conduit shall be cast-metal cadmium or zinc-coated if of ferrous metal with gasketed closures and shall conform to UL 514A.

2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors shall be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements. Wires and cables manufactured more than 12 months prior to date of delivery to the site shall not be accepted. Service entrance conductors shall conform to UL 854, type USE.

2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and THHN/THWN unless otherwise noted. Conductors No. 10 AWG and smaller shall be solid copper. Conductors No. 8 AWG and larger shall be stranded copper. All conductors shall be copper.

2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, shall be 600-volt, Type THWN/THHN conforming to UL 83 or Type XHHW or RHW conforming to UL 44. Copper conductors shall be annealed copper complying with ASTM B3 and ASTM B8.

2.2.3 Jackets

Multiconductor cables shall have an overall PVC outer jacket.

2.2.4 Cable Marking

Insulated conductors shall have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Each cable shall be identified by means of a fiber, laminated plastic, or non-ferrous metal tags, or approved equal, in each manhole, handhole,

junction box, and each terminal. Each tag shall contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Conductors shall be color coded. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made. Conductor identification shall be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves, or colored electrical tape. Control circuit terminations shall be properly identified. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows

a. 208/120 volt, three-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Shall provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

a. For use with copper conductors: UL 486A-486B.

2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply NEMA C119.1.

2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material which shall be applied in accordance with the manufacturer's written instructions.

2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation shall not require heat or flame, or any additional materials such as covering or adhesive. It shall be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.5 MEDIUM VOLTAGE CABLE

Cable (conductor) sizes are designated by American Wire Gauge (AWG) and Thousand Circular Mils (Kcmil). Conductor must be #2 or #4/0 copper. Conductor and conduit sizes indicated are for copper conductors unless otherwise noted. Insulated conductors shall have the date of manufacture

and other identification imprinted on the outer surface of each cable at regular intervals throughout cable length. Wires and cables manufactured more than 12 months prior to date of delivery to the site shall not be accepted. Provide single conductor type cables unless otherwise indicated.

2.5.1 Cable Configuration

Provide Type MV 105 cable, conforming to NEMA WC 74 and UL 1072 with concentric neutral underground distribution cable conforming to ICEA S-94-649. Provide cables manufactured for use in duct applications. Cable shall be rated 15 kV with 133 percent insulation level.

2.5.2 Conductor Material

Provide concentric-lay-stranded, Class B conductors. Provide soft drawn copper cables complying with ASTM B3 and ASTM B8 for regular concentric and compressed stranding.

2.5.3 Insulation

Provide ethylene-propylene-rubber (EPR) insulation conforming to the requirements of NEMA WC 71 and AEIC CS8.

2.5.4 Shielding

Cables rated for 2 kV and above shall have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper wire shield for each phase.

2.5.5 Neutrals

Concentric neutrals conductors must be copper, having a combined ampacity equal to the phase conductor ampacity rating.

2.5.6 Jackets

Cables shall be provided with a PVC jacket. Direct buried cables shall be rated for direct burial. Provide PVC jackets with a separator that prevents contact when underlying semiconducting insulating shield.

2.6 MEDIUM VOLTAGE CABLE TERMINATIONS

IEEE Std 48 Class 1; of the molded elastomer, prestretched elastomer, or heat-shrinkable elastomer. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Terminations, where required, shall be provided with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, or armor. Terminations shall be provided in a kit, including: skirts, stress control terminator, ground clamp, connectors, lugs, and complete instructions for assembly and installation. Terminations shall be the product of one manufacturer, suitable for the type, diameter, insulation class and level, and materials of the cable terminated. Do not use separate parts of copper or copper alloy in contact with aluminum alloy parts in the construction or installation of the terminator.

2.6.1 Cold-Shrink Type

Terminator shall be a one-piece design, utilizing the manufacturer's latest technology, where high-dielectric constant (capacitive) stress control is integrated within a skirted insulator made of silicone rubber. Termination shall not require heat or flame for installation. Termination kit shall contain all necessary materials (except for the lugs). Termination shall be designed for installation in low or highly contaminated indoor and outdoor locations and shall resist ultraviolet rays and oxidative decomposition.

2.6.2 Separable Insulated Connector Type

IEEE 386. Provide connector with steel reinforced hook-stick eye, grounding eye, test point, and arc-quenching contact material. Provide connectors of the loadbreak or deadbreak type as indicated, of suitable construction for the application and the type of cable connected, and that include cable shield adaptors. Provide external clamping points and test points.

- a. 200 Ampere loadbreak connector ratings: Voltage: 15 kV, 95 kV
BIL. Short time rating: 10,000 rms symmetrical amperes.

2.7 MEDIUM VOLTAGE CABLE JOINTS

Provide joints (splices) in accordance with IEEE Std 404 suitable for the rated voltage, insulation level, insulation type, and construction of the cable. Joints shall be certified by the manufacturer for waterproof, submersible applications. Upon request, supply manufacturer's design qualification test report in accordance with IEEE Std 404. Connectors for joint shall be tin-plated electrolytic copper, having ends tapered and having center stops to equalize cable insertion.

2.7.1 Cold-Shrink Rubber-Type Joint

Joint shall be of a cold shrink design that does not require any heat source for its installation. Splice insulation and jacket shall be of a one-piece factory formed cold shrink sleeve made of black EPDM rubber. Splice shall be packaged three splices per kit, including complete installation instructions.

2.8 TELECOMMUNICATIONS CABLING

Provide telecommunications cabling in accordance with Section 33 82 00 TELECOMMUNICATIONS OUTSIDE PLANT (OSP).

2.9 TAPE

2.9.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.9.2 Buried Warning and Identification Tape

Provide metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches minimum width, Red in color for electrica and Orange for

telecommunications for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

2.9.3 Fireproofing Tape

Provide tape composed of a flexible conformable unsupported intumescent elastomer. Tape shall be not less than .030 inch thick, noncorrosive to cable sheath, self-extinguishing, noncombustible, and shall not deteriorate when subjected to oil, water, gases, salt water, sewage, and fungus.

2.10 PULL ROPE

Shall be plastic or flat pull line (bull line) having a minimum tensile strength of 200 pounds. Leave a minimum of 24 inches of slack at each end of the pull wires.

2.11 GROUNDING AND BONDING

2.11.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used for rods 20 feet or longer.

2.11.2 Grounding Conductors

Stranded-bare copper conductors shall conform to ASTM B8, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors shall conform to ASTM B1 for sizes No. 8 and smaller. Insulated conductors shall be of the same material as phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Aluminum is not acceptable.

2.12 Precast concrete structures

Provide precast concrete support pad for transformer.

2.12.1 Precast Concrete Transformer Support (Pad)

In lieu of cast-in-place, Contractors, shall provide precast concrete structures designed for transformer support and subject to the requirements specified below. Precast units shall be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

2.12.1.1 General

Precast concrete structures shall have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures shall have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction shall be the same as for cast-in-place concrete construction, as modified herein. Concrete for precast work shall have a 28-day compressive strength of not less than 4000 psi. Structures shall be identified with the manufacturer's name embedded in or otherwise permanently attached to

an interior wall face.

2.13 CABLE SUPPORTS (RACKS, ARMS, AND INSULATORS)

The metal portion of racks and arms shall be zinc-coated after fabrication.

2.13.1 Cable Racks

The wall bracket shall be 4 inches by approximately 1-1/2 inch by 3/16 inch channel steel, 48 inches long (minimum) in manholes. Slots for mounting cable rack arms shall be spaced at 8 inch intervals.

2.13.2 Rack Arms

Cable rack arms shall be steel or malleable iron or glass reinforced nylon and shall be of the removable type. Rack arm length shall be a minimum of 8 inches and a maximum of 12 inches.

2.13.3 Insulators

Insulators for metal rack arms shall be dry-process glazed porcelain. Insulators are not required for nylon arms.

2.14 CABLE TERMINATING CABINETS

Cable terminating cabinets shall be hook-stick operable, deadfront construction conforming to the requirements of IEEE C37.20.3, Category A. Cabinets shall be provided with 200 A. loadbreak junctions and elbow-type separable loadbreak connectors, cable parking stands, and grounding lugs. Provide cable terminating equipment in conformance with IEEE 386.

Ratings at 60 Hz shall be:

Nominal voltage (kV).....	12.47
Rated maximum voltage (kV).....	15
Rated continuous current (A).....	200
Three-second short-time current-carrying capacity (kA).....	10
BIL (kV).....	125

2.15 SOURCE QUALITY CONTROL

2.15.1 Arc-Proofing Test for Cable Fireproofing Tape

Manufacturer shall test one sample assembly consisting of a straight lead tube 12 inches long with a 2 1/2 inch outside diameter, and a 1/8 inch thick wall, and covered with one-half lap layer of arc and fireproofing material per manufacturer's instructions. The arc and fireproofing tape shall withstand extreme temperature of a high-current fault arc 13,000 degrees K for 70 cycles as determined by using an argon directed plasma jet capable of constantly producing and maintaining an arc temperature of 13,000 degrees K. Temperature (13,000 degrees K) of the ignited arc between the cathode and anode shall be obtained from a dc power source of

305 (plus or minus 5) amperes and 20 (plus or minus 1) volts. The arc shall be directed toward the sample assembly accurately positioned 5 (plus or minus 1) millimeters downstream in the plasma from the anode orifice by fixed flow rate of argon gas (0.18 g per second). Each sample assembly shall be tested at three unrelated points. Start time for tests shall be taken from recorded peak current when the specimen is exposed to the full test temperature. Surface heat on the specimen prior to that time shall be minimal. The end point is established when the plasma or conductive arc penetrates the protective tape and strikes the lead tube. Submittals for arc-proofing tape shall indicate that the test has been performed and passed by the manufacturer.

2.15.2 Medium Voltage Cable Qualification and Production Tests

Results of AEIC CS8 qualification and production tests as applicable for each type of medium voltage cable.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable. In addition to these requirements, install telecommunications in accordance with TIA-758-A and RUS Bull 1751F-644.

3.2 CABLE INSPECTION

Prior to installation, each cable reel shall be inspected for correct storage positions, signs of physical damage, and broken end seals. If end seal is broken, moisture shall be removed from cable prior to installation in accordance with the cable manufacturer's recommendations.

3.3 CABLE INSTALLATION PLAN AND PROCEDURE

The Contractor shall obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature limits for installation, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, maximum allowable pulling tension, and maximum allowable sidewall bearing pressure. The Contractor shall then perform pulling calculations and prepare a pulling plan which shall be submitted along with the manufacturers instructions in accordance with SUBMITTALS. Cable shall be installed strictly in accordance with the cable manufacturer's recommendations and the approved installation plan.

Calculations and pulling plan shall include:

- a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.
- b. List of cable installation equipment.
- c. Lubricant manufacturer's application instructions.
- d. Procedure for resealing cable ends to prevent moisture from entering cable.

- e. Cable pulling tension calculations of all cable pulls.
- f. Cable percentage conduit fill.
- g. Cable sidewall bearing pressure.
- h. Cable minimum bend radius and minimum diameter of pulling wheels used.
- i. Cable jam ratio.
- j. Maximum allowable pulling tension on each different type and size of conductor.
- k. Maximum allowable pulling tension on pulling device.

3.4 UNDERGROUND FEEDERS SUPPLYING BUILDINGS

Terminate underground feeders supplying building at a point 5 feet outside the building and projections thereof, except that conductors shall be continuous to the terminating point indicated. Coordinate connections of the feeders to the service entrance equipment with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Conduit shall be PVC, Type schedule-40 from the supply equipment to a point 5 feet outside the building and projections thereof. Protect ends of underground conduit with plastic plugs until connections are made.

3.5 UNDERGROUND CONDUIT AND DUCT SYSTEMS

3.5.1 Requirements

Depths to top of the conduit shall be in accordance with NFPA 70. Run conduit in straight lines except where a change of direction is necessary. Numbers and sizes of ducts shall be as indicated. Ducts shall have a continuous slope downward toward underground structures and away from buildings, laid with a minimum slope of 3 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter. Otherwise, long sweep bends having a minimum radius of 25 feet shall be used for a change of direction of more than 5 degrees, either horizontally or vertically. Both curved and straight sections may be used to form long sweep bends, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in structures.

3.5.2 Treatment

Ducts shall be kept clean of concrete, dirt, or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being

laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.5.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

3.5.4 Jacking and Drilling Under Roads and Structures

Conduits to be installed under existing paved areas which are not to be disturbed, and under roads and railroad tracks, shall be zinc-coated, rigid steel, jacked into place. Where ducts are jacked under existing pavement, rigid steel conduit will be installed because of its strength. To protect the corrosion-resistant conduit coating, predrilling or installing conduit inside a larger iron pipe sleeve (jack-and-sleeve) is required. For crossings of existing railroads and airfield pavements greater than 50 feet in length, the predrilling method or the jack-and-sleeve method will be used. Separators or spacing blocks shall be made of steel, concrete, plastic, or a combination of these materials placed not farther apart than 4 feet on centers. Hydraulic jet method shall not be used.

3.5.5 Galvanized Conduit Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations shall be PVC coated and shall extend from at least 2 inches within the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches from penetration).

3.5.6 Multiple Conduits

Separate multiple conduits by a minimum distance of 2 1/2 inches, except that light and power conduits shall be separated from control, signal, and telephone conduits by a minimum distance of 12 inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that interlock vertically and horizontally. Spacer assembly shall consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers per manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.5.7 Conduit Plugs and Pull Rope

New conduit indicated as being unused or empty shall be provided with plugs on each end. Plugs shall contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

3.5.8 Conduit and Duct Without Concrete Encasement

Provide not less than 3 inches clearance from the conduit to each side of

the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve. The first 6 inch layer of backfill cover shall be sand compacted as previously specified. The rest of the excavation shall be backfilled and compacted in 3 to 6 inch layers. Provide color, type and depth of warning tape as specified above.

3.5.8.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts. Concrete encasement shall extend at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks.

3.5.9 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 2 1/2 inches, except separate light and power conduits from control, signal, and telecommunications conduits by a minimum concrete thickness of 3 inches. Before pouring concrete, anchor duct bank assemblies to prevent the assemblies from floating during concrete pouring. Anchoring shall be done by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly. Provide color, type and depth of warning tape as specified above.

3.6 CABLE PULLING

Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into switches, transformers, switchgear, switchboards, and other enclosures. Cable with tape shield shall have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.6.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables.

3.7 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set. Make splices in underground distribution systems only in accessible locations such as manholes, handholes, or aboveground termination cabinets.

3.8 MEDIUM VOLTAGE CABLE TERMINATIONS

Make terminations in accordance with the written instruction of the termination kit manufacturer.

3.9 MEDIUM VOLTAGE CABLE JOINTS

Provide power cable joints (splices) suitable for continuous immersion in water. Make joints only in accessible locations in manholes or handholes by using materials and methods in accordance with the written instructions of the joint kit manufacturer.

3.9.1 Joints in Shielded Cables

Cover the joined area with metallic tape, or material like the original cable shield and connect it to the cable shield on each side of the splice. Provide a bare copper ground connection brought out in a watertight manner and grounded to the manhole grounding loop as part of the splice installation. Ground conductors, connections, and rods shall be as specified elsewhere in this section. Wire shall be trained to the sides of the enclosure to prevent interference with the working area.

3.10 CABLE END CAPS

Cable ends shall be sealed at all times with coated heat shrinkable end caps. Cables ends shall be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps shall remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.11 FIREPROOFING OF CABLES IN UNDERGROUND STRUCTURES

Fireproof (arc proof) wire and cables which will carry current at 2200 volts or more in underground structures.

3.11.1 Fireproofing Tape

Tightly wrap strips of fireproofing tape around each cable spirally in half-lapped wrapping. Install tape in accordance with manufacturer's instructions.

3.11.2 Tape-Wrap

Tape-wrap metallic-sheathed or metallic armored cables without a nonmetallic protective covering over the sheath or armor prior to application of fireproofing. Wrap shall be in the form of two tightly applied half-lapped layers of a pressure-sensitive 10 mil thick plastic tape, and shall extend not less than one inch into the duct. Even out irregularities of the cable, such as at splices, with insulation putty before applying tape.

3.12 GROUNDING SYSTEMS

Provide grounding system as indicated, in accordance with NFPA 70 and IEEE C2, and as specified herein.

Noncurrent-carrying metallic parts associated with electrical equipment

shall have a maximum resistance to solid earth ground not exceeding the following values:

Pad-mounted transformers without protective fences	5 ohms
Ground in manholes	5 ohms
Grounding other metal enclosures of primary voltage electrical and electrically-operated equipment	5 ohms

3.12.1 Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus 6 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded.

If the specified ground resistance is not met, an additional ground rod shall be provided in accordance with the requirements of NFPA 70 (placed not less than 6 feet from the first rod). Should the resultant (combined) resistance exceed the specified resistance, measured not less than 48 hours after rainfall, the Contracting Officer shall be notified immediately.

3.12.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

- a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.
- b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

3.12.3 Grounding Conductors

Provide bare grounding conductors, except where installed in conduit with associated phase conductors. Ground cable sheaths, cable shields, conduit, and equipment with No. 6 AWG. Ground other noncurrent-carrying metal parts and equipment frames of metal-enclosed equipment. Ground metallic frames and covers of handholes and pull boxes with a braided, copper ground strap with equivalent ampacity of No. 6 AWG.

3.12.4 Ground Cable Crossing Expansion Joints

Protect ground cables crossing expansion joints or similar separations in structures and pavements by use of approved devices or methods of installation which provide the necessary slack in the cable across the joint to permit movement. Use stranded or other approved flexible copper cable across such separations.

3.13 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70 and PART 4 of the RFP.

3.13.1 Reconditioning of Surfaces

3.13.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct . Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

3.13.1.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists , restore such surface treatment or pavement the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.

3.14 FIELD QUALITY CONTROL

3.14.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.14.1.1 Medium Voltage Cables

Perform tests after installation of cable, splices, and terminators and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

- (1) Inspect exposed cable sections for physical damage.
- (2) Verify that cable is supplied and connected in accordance with contract plans and specifications.
- (3) Inspect for proper shield grounding, cable support, and cable termination.
- (4) Verify that cable bends are not less than ICEA or manufacturer's minimum allowable bending radius.
- (5) Inspect for proper fireproofing.
- (6) Visually inspect jacket and insulation condition.
- (7) Inspect for proper phase identification and arrangement.

b. Electrical Tests

(1) Perform a shield continuity test on each power cable by ohmmeter method. Record ohmic value, resistance values in excess of 10 ohms per 1000 feet of cable must be investigated and justified.

(2) Perform acceptance test on new cables before the new cables are connected to existing cables and placed into service, including terminations and joints. Perform maintenance test on complete cable system after the new cables are connected to existing cables and placed into service, including existing cable, terminations, and joints. Tests shall be very low frequency (VLF) alternating voltage withstand tests in accordance with IEEE Std 400.2. VLF test frequency shall be 0.05 Hz minimum for a duration of 60 minutes using a sinusoidal waveform. Test voltages shall be as follows:

CABLE RATING AC TEST VOLTAGE for ACCEPTANCE TESTING

5 kV	10kV rms(peak)
8 kV	13kV rms(peak)
15 kV	20kV rms(peak)
25 kV	31kV rms(peak)
35 kV	44kV rms(peak)

CABLE RATING AC TEST VOLTAGE for MAINTENANCE TESTING

5 kV	7kV rms(peak)
8 kV	10kV rms(peak)
15 kV	16kV rms(peak)
25 kV	23kV rms(peak)
35 kV	33kV rms(peak)

3.14.1.2 Grounding System

a. Visual and mechanical inspection

Inspect ground system for compliance with contract plans and specifications

b. Electrical tests

Perform ground-impedance measurements utilizing the fall-of-potential method in accordance with IEEE Std 81. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable megohmmeter tester in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test.

3.14.2 Follow-Up Verification

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer shall be given 5 working days advance notice of the dates and times of checking and testing.

20-0075 Repair BEQ FC530

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SECTION 33 82 00

TELECOMMUNICATIONS OUTSIDE PLANT (OSP)

06/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2011; R 2017) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³) (2700 kN-m/m ³)
ASTM D709	(2016) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2017; Errata 1-2 2017; INT 1 2017) National Electrical Safety Code

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-87-640	(2016) Optical Fiber Outside Plant Communications Cable; 4th Edition
ICEA S-98-688	(2012) Broadband Twisted Pair Telecommunication Cable, Aircore, Polyolefin Insulated, Copper Conductors Technical Requirements
ICEA S-99-689	(2012) Broadband Twisted Pair Telecommunication Cable Filled, Polyolefin Insulated, Copper Conductors Technical Requirements

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C62.61	(1993) American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
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TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-455-107	(1999a) FOTP-107 Determination of Component Reflectance or Link/System Return Loss using a Loss Test Set
TIA-455-46A	(1990) FOTP-46 Spectral Attenuation Measurement for Long-Length, Graded-Index Optical Fibers
TIA-455-78-B	(2002) FOTP-78 Optical Fibres - Part 1-40: Measurement Methods and Test Procedures - Attenuation
TIA-472D000	(2007b) Fiber Optic Communications Cable for Outside Plant Use
TIA-492AAAA	(2009b) 62.5-um Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers
TIA-492CAAA	(1998; R 2002) Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers
TIA-492E000	(1996; R 2002) Sectional Specification for Class IVd Nonzero-Dispersion Single-Mode Optical Fibers for the 1550 nm Window
TIA-526-14	(2015c) OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
TIA-526-7	(2015a) OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
TIA-568-C.1	(2009; Add 2 2011; Add 1 2012) Commercial Building Telecommunications Cabling Standard
TIA-568-C.2	(2009; Errata 2010; Add 2 2014; Add 1 2016) Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA-568-C.3	(2008; Add 1 2011) Optical Fiber Cabling Components Standard
TIA-569	(2015d) Commercial Building Standard for Telecommunications Pathways and Spaces

TIA-590	(1997a) Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant
TIA-606	(2012b; Add 1 2015) Administration Standard for the Telecommunications Infrastructure
TIA-607	(2011b) Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
TIA-758	(2012b) Customer-Owned Outside Plant Telecommunications Infrastructure Standard
TIA/EIA-455	(1998b) Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components
TIA/EIA-455-204	(2000) Standard for Measurement of Bandwidth on Multimode Fiber
TIA/EIA-598	(2014d) Optical Fiber Cable Color Coding

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS 1755	Telecommunications Standards and Specifications for Materials, Equipment and Construction
RUS Bull 1751F-630	(1996) Design of Aerial Plant
RUS Bull 1751F-640	(1995) Design of Buried Plant, Physical Considerations
RUS Bull 1751F-643	(2002) Underground Plant Design
RUS Bull 1751F-815	(1979) Electrical Protection of Outside Plant
RUS Bull 1753F-201	(1997) Acceptance Tests of Telecommunications Plant (PC-4)
RUS Bull 1753F-401	(1995) Splicing Copper and Fiber Optic Cables (PC-2)
RUS Bull 345-50	(1979) Trunk Carrier Systems (PE-60)
RUS Bull 345-65	(1985) Shield Bonding Connectors (PE-65)
RUS Bull 345-72	(1985) Filled Splice Closures (PE-74)
RUS Bull 345-83	(1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)

UNDERWRITERS LABORATORIES (UL)

UL 497	(2001; Reprint Jul 2013) Protectors for
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Paired Conductor Communication Circuits

UL 510	(2017) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 83	(2017) UL Standard for Safety Thermoplastic-Insulated Wires and Cables

1.2 RELATED REQUIREMENTS

Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM, and Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION apply to this section with additions and modifications specified herein.

1.3 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in this specification shall be as defined in TIA-568-C.1, TIA-568-C.2, TIA-568-C.3, TIA-569, TIA-606, and IEEE 100 and herein.

1.3.1 Campus Distributor (CD)

A distributor from which the campus backbone cabling emanates. (International expression for main cross-connect - (MC).) On Camp Lejeune the main cross-connect is established in Area Distribution Nodes (ADN), network operation centers (NOC), or telephone central office serving predesignated areas of the base. Designers should not design any new main cross-connects without approval from TSD (Telecommunications Support Division aka Base Telephone). The campus backbone is outside plant (OSP) back to TSD and a network operations center.

1.3.2 Entrance Facility (EF) (Telecommunications)

An entrance to the building for both private and public network service cables (including antennae, CATV, CCTV, IDS) including the entrance point at the building wall and continuing to the entrance room or space.

1.3.3 Entrance Room (ER) (Telecommunications)

A centralized space for telecommunications equipment that serves the occupants of a building. Equipment housed therein is considered distinct from a telecommunications room because of the nature of its complexity but could be combined within the communications room if additional space needed is allotted.

1.3.4 Building Distributor (BD)

A distributor in which the building backbone cables terminate and at which connections to the campus backbone cables may be made. (International expression for intermediate cross-connect - (IC).)

1.3.5 Pathway

A physical infrastructure utilized for the placement and routing of telecommunications cable.

1.4 SYSTEM DESCRIPTION

The telecommunications outside plant consists of cable, conduit, manholes, splices, protection, riser points, load coils, etc. required to provide signal paths from the closest point of presence (demarcation) to the new facility, including free standing frames or backboards, interconnecting hardware, terminating cables, lightning and surge protection modules at one or both ends of the cable, installed from the entrance facility in building to designated demarcation point. The work consists of providing, testing and making operational cabling, interconnecting hardware and lightning and surge protection necessary to form a complete outside plant telecommunications system for continuous use. The telecommunications contractor must coordinate with TSD concerning layout and configuration of the EF telecommunications and OSP. The telecommunications contractor may be required to coordinate work effort for access to the EF telecommunications and OSP with TSD.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- a. Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph "Regulatory Requirements" and as required for certificates in Section 01 33 00 SUBMITTAL PROCEDURES.
- b. Commercial off-the-shelf manuals shall be provided for operation, installation, configuration, and maintenance of products provided as a part of the communications outside plant (OSP). Submit operations and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein not later than 2 months prior to the date of beneficial occupancy. In addition to requirements of Data package 5, include the requirements of paragraphs "Telecommunications Outside Plant Shop Drawings" and "Telecommunications Entrance Facility Drawings".

SD-02 Shop Drawings

Telecommunications Outside Plant; G

Telecommunications Entrance Facility Drawings; G

In addition to Section 01 33 00 SUBMITTAL PROCEDURES, provide shop drawings in accordance with paragraph SHOP DRAWINGS.

SD-03 Product Data

Wire and cable; G

Cable splices, and connectors; G

Closures; G

Building protector assemblies; G

Protector modules; G

Cross-connect terminal cabinets; G

Spare Parts; G

Submittals shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Submittals shall also include applicable federal, military, industry, and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified in paragraph REGULATORY REQUIREMENTS and as required for certificates in Section 01 33 00 SUBMITTAL PROCEDURES.

SD-06 Test Reports

Pre-installation tests; G

Acceptance tests; G

Outside Plant Test Plan; G

SD-07 Certificates

Telecommunications Contractor Qualifications; G

Key Personnel Qualifications; G

Minimum Manufacturer's Qualifications; G

SD-08 Manufacturer's Instructions

Building protector assembly installation; G

Cable tensions; G

Fiber Optic Splices; G

Submit instructions prior to installation.

SD-09 Manufacturer's Field Reports

Factory Reel Test Data; G

SD-10 Operation and Maintenance Data

Telecommunications outside plant (OSP), Data Package 5; G

Commercial off-the-shelf manuals shall be provided for operation, installation, configuration, and maintenance of products provided as a part of the telecommunications outside plant (OSP). Submit operations and maintenance data in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA and as specified herein not later than 2 months prior to the date of beneficial occupancy. In addition to requirements of Data package 5, include the

requirements of paragraphs TELECOMMUNICATIONS OUTSIDE PLANT SHOP DRAWINGS and TELECOMMUNICATIONS ENTRANCE FACILITY DRAWINGS.

SD-11 Closeout Submittals

Record Documentation; G

In addition to other requirements, provide in accordance with paragraph RECORD DOCUMENTATION.

1.5.1 ADDITIONAL SUBMITTAL REQUIREMENTS

All submittals of material, equipment and design must be approved by the TSD Office prior to installing any telecommunications cabling and equipment.

1.6 QUALITY ASSURANCE

Ensure compliance with Section 01 45 10 QUALITY CONTROL.

1.6.1 Shop Drawings

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. Submittals shall include the nameplate data, size, and capacity. Submittals shall also include applicable federal, military, industry, and technical society publication references.

1.6.1.1 Telecommunications Outside Plant Shop Drawings

Provide Outside Plant Design in accordance with TIA-758, RUS Bull 1751F-630 for aerial system design, and RUS Bull 1751F-643 for underground duct system design and for direct buried system design. Provide T0 shop drawings that show the physical and logical connections from the perspective of an entire campus, such as actual building locations, exterior pathways and campus backbone cabling on plan view drawings, major system nodes, and related connections on the logical system drawings in accordance with TIA-606. Drawings shall include wiring and schematic diagrams for fiber optic and copper cabling and splices, copper conductor gauge and pair count, load coils, fiber pair count and type, pathway duct and innerduct arrangement, associated construction materials, and any details required to demonstrate that cable system has been coordinated and will properly support the switching and transmission system identified in specification and drawings. Provide Registered Communications Distribution Designer (RCDD) approved drawings of the telecommunications outside plant. Update existing telecommunication Outside Plant T0 drawings to include information modified, deleted or added as a result of this installation in accordance with TIA-606. The telecommunications outside plant (OSP) shop drawings shall be included in the operation and maintenance manuals.

1.6.1.2 Telecommunications Entrance Facility Drawings

Provide T3 drawings for EF Telecommunications in accordance with TIA-606

that include telecommunications entrance facility plan views, pathway layout (cable tray, racks, ladder-racks, etc.), mechanical/electrical layout, and cabinet, rack, backboard and wall elevations. Drawings shall show layout of applicable equipment including incoming cable connector blocks, building protector assembly, outgoing cable connector blocks, patch panels and equipment spaces and cabinet/racks. Drawings shall include a complete list of equipment and material, equipment rack details, proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearance for maintenance and operation. Drawings may also be an enlargement of a congested area of T1 or T2 drawings. Provide T3 drawings for EF Telecommunications as specified in the paragraph TELECOMMUNICATIONS SPACE DRAWINGS of Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEMS. The telecommunications entrance facility shop drawings shall be included in the operation and maintenance manuals.

1.6.2 Telecommunications Qualifications

Work under this section shall be performed by and the equipment shall be provided by the approved telecommunications contractor and key personnel. Qualifications shall be provided for: the telecommunications system contractor, the telecommunications system installer, the supervisor (if different from the installer), and the cable splicing and terminating personnel. A minimum of 30 days prior to installation, submit documentation of the experience of the telecommunications contractor and of the key personnel.

1.6.2.1 Telecommunications Contractor Qualifications

The telecommunications contractor shall be a firm which is regularly and professionally engaged in the business of the applications, installation, and testing of the specified telecommunications systems and equipment. The telecommunications contractor shall demonstrate experience in providing successful telecommunications systems that include outside plant and broadband cabling within the past 3 years. Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for the telecommunications contractor. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems in accordance with TIA-758 within the past 3 years.

1.6.2.2 Key Personnel Qualifications

Provide key personnel who are regularly and professionally engaged in the business of the application, installation and testing of the specified telecommunications systems and equipment. There may be one key person or more key persons proposed for this solicitation depending upon how many of the key roles each has successfully provided. Each of the key personnel shall demonstrate experience in providing successful telecommunications systems within the past 3 years.

Cable splicing and terminating personnel assigned to the installation of this system or any of its components shall have training in the proper techniques, shall be Building Industry Consulting Services International (BICSI) Certified Cabling Installation Technicians, Installer Level 2, or have a minimum of 3 years current consecutive experience in the installation of the specified copper and fiber optic cable and components for products used.

Supervisors and installers assigned to the installation of this system or any of its components shall have factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.

Submit documentation for a minimum of three and a maximum of five successful telecommunication system installations for each of the key personnel. Documentation for each key person shall include at least two successful system installations provided that are equivalent in system size and in construction complexity to the telecommunications system proposed for this solicitation. Include specific experience in installing and testing telecommunications outside plant systems, including broadband cabling, and provide the names and locations of at least two project installations successfully completed using optical fiber and copper telecommunications cabling systems. All of the existing telecommunications system installations offered by the key persons as successful experience shall have been in successful full-time service for at least 18 months prior to the issuance date for this solicitation. Provide the name and role of the key person, the title, location, and completed installation date of the referenced project, the referenced project owner point of contact information including name, organization, title, and telephone number, and generally, the referenced project description including system size and construction complexity.

Indicate that all key persons are currently employed by the telecommunications contractor, or have a commitment to the telecommunications contractor to work on this project. All key persons shall be employed by the telecommunications contractor at the date of issuance of this solicitation, or if not, have a commitment to the telecommunications contractor to work on this project by the date that the bid was due to the Contracting Officer.

Note that only the key personnel approved by the Contracting Officer in the successful proposal shall do work on this solicitation's telecommunications system. Key personnel shall function in the same roles in this contract, as they functioned in the offered successful experience. Any substitutions for the telecommunications contractor's key personnel requires approval from the Contracting Officer.

1.6.2.3 Minimum Manufacturer's Qualifications

Cabling, equipment and hardware manufacturers shall have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of components which comply with, TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3. In addition, cabling manufacturers shall have a minimum of 3 years experience in the manufacturing and factory testing of cabling which comply with ICEA S-87-640, ICEA S-98-688, and ICEA S-99-689.

1.6.3 Outside Plant Test Plan

Prepare and provide a complete and detailed test plan for field tests of the outside plant including a complete list of test equipment for the copper conductor and optical fiber cables, components, and accessories for approval by Telecommunications Support Division (aka Base Telephone) via the Contracting Officer. Include a cut-over plan with procedures and schedules for relocation of facility station numbers without interrupting service to any active location. Submit the plan at least 30 days prior to tests for Contracting Officer approval. Provide outside plant testing and performance measurement criteria in accordance with TIA-568-C.1 and

RUS Bull 1753F-201. Include procedures for certification, validation, and testing that includes fiber optic link performance criteria.

1.6.4 Standard Products

Provide materials and equipment that are standard products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and shall be the manufacturer's latest standard design that has been in satisfactory commercial or industrial use for at least 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section. Product submission must be approved for use by TSD via Contracting Officer prior to install.

1.6.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is provided.

1.6.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6.5 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the TSD via the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated by references or AHJ. Because references are living documents use of most current version shall be enforced.

1.6.5.1 Independent Testing Organization Certificate

In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.7 DELIVERY, STORAGE, AND HANDLING

Ship cable on reels in 5000 feet length with a minimum overage of 10

percent for 25, 50 or 100 pair configuration and 1250 feet length for larger cables. Radius of the reel drum shall not be smaller than the minimum bend radius of the cable. Wind cable on the reel so that unwinding can be done without kinking the cable. Two meters of cable at both ends of the cable shall be accessible for testing. Attach permanent label on each reel showing length, cable identification number, cable size, cable type, and date of manufacture. Provide water resistant label and the indelible writing on the labels. Apply end seals to each end of the cables to prevent moisture from entering the cable. Reels with cable shall be suitable for outside storage conditions when temperature ranges from minus 40 degrees C to plus 65 degrees C, with relative humidity from 0 to 100 percent. Equipment, other than cable, delivered and placed in storage shall be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants in accordance with manufacturer's requirements.

1.8 MAINTENANCE

1.8.1 Record Documentation

Provide the activity responsible for telecommunications system maintenance and administration (TSD via the Contracting Officer) a single complete and accurate set of record documentation for the entire telecommunications system for each structure with respect to this project.

Provide record documentation as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

Provide T5 drawings including documentation on cables and termination hardware in accordance with TIA-606. T5 drawings shall include schedules to show information for cut-overs and cable plant management, patch panel layouts, cross-connect information and connecting terminal layout as a minimum. T5 drawings shall be provided in both hard copy format and on electronic media using Windows based computer cable management software. A licensed copy of the cable management software including documentation, shall be provided. Update existing record documentation to reflect campus distribution T0 drawings and T3 drawing schedule information modified, deleted or added as a result of this installation. Provide the following T5 drawing documentation as a minimum:

- a. Cables - A record of installed cable shall be provided in accordance with TIA-606. The cable records shall include the required data fields for each cable and complete end-to-end circuit report for each complete circuit from the assigned outlet to the entry facility for the soft copy in accordance with TIA-606. Include manufacture date of cable with submittal.
- b. Termination Hardware - Provide a record of installed patch panels, cross-connect points, campus distributor and terminating block arrangements and type in accordance with TIA-606. Documentation shall include the required data fields as a minimum in accordance with TIA-606.

Provide record documentation as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM.

1.8.2 Spare Parts

In addition to the requirements of Section 01 78 23 OPERATION AND

MAINTENANCE DATA, provide a complete list of parts and supplies, with current unit prices and source of supply, and a list of spare parts recommended for stocking. Spare parts shall be provided no later than the start of field testing.

1.9 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Products supplied shall be specifically designed and manufactured for use with outside plant telecommunications systems. All product data must be supplied in the submittal process and no product can be used without approval from TSD via the Contracting Officer.

2.2 TELECOMMUNICATIONS ENTRANCE FACILITY

2.2.1 Building Protector Assemblies

Building protector assembly (BEP) shall be self-contained and have interconnecting hardware (710 input and 66 output) for connection to all Outside Plant rated cabling at full capacity. Provide and follow manufacturers instructions for building protector assembly installation. If Multiple BEPs are used, arrange and connect with lowest count high and to left and highest to bottom right. Provide copper cable interconnecting hardware as specified in Section 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM. There will be no service loops or splicing of copper cable outside of the building protector assembly within the telecommunications room (pigtail BEPs are not authorized).

2.2.2 Protector Modules

Provide in accordance with UL 497 three-electrode gas tube type, 5 pin, rated for the application. Provide gas tube protection modules in accordance with RUS Bull 345-83 and shall be heavy duty, A>10kA, B>400, C>65A where A is the maximum single impulse discharge current, B is the impulse life and C is the AC discharge current in accordance with ANSI C62.61. The gas modules shall shunt high voltage to ground, fail short, and be equipped with an external spark gap and heat coils in accordance with UL 497. Provide the number of surge protection modules equal to the number of pairs of exterior cable of the building protector assembly. Recommend 4B1E type.

2.2.3 Fiber Optic Terminations

Provide fiber optic cable terminations as specified in 27 10 00 BUILDING TELECOMMUNICATIONS CABLING SYSTEM. Ensure terminations within the Fiber Distribution Center (FDC) are logical left to right and top to bottom (OSP SM/Backbone SM then MM/Row to Row SM then MM).

2.2.4 Pathways

Underground applications for single buildings: provide a minimum of (3)

four inch ducts (copper, fiber, maintenance duct... in that order), one of which (fiber) contains (2)- three cell fabric inner duct. The (3) four inch ducts shall enter the Main Communications Room (entrance facility) to the far left of the communications backboard (longest farthest wall from the door) and shall be 3-6 inches above floor and 3-6 inches away from wall, aligned parallel to the communications backboard wall. The underground ducts must have 3" concrete encasing, with 24 inches minimum backfill below grade from the Communications Entrance Facility to the maintenance hole that will be providing service to the building (Demarcation point).

For campus distribution between maintenance holes, ducts may need to be 5" to support larger cables, also there will be no less than 4, and up to xx ducts as needed for distribution to the area serviced. All new ducts will include bell ends and terminators flush with MH walls sealed water tight. Both ends of new duct shall be plugged with compression plugs or duct seal around cables (no expanding foam). All new pathway shall be visibly marked and provided on area map with GPS coordinates. All ducts shall be installed as straight through runs between holes and shall not cross each other allowing a straight pull through. All duct banks where fiber cables are installed shall include fabric innerduct to maximize the pathway.

For direct buried applications (only in remote areas where there is no manhole duct systems and none is in project contract), provide a minimum of three (3) four inch ducts from the Communications Entrance Facility to outside the bldg foot print past any obstructions, footers, or sidewalks by at least 5 feet into clear soil/entryway, 24 inches below grade. The ducts will be plugged at both ends and clearly marked on outside end. For distribution to demarcation, between handholes, and riser points cables need to be 36" below grade with metal locating tape at 24" below grade. Cables need to be in HDDPE direct bored, HDDPE direct buried, concrete encased in conduit, or concrete encased split duct under all roadways and pavement. All new cables need to be provided on area map with GPS coordinates for riser points or hand holes. Handholes and maintenance holes shall be traffic rated (MIN tier 22). Handhole size min 4'x4'x4'. Maintenance hole size 6'x7'x8' and all penetrations should be splayed.

If utility pathway conflicts necessitate placement of a manhole below the typical/normal depth (6-12 inches), the roof of the manhole shall be placed at normal depth and riser extensions shall be used to increase the depth of the manhole. If a deep collar is unavoidable and the depth of the collar will exceed 24 inches, the Designer shall obtain written permission from TSD (Base Telephone) and ensure that the collar is equipped with permanent galvanized steps (rungs). Also do not drill hole in bottom of maintenance/handhole for grounding rod, use grounding ribbon built into the concrete structure itself that is in full contact with the ground.

2.3 CLOSURES

2.3.1 Copper Conductor Closures

2.3.1.1 Aerial Cable Closures

Provide cable closure assembly consisting of a frame with clamps, a lift-off polyethylene cover, cable nozzles, and drop wire rings. Closure shall be suitable for use on Figure 8 cables. Closures shall be free breathing and suitable for housing either straight-through type or branch type splices of non-pressurized communications cables and shall be sized

as indicated. The closure shall be constructed with ultraviolet resistant PVC.

NOTE: The installation of aerial cabling aboard Marine Corps Base, Camp Lejeune and Marine Corps Air Station, New River is not authorized.

2.3.1.2 Underground Cable Closures

- a. Aboveground: Provide aboveground closures constructed of not less than 14 gauge steel and acceptable for pole or stake mounting in accordance with RUS 1755.910. Closures shall be sized and contain a marker as indicated. Covers shall be secured to prevent unauthorized entry. PVC type closures are to be used in beach areas. All pedestals shall contain a minimum 4 foot x 3/8 inch pigtailed ground rod.
- b. Direct burial: Provide buried closure suitable for enclosing a straight, butt, and branch splice in a container into which can be poured an encapsulating compound. Closure shall have adequate strength to protect the splice and maintain cable shield electrical continuity in the buried environment. Encapsulating compound shall be reenterable and shall not alter the chemical stability of the closure. Provide filled splice cases in accordance with RUS Bull 345-72.

NOTE: The installation of a direct buried closure aboard Marine Corps Base, Camp Lejeune and Marine Corps Air Station, New River is not authorized; all closures shall be in a riser point, handhole, or manhole.

- c. In vault or manhole: Provide underground closure suitable to house a straight, butt, and branch splice in a protective housing into which air can be pumped for flash testing. Closure shall be of suitable thermoplastic or stainless steel material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Heat shrinkable type closures shall not be used. Provide filled splice cases in accordance with RUS Bull 345-72.

2.3.2 Fiber Optic Closures

2.3.2.1 Aerial

Provide aerial closure that is free breathing and suitable for housing splice organizer of non-pressurized cables. Closure shall be constructed from heavy PVC with ultraviolet resistance.

NOTE: The installation of new aerial cabling aboard Marine Corps Base, Camp Lejeune and Marine Corps Air Station, New River is not authorized.

2.3.2.2 Direct Burial

Provide buried closure suitable to house splice organizer in protective housing into which can be poured an encapsulating compound. Closure shall have adequate strength to protect the splice and maintain cable shield electrical continuity, when metallic, in buried environment. Encapsulating compound shall be reenterable and shall not alter chemical stability of the closure.

NOTE: The installation of a direct buried closure aboard Marine Corps

Base, Camp Lejeune and Marine Corps Air Station, New River is not authorized; all closures shall be in a riser point, handhold, or manhole.

2.3.2.3 In Vault or Manhole

Provide underground closure suitable to house splice organizer in a protective housing into which air can be pumped for flash testing. Closure shall be of thermoplastic material supplying structural strength necessary to pass the mechanical and electrical requirements in a vault or manhole environment. Provide 60' slack coils on fiber in every 3rd manhole/handhole or in any which a turn is made.

2.4 PAD MOUNTED CROSS-CONNECT TERMINAL CABINETS

Provide in accordance with RUS 1755.910 and the following:

- a. Constructed of 14 gauge steel.
- b. Equipped with a double set of hinged doors with closed-cell foam weatherstripping. Doors shall be locked and contain a marker as indicated.
- c. Equipped with spool spindle bracket, mounting frames, binding post log, jumpering instruction label, and load coil mounting provisions.
- d. Complete with cross connect modules to terminate number of pairs as indicated.
- e. Sized as indicated.

2.5 CABLE SPLICES, AND CONNECTORS

2.5.1 Copper Cable Splices

In vaults or manholes or entrance protectors provide multi-pair, in-line fold back to maximize length of accessible conductors for maintenance or single pair, in-line splices of a moisture resistant, three-wire insulation displacement connector held rigidly in place to assure maximum continuity in accordance with RUS Bull 1753F-401. Cables greater than 25 pairs shall be spliced using multipair splicing connectors, which accommodate 25 pairs of conductors at a time (typical 710). Provide correct connector size to accommodate the cable gauge of the supplied cable. Provide enough cable slack suitable for splicing operations to maximize length of accessible conductors for maintenance operations. In above ground splices use three wire insulation displacement single pair connectors no matter what size the cable. In longer runs of copper provide proper load coils to balance the load as needed to ensure line quality in accordance with RUS Bull 1753F-201.

2.5.2 Copper Cable Splice Connector

Provide splice connectors with a polycarbonate body and cap and a tin-plated brass contact element. Connector shall accommodate 19 to 26 AWG solid wire with a maximum insulation diameter of 0.065 inch and shall only be installed with manufacturer recommended crimp/cut tool. Fill connector with sealant grease to make a moisture resistant connection, in accordance with RUS Bull 1753F-401.

2.5.3 Fiber Optic Cable Splices

Provide fiber optic cable splices and splicing materials for fusion methods at locations shown on the construction drawings. The splice insertion loss shall be 0.3 dB maximum when measured in accordance with TIA-455-78-B using an Optical Time Domain Reflectometer (OTDR). Splices shall be designed for a return loss of 40.0 db max for single mode fiber when tested in accordance with TIA-455-107. Physically protect each fiber optic splice by a splice kit specially designed for the splice. Provide enough cable slack suitable for splicing operations, but in no case less than 30 feet at each end.

2.5.4 Fiber Optic Splice Organizer

Provide splice organizer suitable for housing fiber optic splices in a neat and orderly logical fashion. Splice organizer shall allow for a minimum of 3 feet of fiber for each fiber within the cable to be neatly stored without kinks or twists. Splice organizer shall accommodate individual strain relief for each splice and allow for future maintenance or modification, without damage to the cable or splices. Provide splice organizer hardware, such as splice trays, protective glass shelves, and shield bond connectors in a splice organizer kit.

2.5.5 Shield Connectors

Provide connectors with a stable, low-impedance electrical connection between the cable shield and the bonding conductor in accordance with RUS Bull 345-65.

2.6 CONDUIT

Provide conduit as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.7 PLASTIC INSULATING TAPE

Tape shall be premium quality, heavy-duty, weather-resistant designed for use on electrical and telecommunications applications and UL 510 compliant.

2.8 WIRE AND CABLE

2.8.1 Copper Conductor Cable

Solid copper conductors, covered with an extruded solid insulating compound. Insulated conductors shall be twisted into pairs which are then stranded or oscillated to form a cylindrical core. For special high frequency applications, the cable core shall be separated into compartments. Cable shall be completed by the application of a suitable core wrapping material, a corrugated copper or plastic coated aluminum shield, and an overall extruded jacket. Telecommunications contractor shall verify distances between splice points, slack required, and pair count required prior to ordering cable. Gauge of conductor shall be determined by the distance from the central office. In all cases the installed cable shall be of the same gauge as the cable it is being spliced into at the Demarcation point. The cable range available is; numbers of pairs specified; 19 gauge (6 to 400 pairs), 22 gauge (6 to 1200 pairs), 24 gauge (6 to 2100 pairs), and 26 gauge (6 to 3000 pairs). **26 AWG is not used on Camp Lejeune** Copper conductors shall conform to the following: All outside plant copper conductor cable available in PE-39

type shall be used; PE-89 is only approved for large pair counts when PE-39 is not manufactured due to large count.

2.8.1.1 Underground

Provide filled cable (type PE-39/89) meeting the requirements of ICEA S-99-689, RUS 1755.390, and RUS 1755.890. Provide enough cable slack suitable for splicing operations, but in no case less than 10 feet.

2.8.1.2 Aerial

Provide filled cable meeting the requirements of ICEA S-99-689, ICEA S-98-688, and RUS 1755.390 except that it shall be suitable for aerial installation and shall be Figure 8 distribution wire with 6,000 pound Class A galvanized steel or 6,000 pound aluminum-clad steel strand.

2.8.1.3 Screen

Provide screen-compartmental core cable filled cable meeting the requirements of ICEA S-99-689 and RUS 1755.390.

2.8.2 Fiber Optic Cable

Provide single-mode, 8/125-um, 0.10 aperture 1310 nm fiber optic cable in accordance with TIA-492CAAA, and single-mode, 8/125-um, 0.10 aperture 1550 nm fiber optic cable in accordance with TIA-492E000 and multimode 62.5/125-um, 0.275 aperture fiber optic cable in accordance with TIA-492AAAA, TIA-472D000, and ICEA S-87-640 including any special requirements made necessary by a specialized design. Provide a minimum of 24 optical fibers or more as indicated by drawings but never less without a waiver from local authority having jurisdiction. Fiber optic cable shall be specifically designed for outside use with preferred double jacket (if buried), single armor, loose buffer construction, and must be shielded. Provide fiber optic color code in accordance with TIA/EIA-598. Provide minimum 60' slack coil in every 3rd MH or any one where a turn is made.

NOTE: The installation of Multi-mode OSP Fiber Optic cables aboard Marine Corps Base, Camp Lejeune and Marine Corps Air Station, New River is not authorized; except as Backbone Underground Cabling between Communications Rooms within the same building, which is allowed, but not recommended.

2.8.2.1 Strength Members

Provide central/non-central, non-metallic/metallic strength members with sufficient tensile strength for installation and residual rated loads to meet the applicable performance requirements in accordance with ICEA S-87-640. The strength member is included to serve as a cable core foundation to reduce strain on the fibers, and shall not serve as a pulling strength member.

2.8.2.2 Shielding or Other Metallic Covering

Provide continuous, conductive or locatable, single tape covering and shield in accordance with ICEA S-87-640 on all cables.

2.8.2.3 Performance Requirements

Provide fiber optic cable with optical and mechanical performance

requirements in accordance with ICEA S-87-640.

2.8.3 Grounding and Bonding Conductors

Provide grounding and bonding conductors in accordance with RUS 1755.200, TIA-607, IEEE C2, and NFPA 70. Solid bare copper wire meeting the requirements of ASTM B1 for sizes No. 8 AWG and smaller and stranded bare copper wire meeting the requirements of ASTM B8, for sizes No. 6 AWG and larger. Conductors should be installed so as not to exceed minimum bend radius and shall be attached to most suitable bond available at location. Do not install field modified ground rods in maintenance holes that already have factory grounding. Insulated conductors shall have 600-volt, Type TW insulation meeting the requirements of UL 83.

2.9 T-SPAN LINE TREATMENT REPEATERS

Provide as indicated. Repeaters shall be pedestal mounted with pressurized housings, sized as indicated and shall meet the requirements of RUS Bull 345-50.

2.10 CABLE TAGS IN MANHOLES, HANDHOLES, AND VAULTS

Provide tags for each telecommunications cable or wire located in manholes, handholes, and vaults. Cable tags shall be stainless steel or polyethylene and labeled in accordance with TIA-606. Coordinate actual cable tag information with TSD. Handwritten labeling is unacceptable.

2.10.1 Stainless Steel

Provide stainless steel, cable tags 1 5/8 inches in diameter 1/16 inch thick minimum, and circular in shape. Tags shall be die stamped with numbers, letters, and symbols not less than 0.25 inch high and approximately 0.015 inch deep in normal block style.

2.10.2 Polyethylene Cable Tags

Provide tags of polyethylene that have an average tensile strength of 3250 pounds per square inch; and that are 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 170 degrees F. Provide 0.05 inch (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag. Ties shall have a minimum loop tensile strength of 175 pounds. The cable tags shall have black block letters, numbers, and symbols one inch high on a yellow background. Letters, numbers, and symbols shall not fall off or change positions regardless of the cable tags orientation.

2.11 BURIED WARNING AND IDENTIFICATION TAPE

Provide fiber optic media marking and protection in accordance with TIA-590. Provide color, type and depth of tape as specified in paragraph BURIED WARNING AND IDENTIFICATION TAPE in Section 31 23 00.00 20 EXCAVATION AND FILL.

2.12 GROUNDING BRAID

Provide grounding braid that provides low electrical impedance connections for dependable shield bonding in accordance with RUS 1755.200. Braid shall be made from flat tin-plated copper properly attached to factory

ground in maintenance/handhole, TMGB, building steel, electrical bus, or approved grounding rods in riser points.

2.13 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.14 FIELD FABRICATED NAMEPLATES

Provide laminated plastic nameplates in accordance with ASTM D709 for each patch panel, protector assembly, rack, cabinet and other equipment or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.15 TESTS, INSPECTIONS, AND VERIFICATIONS

2.15.1 Factory Reel Test Data

Test 100 percent OTDR test of FO media at the factory in accordance with TIA-568-C.1 and TIA-568-C.3. Use TIA-526-7 for single mode fiber and TIA-526-14 Method B for multi mode fiber measurements. Calibrate OTDR to show anomalies of 0.2 dB minimum. Enhanced performance filled OSP copper cables, referred to as Broadband Outside Plant (BBOSP), shall meet the requirements of ICEA S-99-689. Enhanced performance air core OSP copper cables shall meet the requirements of ICEA S-98-688. Submit test reports, including manufacture date for each cable reel and receive approval before delivery of cable to the project site.

PART 3 EXECUTION

3.1 INSTALLATION

Install all system components and appurtenances in accordance with manufacturer's instructions, IEEE C2, NFPA 70, and as indicated. Provide all necessary interconnections, services, and adjustments required for a complete and operable telecommunications system from designated demarcation point to building entrance facility, to include lightning protection terminations at one or both ends of the cable as required per paragraph: SYSTEM DESCRIPTION.

3.1.1 Contractor Damage

Promptly repair indicated utility lines or systems damaged during site preparation and construction. Damages to lines or systems not indicated, which are caused by Contractor operations, shall be treated as "Changes" under the terms of the Contract Clauses. When Contractor is advised in writing of the location of a nonindicated line or system, such notice shall provide that portion of the line or system with "indicated" status in determining liability for damages. In every event, immediately notify Base Telephone via the Contracting Officer of damage.

3.1.2 Cable Inspection and Repair

Handle cable and wire provided in the construction of this project with care. Inspect cable reels for cuts, nicks or other damage. Damaged cable shall be replaced or repaired to the satisfaction of the Contracting Officer. Reel wraps shall remain intact on the reel until the cable is ready for placement.

3.1.3 Direct Burial System

Installation shall be in accordance with RUS Bull 1751F-640. Under railroad tracks, paved areas, and roadways install cable in conduit encased in concrete. Slope ducts to drain. Excavate trenches by hand or mechanical trenching equipment after proper locates and pothole methods are used. Provide a minimum cable cover of 36 inches below finished grade for both fiber and copper cable. Trenches shall be not less than 6 inches wide and in straight lines between cable markers. Do not use cable plows. Bends in trenches shall have a radius of not less than 36 inches. Where two or more cables are laid parallel in the same trench, space laterally at least 3 inches apart. When rock is encountered, remove it to a depth of at least 3 inches below the cable and fill the space with sand or clean earth free from particles larger than 1/4 inch. Do not unreel and pull cables into the trench from one end. Cable may be unreeled on grade and lifted into position. Provide color, type and depth of warning tape as specified in paragraph BURIED WARNING AND IDENTIFICATION TAPE in Section 31 23 00.00 20 EXCAVATION AND FILL. Fiber optic cable will not be direct buried, it will be installed in a smooth wall HDPE type duct.

3.1.3.1 Cable Placement

- a. Prior to design and installation of any copper or optical fiber cable systems, cable routes and pathways must be approved by the Base Telephone via Contracting Officer. Manhole layouts (butterflies) shall be provided for review and approval. Cable route shall include which conduits are to be used for which cables using a logical bottom up and straight run approach.
- b. Separate cables crossing other cables or metal piping from the other cables or pipe by not less than 3 inches of well tamped earth. Do not install circuits for communications under or above traffic signal loops.
- c. Cables shall be in one piece without splices between connections except where the distance exceeds the lengths in which the cable is furnished.
- d. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 10 times the outside diameter of the cable or wire.
- e. Leave a horizontal slack of approximately 10 feet in the ground on each end of cable runs, on each side of connection boxes, and at points where connections are brought aboveground. Where cable is brought aboveground, leave additional slack to make necessary connections. (For fiber, provide a minimum of 30 feet at each end.)

3.1.3.2 Identification Slabs (Markers)

Provide a marker at each change of direction of the cable, over the ends

of ducts or conduits which are installed under paved areas and roadways and over each splice. Identification markers shall be of concrete, approximately 20 inches square by 6 inches thick.

3.1.3.3 Backfill for Rocky Soil

When placing cable in a trench in rocky soil, the cable shall be cushioned by a fill of sand or selected soil at least 2 inches thick on the floor of the trench before placing the cable or wire. The backfill for at least 4 inches above the wire or cable shall be free from stones, rocks, or other hard or sharp materials which might damage the cable or wire. If the buried cable is placed less than 24 inches in depth, a protective cover of concrete shall be used.

3.1.4 Cable Protection

Provide direct burial cable protection in accordance with NFPA 70 and as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Galvanized conduits which penetrate concrete (slabs, pavement, and walls) shall be PVC coated and shall extend from the first coupling or fitting outside either side of the concrete minimum of 6 inches per 12 inches burial depth beyond the edge of the surface where cable protection is required; all conduits shall be sealed on each end. Where additional protection is required, cable may be placed in galvanized iron pipe (GIP) sized on a maximum fill of 40 percent of cross-sectional area, or in concrete encased 4 inches PVC pipe. Conduit may be installed by jacking or trenching. Trenches shall be backfilled with earth and mechanically tamped at 6 inches lift so that the earth is restored to the same density, grade and vegetation as adjacent undisturbed material.

3.1.4.1 Cable End Caps

Cable ends shall be sealed at all times with coated heat shrinkable end caps. Cables ends shall be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps shall remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.1.5 Underground Duct

Provide underground duct and connections (terminators and bell ends) to existing manholes or handholes, as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION with any additional requirements as specified herein. Minimum size of ducts shall be 4 inch and minimum number will be three (3) into any building.

3.1.6 Reconditioning of Surfaces

Provide reconditioning of surfaces as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.1.7 Penetrations

Caulk and seal cable access penetrations in walls, ceilings and other parts of the building. Seal openings around electrical penetrations through fire resistance-rated wall, partitions, floors, or ceilings in accordance with Section 07 84 00 FIRESTOPPING.

3.1.8 Cable Pulling

Test duct lines with a mandrel (SHALL BE WITNESSED BY GOVERNMENT) and swab out to remove foreign material before the pulling of cables. Avoid damage to cables in setting up pulling apparatus or in placing tools or hardware. Do not step on cables when entering or leaving the manhole. Do not place cables in ducts other than those shown without prior written approval of Base Telephone via the Contracting Officer. Roll cable reels in the direction indicated by the arrows painted on the reel flanges. Set up cable reels on the same side of the manhole as the conduit section in which the cable is to be placed. Level the reel and bring into proper alignment with the conduit section so that the cable pays off from the top of the reel in a long smooth bend into the duct without twisting. Under no circumstances shall the cable be paid off from the bottom of a reel. Check the equipment set up prior to beginning the cable pulling to avoid an interruption once pulling has started. Use a cable feeder guide of suitable dimensions between cable reel and face of duct to protect cable and guide cable into the duct as it is paid off the reel. As cable is paid off the reel, lubricate and inspect cable for sheath defects. When defects are noticed, stop pulling operations and notify the Contracting Officer to determine required corrective action. Cable pulling shall also be stopped when reel binds or does not pay off freely. Rectify cause of binding before resuming pulling operations. Provide cable lubricants recommended by the cable manufacturer. Avoid bends in cables of small radii and twists that might cause damage. Do not bend cable and wire in a radius less than 10 times the outside diameter of the cable or wire.

3.1.8.1 Cable Tensions

Obtain from the cable manufacturer and provide to the Contracting Officer, the maximum allowable pulling tension. This tension shall not be exceeded.

3.1.8.2 Pulling Eyes

Equip cables 1.25 inches in diameter and larger with cable manufacturer's factory installed pulling-in eyes. Provide cables with diameter smaller than 1.25 inches with heat shrinkable type end caps or seals on cable ends when using cable pulling grips. Rings to prevent grip from slipping shall not be beaten into the cable sheath. Use a swivel of 3/4 inch links between pulling-in eyes or grips and pulling strand.

3.1.8.3 Installation of Cables in Manholes, Handholes, and Vaults

Do not install cables utilizing the shortest route, but route along those walls providing the longest route and the maximum spare cable lengths. Do not install slack coils in copper unless approved or requested by AHJ. Fiber slack coils should be min 60' in every 3rd MH or any MH where a turn is made. Form cables to closely parallel walls, not to interfere with duct entrances, and support cables on brackets and cable insulators at a maximum of 4 feet. Install cable or cables in corresponding ducts entering and exiting the manholes in straight lines, do not cross ducts or manhole. In existing manholes, handholes, and vaults where new ducts are to be terminated, or where new cables are to be installed, modify the existing installation of cables, cable supports, and grounding as required with cables arranged and supported as specified for new cables. Identify each cable with corrosion-resistant embossed metal tags. All fiber optic cables will be installed in fabric innerduct measuring min 1 inch (or larger) with min of three cells (but should maximize pathways).

3.1.9 Aerial Cable Installation

Where physical obstructions make it necessary to pull distribution wire along the line from a stationary reel, use cable stringing blocks to support wire during placing and tensioning operations. Do not place ladders, cable coils, and other equipment on or against the distribution wire. Wire shall be sagged in accordance with the data shown. Protect cable installed outside of building less than 8 feet above finished grade against physical damage.

NOTE: The installation of aerial cabling aboard Marine Corps Base, Camp Lejeune and Marine Corps Air Station, New River is not authorized.

3.1.9.1 Figure 8 Distribution Wire

Perform spiraling of the wire within 24 hours of the tensioning operation. Perform spiraling operations at alternate poles with the approximate length of the spiral being 15 feet. Do not remove insulation from support members except at bonding and grounding points and at points where ends of support members are terminated in splicing and dead-end devices. Ground support wire at poles to the pole ground.

3.1.9.2 Suspension Strand

Place suspension strand as indicated. Tension in accordance with the data indicated. When tensioning strand, loosen cable suspension clamps enough to allow free movement of the strand. Place suspension strand on the road side of the pole line. In tangent construction, point the lip of the suspension strand clamp toward the pole. At angles in the line, point the suspension strand clamp lip away from the load. In level construction place the suspension strand clamp in such a manner that it will hold the strand below the through-bolt. At points where there is an up-pull on the strand, place clamp so that it will support strand above the through-bolt. Make suspension strand electrically continuous throughout its entire length, bond to other bare cables suspension strands and connect to pole ground at each pole.

3.1.9.3 Aerial Cable

Keep cable ends sealed at all times using cable end caps. Take cable from reel only as it is placed. During placing operations, do not bend cables in a radius less than 10 times the outside diameter of cable. Place temporary supports sufficiently close together and properly tension the cable where necessary to prevent excessive bending. In those instances where spiraling of cabling is involved, accomplish mounting of enclosures for purposes of loading, splicing, and distribution after the spiraling operation has been completed.

NOTE: The installation of aerial cabling aboard Marine Corps Base, Camp Lejeune and Marine Corps Air Station, New River is not authorized.

3.1.10 Cable Splicing

3.1.10.1 Copper Conductor Splices

Perform splicing in accordance with manufacturer, best known practices, and requirements of RUS Bull 1753F-401 except that direct buried splices and twisted and soldered splices are not allowed. Exception does not apply

for pairs assigned for carrier application.

3.1.10.2 Fiber Optic Splices

Fiber optic splicing shall be in accordance with manufacturer's recommendation and shall exhibit an insertion loss not greater than 0.2 dB for fusion splices.

NOTE: The installation of Mechanical Fiber Optic Splices aboard Marine Corps Base, Camp Lejeune and Marine Corps Air Station, New River is not authorized.

3.1.11 Surge Protection

All cables and conductors, except fiber optic cable, which serve as communication lines through off-premise lines, shall have surge protection (710 input/66 output) installed at each end which meet the requirements of RUS Bull 1751F-815.

3.1.12 Grounding

Provide grounding and bonding in accordance with RUS 1755.200, TIA-607, IEEE C2, and NFPA 70. Ground exposed noncurrent carrying metallic parts of telephone equipment, cable sheaths, cable splices, and terminals.

3.1.12.1 Telecommunications Master Ground Bar (TMGB)

The TMGB is the hub of the basic telecommunications grounding system providing a common point of connection for ground from outside cable, CD, and equipment. Establish a TMGB for connection point for cable stub shields to connector blocks and CD protector assemblies as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. The TMGB will at a minimum be 4 inches by 10 inches by 1/4 inch as shown in TIA-607.

3.1.12.2 Incoming Cable Shields

Shields shall not be bonded across the splice to the cable stubs at the main distribution frame. Ground shields of incoming cables in the EF Telecommunications to the TMGB.

3.1.12.3 Campus Distributor Grounding

- a. Protection assemblies: Mount CD protector assemblies directly on the telecommunications backboard. Connect assemblies mounted on each vertical frame with No. 6 AWG copper conductor to provide a low resistance path to TMGB.
- b. TMGB connection: Connect TMGB to TGB with copper conductor with a total resistance of less than 0.01 ohms.

3.1.13 Cut-Over

All necessary transfers and cut-overs, shall be accomplished by the telecommunications contractor except government owned cables with active service which must be done by TSD.

3.2 LABELING

3.2.1 Labels

Provide labeling for new cabling and termination hardware located within the facility in accordance with TIA-606. Handwritten labeling is unacceptable. Stenciled lettering for cable and termination hardware shall be provided using either thermal ink transfer process or laser printer. Actual information on labels shall be obtained from TSD via contracting office.

3.2.2 Cable Tag Installation

Install cable tags for each telecommunications cable or wire located in manholes, handholes, and vaults including each splice. Tag new wire and cable provided under this contract and existing wire and cable which are indicated to have splices and terminations provided by this contract. The labeling of telecommunications cable tag identifiers shall be in accordance with TIA-606. Tag legend shall be as indicated. Do not provide handwritten letters. Install cable tags so that they are clearly visible without disturbing any cabling or wiring in the manholes, handholes, and vaults.

3.2.3 Termination Hardware

Label patch panels, distribution panels, connector blocks and protection modules using color coded labels with identifiers in accordance with TIA-606.

3.3 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.4 FIELD QUALITY CONTROL

Provide the Contracting Officer 10 working days notice prior to each test. Provide labor, equipment, and incidentals required for testing. Correct defective material and workmanship disclosed as the results of the tests. Furnish a signed copy of the test results to the Contracting Officer within 3 working days after the tests for each segment of construction are completed. Perform testing as construction progresses and do not wait until all construction is complete before starting field tests.

3.4.1 Pre-Installation Tests

Perform the following tests on cable at the job site before it is removed from the cable reel. For cables with factory installed pulling eyes, these tests shall be performed at the factory and certified test results shall accompany the cable.

3.4.1.1 Cable Capacitance

Perform capacitance tests on all pairs within a cable to determine if cable capacitance is within the limits specified.

3.4.1.2 Loop Resistance

Perform DC-loop resistance on all of the pairs within a cable to determine if DC-loop resistance is within the manufacturer's calculated resistance.

3.4.1.3 Pre-Installation Test Results

Provide results of pre-installation tests to the Contracting Officer at least 5 working days before installation is to start. Results shall indicate reel number of the cable, manufacturer, size of cable, pairs tested, and recorded readings. When pre-installation tests indicate that cable does not meet specifications, remove cable from the job site.

3.4.2 Acceptance Tests

Perform acceptance testing in accordance with RUS Bull 1753F-201 and as further specified in this section. Provide personnel, equipment, instrumentation, and supplies necessary to perform required testing. Notification of any planned testing shall be given to the Contracting Officer at least 14 days prior to any test unless specified otherwise. Testing shall not proceed until after the Contractor has received written Contracting Officer's approval of the test plans as specified. Test plans shall define the tests required to ensure that the system meets technical, operational, and performance specifications. The test plans shall define milestones for the tests, equipment, personnel, facilities, and supplies required. The test plans shall identify the capabilities and functions to be tested. Provide test reports to TSD via Contracting officer in soft and hard copy in .pdf or .xls form showing all field tests performed, upon completion and testing of the installed system. Measurements shall be tabulated on a pair by pair or strand by strand basis. Blank forms can be provided from Base Telephone upon request.

3.4.2.1 Copper Conductor Cable

Perform the following acceptance tests in accordance with TIA-758:

- a. Wire map (pin to pin continuity)
- b. Continuity to remote end
- c. Crossed pairs
- d. Reversed pairs
- e. Split pairs
- f. Shorts between two or more conductors
- g. Grounded pairs.

3.4.2.2 Fiber Optic Cable

Test fiber optic cable in accordance with TIA/EIA-455 and as further specified in this section. Two optical tests shall be performed on all optical fibers: Optical Time Domain Reflectometry (OTDR) Test, and Attenuation Test. These tests shall be performed on the completed end-to-end spans which include the near-end pre-connectorized single fiber cable assembly, outside plant as specified, outside plant field un-terminated at demarcation point, and the far-end pre-connectorized

single fiber cable assembly.

- a. OTDR Test: The OTDR test shall be used to determine the adequacy of the cable installations by showing any irregularities, such as discontinuities, micro-bendings or improper splices for the cable span under test. Hard copy fiber signature records shall be obtained from the OTDR for each fiber in each span and shall be included in the test results. The OTDR test shall be measured in both directions. A reference length of fiber, 1000 feet minimum, used as the delay line shall be placed before the new end connector and after the far end patch panel connectors for inspection of connector signature. Conduct OTDR test and provide calculation or interpretation of results in accordance with TIA-526-7 for single-mode fiber and TIA-526-14 for multimode fiber. Splice losses shall not exceed 0.2 db.
- b. Attenuation Test: End-to-end attenuation measurements shall be made on all fibers, in both directions, using a 850 & 1300 for 62.5 multi-mode fiber and 1310 & 1550 for single mode nanometer light source at one end and the optical power meter on the other end to verify that the cable system attenuation requirements are met in accordance with TIA-455-46A for multimode and TIA-526-7 for single-mode fiber optic cables. The measurement method shall be in accordance with TIA-455-78-B. Attenuation losses shall not exceed 0.5 db/km at 1310 nm and 1550 nm for single-mode fiber. Attenuation losses shall not exceed 5.0 db/km at 850 nm and 1.5 db/km at 1300 nm for multimode fiber.
- c. Bandwidth Test: The end-to-end bandwidth of all multimode fiber span links shall be measured by the frequency domain method. The bandwidth shall be measured in both directions on all fibers. The bandwidth measurements shall be in accordance with TIA/EIA-455-204.

3.4.3 Soil Density Tests

- a. Determine soil-density relationships for compaction of backfill material in accordance with ASTM D1557, Method D.
- b. Determine soil-density relationships as specified for soil tests in Section 31 23 00.00 20 EXCAVATION AND FILL.

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Marine Corps Base (MCB) Camp Lejeune Contractor Environmental Guide

Prepared For:

Marine Corps Installations East-Marine Corps Base Camp Lejeune

Version Number 3



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INTERNATIONAL



Prepared By:
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CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE
FINAL

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TABLE OF CONTENTS

Table of Contents	i
Record of Changes	ix
Certification Page.....	xi
List of Acronyms and Abbreviations	xiii
Contractor's Phone Directory	xix
1.0 Contractor Environmental Guide Overview.....	1-1
1.1. Key Definitions and Concepts.....	1-3
1.1.1. Key Definitions	1-3
1.1.2. Key Concepts	1-4
1.2. Installation Background	1-5
1.2.1. Environmental Management Division and Environmental Affairs Department.....	1-6
1.2.2. Expectations	1-7
1.3. Overview of Requirements.....	1-8
1.3.1. Contractor Environmental Guide.....	1-9
1.3.2. Environmental and EMS Training	1-10
1.4. Points of Contact	1-12
1.5. Overview Map	1-13
2.0 Environmental Management System.....	2-1
2.1. Key Definition and Concepts	2-2
2.1.1. Key Definitions	2-2
2.1.2. Key Concepts	2-3
2.2. Overview of Requirements.....	2-5
2.3. Environmental Management System.....	2-6
2.4. EMS Responsibilities	2-8
2.5. Contractor Environmental Guide and EMS	2-9

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE

FINAL

3.0	Training	3-1
3.1.	Key Definitions and Concepts.....	3-2
3.1.1.	Key Definitions	3-2
3.1.2.	Key Concepts	3-3
3.1.3.	Environmental Management System	3-4
3.2.	Overview of Requirements.....	3-4
3.3.	Training Requirements	3-4
3.3.1.	General Environmental Awareness.....	3-4
3.3.2.	Environmental Management System	3-5
3.3.3.	Recordkeeping	3-5
4.0	Air Quality.....	4-1
4.1.	Key Definitions and Concepts.....	4-1
4.1.1.	Key Definitions	4-1
4.1.2.	Key Concepts	4-2
4.1.3.	Environmental Management System	4-3
4.2.	Overview of Requirements.....	4-4
4.3.	Permit Requirements	4-5
4.4.	Additional Activities of Concern	4-6
5.0	Environmental Emergency Planning and Response.....	5-1
5.1.	Key Definitions and Concepts.....	5-1
5.1.1.	Key Definitions	5-2
5.1.2.	Key Concepts	5-3
5.1.3.	Environmental Management System	5-4
5.2.	Overview of Requirements.....	5-4
5.3.	Spill Notification	5-6
5.3.1.	POL/Hazardous Materials Spill Notification Procedures.....	5-6
5.3.2.	Wastewater Spill and Water Line Break Notification	5-8
5.4.	Follow-Up	5-9
6.0	Cultural Resources	6-1
6.1.	Key Definitions and Concepts.....	6-1

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

6.1.1.	Key Definitions	6-1
6.1.2.	Key Concepts	6-3
6.1.3.	Environmental Management System	6-3
6.2.	Overview of Requirements	6-4
6.3.	Procedures	6-7
7.0	Hazardous Materials/Hazardous Waste Management	7-1
7.1.	Key Definitions and Concepts	7-1
7.1.1.	Key Definitions	7-2
7.1.2	Key Concepts	7-5
7.1.3	Environmental Management System	7-8
7.2.	Overview of Requirements	7-11
7.3.	Hazardous Materials Requirements	7-14
7.4.	Universal Waste Requirements	7-16
7.5.	Hazardous Waste Requirements	7-18
7.5.1.	Storage	7-19
7.5.2.	Manifesting and Disposal	7-21
7.6.	Non-RCRA-Regulated Waste Requirements	7-22
7.6.1.	Used Oil and Oil Filters	7-22
7.6.2.	Used Antifreeze	7-24
7.6.3.	Petroleum-Contaminated Wipes and Oily Rags .	7-25
7.6.4.	Used Electronic Equipment	7-25
7.6.5.	New and Used Batteries (Not Regulated as Universal Waste)	7-25
8.0	Asbestos	8-1
8.1.	Key Definitions and Concepts	8-1
8.1.1.	Key Definitions	8-1
8.1.2.	Key Concepts	8-3
8.1.3.	Environmental Management System	8-4
8.2.	Overview of Requirements	8-5
8.3.	Responsibilities Before a Demolition or Renovation Project	8-6
8.3.1.	Identification of ACM and PACM	8-7

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE

FINAL

8.3.2. Notification	8-8
8.3.3. Removal	8-8
8.3.4. Training	8-9
8.4. Responsibilities During a Demolition or Renovation Project.....	8-9
8.5. Disposal of ACM Waste.....	8-10
9.0 Lead-Based Paint.....	9-1
9.1. Key Definitions and Concepts.....	9-1
9.1.1. Key Definitions	9-1
9.1.2. Key Concepts	9-3
9.1.3. Environmental Management System	9-3
9.2. Overview of Requirements.....	9-4
9.3. Responsibilities Before Renovation or Demolition....	9-6
9.4. Permits	9-8
9.5. Disposal	9-8
9.6. Training	9-9
10.0 Natural Resources.....	10-1
10.1. Key Definitions and Concepts.....	10-1
10.1.1. Key Definitions	10-2
10.1.2. Key Concepts	10-3
10.1.3. Environmental Management System	10-5
10.2. Overview of Requirements.....	10-6
10.3. National Environmental Policy Act	10-10
10.4. Timber	10-11
10.5. Threatened and Endangered Species	10-13
10.6. Wetlands	10-14
10.6.1. Avoidance	10-14
10.6.2. Permits	10-15
10.6.3. Impacts	10-18
10.6.4. Mitigation.....	10-19
10.7. Temporary Construction.....	10-20

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

11.0	Stormwater	11-1
11.1	Key Definitions and Concepts.....	11-1
11.1.1	Key Definitions	11-2
11.1.2	Key Concepts	11-5
11.1.3	Environmental Management System	11-8
11.2	Overview of Requirements.....	11-9
11.3	Prior to Site Work.....	11-11
11.3.1	Construction Notifications	11-12
11.3.2	Familiarity with the Stormwater Phase I Industrial Permit.....	11-12
11.3.3	Familiarity with the Stormwater Phase II Municipal Permit	11-13
11.3.4	Project-Specific Construction Permits.....	11-13
11.4	Responsibilities During Site Work.....	11-16
12.0	Solid Waste, Recycling, and Pollution Prevention (P2). 12-1	
12.1	Key Definitions and Concepts.....	12-1
12.1.1	Key Definitions	12-2
12.1.2	Key Concepts	12-3
12.1.3	Environmental Management System	12-4
12.2	Overview of Requirements.....	12-5
12.3	Solid Waste Requirements	12-7
12.3.1	MCB Camp Lejeune Landfill Acceptable Waste Streams.....	12-9
12.4	Recycling Requirements.....	12-14
12.4.1	Recycling Center.....	12-15
12.4.2	Other Recyclables	12-16
12.5	Pollution Prevention and Green Procurement.....	12-17
13.0	Potential Discovery of Undocumented Contaminated Sites	13-1
13.1	Key Definitions and Concepts.....	13-2
13.1.1	Key Definitions	13-2
13.1.2	Key Concepts	13-3

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE

FINAL

13.1.3. Environmental Management System	13-3
13.2. Overview of Requirements.....	13-3
13.3. Unforeseen Site Condition Procedures.....	13-4
13.3.1. Petroleum, Oil, and Lubricants	13-5
13.3.2. Munitions and Ordnance.....	13-6
14.0 Permitting	14-1
14.1. Key Definitions and Concepts.....	14-1
14.1.1. Key Definitions	14-1
14.1.2. Key Concepts	14-2
14.1.3. Environmental Management System	14-3
14.2. Overview of Requirements.....	14-3
14.3. Project Permits and Approvals	14-3
14.3.1. Stormwater (Section 11.0)	14-4
14.3.2. Asbestos (Section 8.0)	14-5
14.3.3. Lead-Based Paint (Section 9.0).....	14-5
14.3.4. Air Quality (Section 4.0).....	14-6
14.3.5. Wetlands (Section 10.6).....	14-7
14.3.6. Drinking Water/Wastewater	14-8

List of Tables

Table 1-1. Contacts in Case of a Spill..... 1-13

Table 2-1. Practices Identified Under MCB Camp Lejeune’s
EMS 2-10

Table 5-1. Environmental Emergency Response Contacts 5-3

Table 12-1. Base Landfill Requirements 12-11

List of Figures

Figure 1-1. Environmental Management Division (MCB Camp
Lejeune) Organization Chart 1-7

Figure 1-2. Environmental Affairs Department (MCAS New
River) Organization Chart 1-7

Figure 1-3. Overview Map..... 1-14

Figure 2-1. Plan, Do, Check, Act Cycle 2-4

Figure 2-2. Potential Interactions of Construction and Demolition
Activities with the Environment..... 2-7

Figure 6-1. Possible Cultural Resource Discovery Flow Chart 6-8

Figure 7-1. Diamond Hazard Label 7-7

Attachments and Appendix

Attachment 2-1 MCB Camp Lejeune’s Environmental Policy
Statement

Attachment 3-1 Spill Reporting Form

Attachment 4-1 Weekly Hazardous Waste (HW) Site
Inspection Form MCB Camp Lejeune

Attachment 4-2 Weekly Hazardous Waste (HW) Site
Inspection Form MCAS New River

Appendix General EMS & Environmental Awareness
Training for Contractors & Vendors

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RECORD OF CHANGES

Date	Description of Changes	Page #	Name/Initials

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CERTIFICATION PAGE

I certify that I have read, understood, and accept this document and all attachments, and that all those within my party working on a job site within Marine Corps Base Camp Lejeune and/or Marine Corps Air Station New River will comply with the environmental policies and regulations herein. I am aware that there are penalties for not complying with this Guide.

Signature

Date

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LIST OF ACRONYMS AND ABBREVIATIONS

ACM	Asbestos-Containing Material
AHERA	Asbestos Hazard and Emergency Response Act
AHPA	Archaeological and Historic Preservation Act
ARPA	Archeological Resource Protection Act
ASHARA	Asbestos School Hazard Abatement Reauthorization Act
ASD	Accumulation Start Date
ASO	Air Station Order
BMP	Best Management Practice
BO	Base Order
C&D	Construction and Demolition
CAA	Clean Air Act
CAMA	Coastal Area Management Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability
CETEP	Comprehensive Environmental Training and Education Program
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
CG	Commanding General
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DHHS	Department of Health and Human Services
DLADS	Defense Logistics Agency Disposition Services
DM	Decision Memorandum

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

DMM	Discarded Military Munitions
DoD	Department of Defense
DoN	Department of Navy
DOT	Department of Transportation
DRMS	Defense Reutilization and Marketing Service
EA	Environmental Assessment
EAD	Environmental Affairs Department
ECON	Environmental Conservation Branch
EISA	Energy Independence and Security Act
EHS	Extremely Hazardous Substances
ELLAP	Environmental Lead Laboratory Accreditation Program
EMD	Environmental Management Division
EMS	Environmental Management System
EO	Executive Order
EOD	Explosives and Ordnance Disposal
EPA	Environmental Protection Agency
EPR	Extended Producer Responsibility
EPCRA	Emergency Planning and Community Right- to-Know Act
EPEAT	Electronic Product Environmental Assessment Tool
FAR	Federal Acquisition Regulation
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FSC	Facilities Support Contracts
FWS	Fish and Wildlife Service
GIS	Geographic Information System
GP	Green Procurement
HAP	Hazardous Air Pollutants

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

HCFC	Hydrochlorofluorocarbon
HCS	Hazard Communication Standard
HHCU	Health Hazards Control Unit (North Carolina)
HM	Hazardous Material
HMTA	Hazardous Materials Transportation Act
HQMC	Headquarters Marine Corps
HQW	High Quality Water
HVAC	Heating, Ventilation, and Air Conditioning
HW	Hazardous Waste
HWMP	Hazardous Waste Management Plan
IGI&S	Installation Geospatial Information & Services
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
LBP	Lead-Based Paint
LDA	Land-Disturbing Activities
LQG	Large Quantity Generator
MAG	Marine Aircraft Group
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCM	Minimum Control Measure
MCIEAST	Marine Corps Installations East
MCO	Marine Corps Order
MEC	Munitions and Explosives of Concern
MEF	Marine Expeditionary Force
MRF	Materials Recovery Facility
MS4	Municipal Separate Storm Sewer Systems
MSW	Municipal Solid Waste
NAPL	Non-Aqueous Phase Liquid

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

NC	North Carolina
NCAC	North Carolina Administrative Code
NCDAQ	North Carolina Department of Air Quality
NCDCM	North Carolina Division of Coastal Management
NCDEQ	North Carolina Department of Environmental Quality
NCDFR	North Carolina Division of Forest Resources
NCDMS	North Carolina Division of Mitigation Services
NCDWR	North Carolina Division of Water Resources
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	National Response Center
NRHP	National Register of Historic Places
ODS	Ozone-Depleting Substance
OPA	Oil Pollution Act
ORW	Outstanding Resource Water
OSHA	Occupational Safety and Health Administration
OWS	Oil-Water Separator
P2	Pollution Prevention
PACM	Presumed Asbestos-Containing Material
PCB	Polychlorinated biphenyl
POC	Point of Contact
POL	Petroleum, Oil, and Lubricant
PPA	Pollution Prevention Act
ppm	Parts Per Million

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

PPV	Public-Private Venture
PWD	Public Works Division
QRP	Qualified Recycling Program
RACM	Regulated Asbestos-Containing Material
RCRA	Resource Conservation and Recovery Act
RCRS	Resource Conservation and Recovery Section
ROICC	Resident Officer in Charge of Construction
RRP	Renovation, Repair, and Painting
SAA	Satellite Accumulation Area
SARA	Superfund Amendments & Reauthorization Act
SDS	Safety Data Sheet
SHPO	State Historic Preservation Officer
SPCC	Spill Prevention Control and Countermeasures
SSPP	Strategic Sustainability Performance Plan
SWDA	Solid Waste Disposal Act
SWPPP	Stormwater Pollution Prevention Plan (Also referred to as SPPP in NC)
T&P	Treatment and Processing
TCLP	Toxic Characteristic Leaching Procedure
TSD	Treatment, Storage, and Disposal
TSI	Thermal System Insulation
ULCP	Unit Level Contingency Plan
USC	United States Code
USACE	United States Army Corps of Engineers
USMC	United States Marine Corps
UW	Universal Waste

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

UXO Unexploded Ordnance

XRF X-Ray Fluorescence

CONTRACTOR’S PHONE DIRECTORY

In the event of an emergency, refer to the emergency numbers below. All non-emergency contractor inquiries regarding the operations at Marine Corps Base (MCB) Camp Lejeune and Marine Corps Air Station New River should be directed to the Resident Officer in Charge of Construction (ROICC) or Contract Representative. The ROICC or Contract Representative will either directly contact or refer contractors to the appropriate Division or Organization.

Emergency and Important Non-Emergency Numbers

Fire and Emergency Services Division.....	911
Ambulance.....	911
Hearing Impaired.....	(910) 451-4444
CHEMTREC (Emergency 24-hour/Outside MCB Camp Lejeune).....	(800) 424-9300
Hazardous Chemical Spill.....	911
Military Police.....	911
National Response Center (Outside MCB Camp Lejeune).....	(202) 372-2428
Toll Free.....	(800) 424-8802
Provost Marshall Office.....	911

Marine Corps Base Camp Lejeune

Operator/ Directory Assistance.....	(910) 451-1113
Confined Space Program Manager.....	(910) 451-5725
Environmental Management Division.....	(910) 451-5003
-Environmental Compliance Branch.....	(910) 451-5837

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

Asbestos Management	
Resource Conservation and Recovery Section	(910) 451-1482
Hazardous Material Consolidation Site/Free Issue	(910) 451-1482
Recycling Center, Building 982	(910) 451-4214
-Environmental Conservation Branch	(910) 451-5063
Fish & Wildlife	
Forestry Management	
NEPA	
Conservation Law Enforcement	(910) 451-2196/5226
-Environmental Quality Branch	(910) 451-5068
Air Quality	
Underground Storage Tanks	
Water Quality	
Explosives and Ordnance Disposal	(910) 451-0558
Public Works Division	(910) 451-5307
-Construction Project Managers	(910) 451-2583
-Contracts Branch	(910) 451-2582
-Officer In Charge of Construction (Main)	(910) 451-2581
-Public Works Base Utility Director	(910) 451-5024
Water Line Break/Wastewater Line Break	(910) 451-7190 (x225)
-Public Works Solid Waste Division/Landfill	(910) 451-2946
Range Control	(910) 451-3064
Regional Geospatial Information & Services (Installation Manager)	(910) 451-8915
Safety Department	(910) 451-5725

Marine Corps Air Station New River

Confined Space Program.....(910) 449-4964

Consolidated Hazardous Material Reutilization and
Inventory Management Program.....(910) 449-4531/4533

Environmental Affairs Department
(Director).....(910) 449-5441

-Environmental Affairs Department (Environmental
Manager).....(910) 449-5442

-Environmental Affairs Department (GIS
Manager).....(910) 449-6144

-Environmental Affairs Department (Hazardous
Waste).....(910) 449-5997

-Conservation Law Enforcement.....(910) 449-0108

Explosives Safety Officer.....(910) 449-5443

Military Police (Non-Emergency).....(910) 449-4248/4249

Public Works Division.....(910) 449-6506

-Officer In Charge of Construction.....(910) 449-5587

Safety Department.....(910) 449-4527

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1.0 CONTRACTOR ENVIRONMENTAL GUIDE OVERVIEW

Environmental protection is an integral part of the Marine Corps mission in order to protect public health, preserve environmental quality, comply with regulatory requirements, and develop and strengthen relationships between the Marine Corps community and external stakeholders. The purpose of the MCB Camp Lejeune Contractor Environmental Guide is to assist contractors working aboard Marine Corps Installations East's (MCIEAST's) Marine Corps Base (MCB) Camp Lejeune and Marine Corps Air Station (MCAS) New River in maintaining the mission by complying with Federal and State environmental laws and regulations, as well as the United States Marine Corps (USMC) and installation environmental policies. This guide is written in accordance with Marine Corps Order (MCO) P5090.2A and designed to answer many of the environmental questions that arise, as well as to provide pertinent information on environmental topics and training requirements.

This document should be used only as a *guide* to the environmental issues contractors may face while working aboard MCB Camp Lejeune and MCAS New River.

NOTE: This document should be used only as a guide to the environmental issues contractors may face while working

aboard MCB Camp Lejeune and MCAS New River. It is expected that contractors will work closely with the Environmental Management Division (EMD) at MCB Camp Lejeune, the Environmental Affairs Department (EAD) at MCAS New River, and Contract Representatives regarding environmental management issues, concerns, and/or questions. Should the need arise, this guide provides

**Contact the ROICC
or Contract
Representative
with any
questions.**

contractors with EMD, EAD, and emergency response points of contact (POCs). All initial inquiries should be directed to the Resident Officer in Charge of Construction (ROICC) or Contract Representative, who will either direct the contractor

or contact the appropriate environmental office if additional clarification regarding an environmental issue is necessary.

NOTE: It is very important to note that this guide is designed to provide requirements specific to MCB Camp Lejeune-issued contracts. It is the contractor's responsibility to know and comply with all Federal, State, and local regulations. MCB Camp Lejeune environmental personnel will assist contractors with compliance issues; however, the primary burden of regulatory identification, familiarity, and compliance lies with the contractor. This training *does not* replace any required regulatory environmental training or certification as per contract requirements. All required environmental training should be completed *prior* to working at MCIEAST installations.

NOTE: It is the contractor's responsibility to review the project-specific contract and specifications. Additional environmental requirements, submissions, and/or meetings not documented in this guide may be required.

1.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are used throughout this guide. If you have any questions about these definitions or concepts, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

1.1.1. Key Definitions

- **Environment.** Surroundings, to include all surface water, groundwater, drinking water supply, land surface or subsurface area, or ambient air within the United States or under the jurisdiction of the United States, including manmade structures, indoor air environments, natural resources, and archeological and cultural resources.
- **Environmental Management Division.** MCB Camp Lejeune's division responsible for environmental issues and compliance at MCB Camp Lejeune.
- **Environmental Affairs Department.** MCAS New River's department responsible for environmental issues and compliance at MCAS New River.
- **Environmental Management System (EMS).** A systematic approach for integrating environmental

considerations and accountability into day-to-day decisionmaking and long-term planning processes across all missions, practices, and functions. The EMS institutionalizes processes for continual environmental improvement and reducing risks to mission through ongoing planning, review, and preventive or corrective action.

1.1.2. Key Concepts

- **Environmental Requirement.** A defined standard pertaining to environmental compliance, pollution prevention (P2), or natural/cultural resources, subject to uniform application. Environmental requirements may be in the form of a law, regulation, Executive Order (EO), policy, ordinance, permit, Base Order (BO), or other form that prescribes a standard.
- **Executive Order.** Legally binding orders given by the President, as head of the Executive Branch, to direct Federal agencies and officials in their execution of congressionally established laws or policies.
- **MCB Camp Lejeune.** Throughout this document, MCB Camp Lejeune includes all MCB Camp Lejeune real property and contracts for work performed at MCAS New River and all outlying fields associated with MCB Camp Lejeune.
- **Marine Corps Order.** A directive of continuing authority or information, meant to be a permanent reference and requiring continuing action, issued by Headquarters Marine Corps (HQMC). In accordance

with MCO 5215.1K (10 May 2007), all MCOs shall, where applicable: establish, describe, or change existing policy, programs and major activities, and organizations; define missions; assign responsibilities; issue procedural guidance; and be written in standardized format.

- **Resident Officer In Charge of Construction.** The ROICC administers construction contracts and is the contractor's first line of contact with the government.
- **Regulatory Requirements.** Government (including Federal, State, and local) environmental regulations implemented by environmental statutes. Federal regulations often establish minimum standards for State and local governments' implementing programs.
- **Statutory Requirements.** Federal environmental statutes are laws that generally require compliance by U.S. Department of Defense (DoD) installations.

1.2. INSTALLATION BACKGROUND

MCB Camp Lejeune was established in 1941 in Onslow County, along the southern coast of North Carolina (NC). MCB Camp Lejeune is just south of MCAS New River. MCB Camp Lejeune takes advantage of 156,000 acres and 11 miles of beach capable of supporting amphibious operations, 32 gun positions, 48 tactical landing zones, three state-of-the-art training facilities, and 80 live fire ranges for its training mission.

The primary function of MCB Camp Lejeune is national defense, providing a home installation for the II Marine Expeditionary Force (MEF), 2nd Marine Division, 2nd Force Service Support Group, and other combat units and support commands. MCB Camp Lejeune's mission is to maintain combat-ready units for expeditionary deployment. MCB Camp Lejeune maintains and utilizes supply warehouses, maintenance shops, hazardous material storage, nonhazardous and hazardous waste storage, bulk fuel storage and transfer facilities, fleet parking, housing areas, recreational areas, two golf courses, and a marina.

MCAS New River is the principal USMC helicopter operating location on the East Coast and supports aircrew training in the H-53 helicopter. It is also the evaluation and prospective bed-down site for the V-22 Osprey. The mission of MCAS New River is to provide the necessary support for its Marine Aircraft Group (MAG) tenant units, MAG-26 and MAG-29.

1.2.1. Environmental Management Division and Environmental Affairs Department

MCB Camp Lejeune's EMD, within the Installation and Environment Department, is responsible for all natural resource and environmental matters aboard the installation. EMD works closely with MCB Camp Lejeune personnel, educating and training them to comply with environmental laws while accomplishing the military mission.

The EAD at MCAS New River works closely with the EMD on environmental compliance and protection matters. Due to

various joint operations, MCB Camp Lejeune and MCAS New River participate together in one EMS. See Figure 1-1 and Figure 1-2 for organization charts of EMD and EAD.



Figure 1-1. Environmental Management Division (MCB Camp Lejeune) Organization Chart



Figure 1-2. Environmental Affairs Department (MCAS New River) Organization Chart

1.2.2. Expectations

Contractors aboard the installation, which are committed to strict compliance with environmental laws and regulations,

assist MCB Camp Lejeune in providing the best possible training facilities for today's Marines and Sailors, while honoring our environmental responsibilities and objectives. Violation of environmental laws may result in severe civil or criminal penalties and fines.

1.3. OVERVIEW OF REQUIREMENTS

Contractors operating aboard MCB Lejeune and MCAS New River must be aware of and adhere to all applicable environmental regulations and requirements, which include but may not be limited to the following:

- **[EO 12088, Federal Compliance with Pollution Control Standards \(October 13, 1978\).](#)** Requires all facilities owned by or leased to or by the military to be designed, operated, and maintained in compliance with all applicable environmental standards. Military and civilian personnel must cooperate with Federal, State, and local environmental protection agencies and comply with applicable standards and criteria issued by these agencies to the extent permitted by law.
- **[EO 13423, Strengthening Federal Environmental, Energy, and Transportation Management.](#)** Requires Federal agencies to comply with applicable Federal, State, local, and host nation environmental laws and regulations. Additionally, requirements include more widespread use of EMSs as the framework for sustainability management.

- [EO 13514, Federal Leadership in Environmental, Energy, and Economic Performance.](#) Requires Federal agencies to meet various sustainability goals, to include the reduction of greenhouse gas emissions. Applicable provisions for meeting these goals are to be included in acquisition and service contracts.
- [MCO P5090.2A, Environmental Compliance and Protection Manual \(26 August 2013\).](#) USMC policies and responsibilities for compliance with environmental statutes and regulations, as well as the management of USMC environmental programs.

1.3.1. Contractor Environmental Guide

This guide consists of the following information:

- MCB Camp Lejeune Contractor Environmental Guide
 - o EMS overview and requirements
 - o Environmental program-specific requirements
- MCB Camp Lejeune General EMS and Environmental Awareness Training for Contractors and Vendors
- Signature Page

Prior to beginning work onsite, or within 30 days of beginning work onsite, all contractors and their employees performing work aboard MCB Camp Lejeune must review these materials and complete EMS and General Environmental Awareness training.

Prior to beginning work onsite, or within 30 days of beginning work onsite, all contractors and their employees performing work aboard MCB Camp Lejeune must review these materials and complete EMS and General Environmental Awareness training. This guide summarizes the EMS and environmental programs at MCB Camp Lejeune, as well as key requirements associated with the various environmental issues contractors may encounter while performing work aboard the installation.

Contractors are expected to work with their ROICC or Contract

Representatives and EMD/EAD when environmental concerns or issues arise.

1.3.2. Environmental and EMS Training

In accordance with Department of Defense (DoD) instructions and MCOs, EMD has implemented a Comprehensive Environmental Training and Education Program (CETEP). The goal of the CETEP is to ensure that appropriate environmental instruction and related information are provided to all levels of the Marine Corps in the most effective and efficient manner to achieve full compliance with all applicable environmental training

requirements. A major component of the CETEP is to provide general environmental awareness training to all individuals associated with the installation, including contractors.

In addition to CETEP requirements, MCB Camp Lejeune has implemented an installation-wide EMS. The EMS highlights the fact that the authority and principal responsibility for controlling environmental impacts belong to those commands, units, offices, and personnel (including contractors) whose activities have the potential to impact the environment.

All contractors are required to receive both EMS and general environmental awareness training at the level necessary for their job function.

All contractors are required to receive both EMS and general environmental awareness training at the level necessary for their job function. This guide satisfies these training requirements (See the Appendix).

As such, contractors working aboard MCB Camp Lejeune will do the following:

- Conduct job responsibilities in compliance with environmental regulations and in conformance with EMS requirements.
- Complete all applicable environmental training and maintain associated records as per contract requirements.

- Complete EMS and general environmental awareness training, and be aware of and understand the MCB Camp Lejeune Environmental Policy.
- Contact their ROICC or Contract Representative immediately regarding environmental and/or EMS issues.

Prior to beginning work onsite or within 30 days, all contractors must sign and date the signature page and return it to the installation Contract Representative. Anyone who works on a contract at any point during the contract period must receive this information and training.

1.4. POINTS OF CONTACT

EMD Branches and phone numbers are found in the Contractor's Phone Directory on pages xv and xvi of this Guide. All initial inquiries regarding an environmental issue should be directed to the ROICC or Contract Representative, who will either directly contact or refer the contractor to the appropriate environmental office if additional clarification is necessary. In the case of a spill or environmental emergency, immediately dial 911. Additional emergency response procedures are provided in Section 5.0 of this Guide.

Table 1-1. Contacts in Case of a Spill

For spills of:	Call:	Follow-up:
Hazardous waste	911	Spill Report
Unknown materials	911	Spill Report
Material on a permeable surface	911	Spill Report
Greater than 5 gallons of a material	911	Spill Report
Material that reaches stormwater inlets or waterways	911	
Nonhazardous waste	(910) 451-1482	911

1.5. OVERVIEW MAP

Figure 1-3 provides an overview map that displays the locations of installation facilities discussed throughout this Guide.

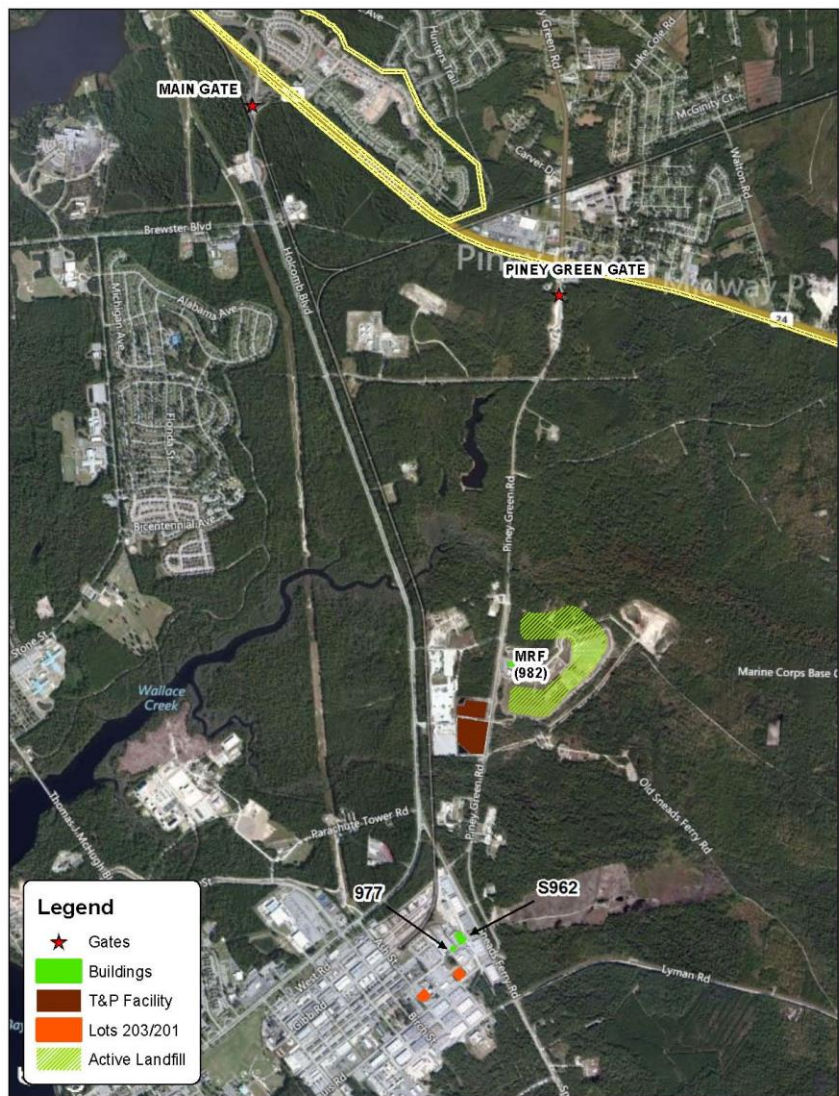


Figure 1-3. Overview Map

2.0 ENVIRONMENTAL MANAGEMENT SYSTEM

Three key principles of the Environmental Policy are to comply with relevant environmental laws and regulations, prevent pollution, and continually improve our EMS.

MCB Camp Lejeune and MCAS New River jointly operate an EMS, which provides a systematic way of continually implementing environmental requirements and evaluating performance. The EMS is founded on the principles of MCB Camp Lejeune's Environmental Policy, which is endorsed by the Commanding General (CG). Three key principles of the Environmental Policy are to:

- Comply with relevant environmental laws and regulations;
- Prevent pollution; and
- Continually improve the EMS.

The EMS promotes sustained mission readiness through actively identifying and implementing opportunities for efficient resource use. The USMC implements EMS at all levels to continually improve environmental compliance programs and meet evolving EOs and DoD requirements for mission sustainability. The EMS highlights the fact that the authority and principal responsibility for controlling environmental impacts belong to those commands, units,

offices, and personnel (including contractors and vendors) whose activities have the potential to impact the environment.

2.1. KEY DEFINITION AND CONCEPTS

The following key definitions and concepts are associated with an EMS. Please consult the ROICC or Contract Representative with any questions about these definitions or concepts.

**Please consult the
ROICC or Contract
Representative
with any
questions.**

2.1.1. Key Definitions

- **Environment.** Surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation.
- **Environmental Aspect.** A characteristic of an organization's activities, products, or services that may cause, in normal operation or upset mode, an impact to an environmental or other resource. Each practice may have several aspects.
- **Environmental Impact.** An effect, beneficial or adverse, of a practice's aspect on an environmental or other resource. Each practice may have several impacts.
- **Environmental Resources.** Sensitive environmental receptors (e.g., air, water, natural

resources) or cultural or historic assets at MCB Camp Lejeune or MCAS New River, in the surrounding community, within the ecosystem, or beyond, that may be impacted by the operation of practices.

- **Practice.** A unit process that supports a military mission and may impact environmental resources. (It is the ability to impact an environmental resource that is key to defining a practice. However, practices may also impact other resources.)
- **Practice Owner.** Person(s) responsible for control of practices. EMS procedures use the term *practice owner* when the assignment of more specific responsibilities is left to the owning organizations.
- **Requirement.** Legislation, regulation, or policy issued by any Executive, Federal, State, local, DoD, Department of Navy (DoN), or USMC authority that addresses environmental considerations and requires action.

2.1.2. Key Concepts

- **Environmental Management System.** A systematic approach for integrating environmental considerations and accountability into day-to-day decisionmaking and long-term planning processes across all missions, activities, and functions. The EMS institutionalizes processes for continual environmental improvement and for reducing risks to mission through ongoing planning, review, and preventive or corrective action.

- **Environmental Policy.** Public commitment by senior leaders to the management of the installation's environmental affairs, including environmental compliance, pollution prevention, natural/cultural resource management, cleanup, risk to mission, and continual improvement of the EMS.
- **Plan, Do, Check, Act.** Four-step model by which the EMS carries out change – **Plan:** establish objectives and processes; **Do:** implement and execute the plan; **Check:** study and analyze the results; **Act:** take action based on what you learned.

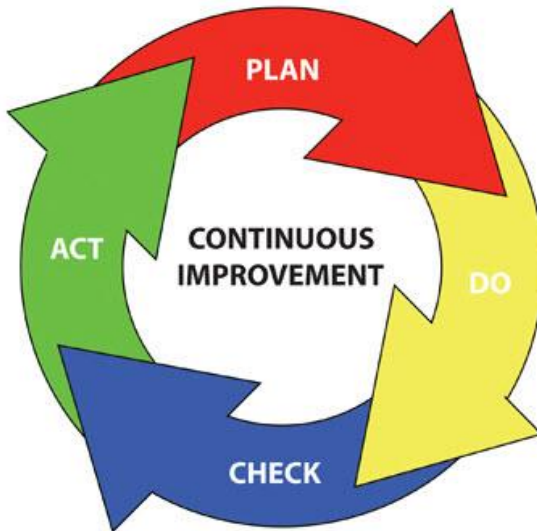


Figure 2-1. Plan, Do, Check, Act Cycle

2.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard MCB Camp Lejeune and MCAS New River must be aware of and adhere to all applicable regulations and requirements concerning EMS, which include but may not be limited to the following:

- **EO 13148, Greening the Government Through Leadership in Environmental Management.** Mandates that environmental management considerations must be an integral component of Federal Government policies, operations, planning, and management, with the primary goal for each agency to promote the sustainable management of Federal facility lands through the implementation of cost-effective, environmentally sound practices, and programs to reduce adverse impacts to the natural environment.
- **EO 13423, Strengthening Federal Environmental, Energy, and Transportation Management.** Establishes the EMS as the primary management approach for addressing environmental aspects, including energy and transportation aspects, and as the reporting mechanism for communicating progress on meeting performance goals.
- **EO 13514, Leadership in Environmental, Energy, and Economic Performance.** Requires continuing implementation of formal EMSs at all appropriate organizational levels to support the sustainability performance requirements of the Order.

2.3. ENVIRONMENTAL MANAGEMENT SYSTEM

An EMS is a systematic way to identify and eliminate or minimize the installation's environmental risk-to-mission. MCB Camp Lejeune's EMS identifies practices and their aspects as a starting point for prioritizing environmental management initiatives. Each installation practice, such as construction/renovation/demolition, equipment operation/maintenance/disposal, landscaping, or pesticide/herbicide management and application, has one or more environmental aspects. Figure 2-2 illustrates the simplified potential interactions of one practice, construction/renovation/demolition, with the environment.



Figure 2-2. Potential Interactions of Construction and Demolition Activities with the Environment

2.4. EMS RESPONSIBILITIES

Contractors are expected to understand that the practices they support on the installation may interact with and have the potential to impact the environment. Therefore, it is expected that contractors will do the following:

- Review the Contractor Environmental Guide.
- Be aware of the Environmental Policy (Attachment 2-1).
- Conduct practices in a way that avoids and/or minimizes impacts to the environment by complying with all applicable Federal, State, and local environmental regulations and BOs.
- Be familiar with spill response procedures.
- Report all environmental emergencies and spills.
- Report any environmental problems or concerns promptly, and notify the ROICC or Contract Representative.
- Respond to data collection efforts upon request.

Contractors are expected to understand that the activities performed on the installation may interact with the environment and have the potential to impact the environment.

2.5. CONTRACTOR ENVIRONMENTAL GUIDE AND EMS

The sections of this Contractor Environmental Guide are categorized based on the type of environmental requirements routinely encountered by contractors at MCB Camp Lejeune. The following matrix is derived from MCB Camp Lejeune's EMS Working Group sessions and relates the contents of this guide to the practices aboard MCB Camp Lejeune. It is provided to assist contractors in narrowing down specific requirements that may apply to onsite activities.

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

**Table 2-1. Practices Identified Under MCB Camp Lejeune's
EMS**

MCB Camp Lejeune 2015 Practices	Env. Emergency Response/ Spill Response, Section 5.0	HM/HW, Section 7.0	Potential Discovery of Undocumented Contaminated Sites, Section 13.0	Asbestos, Section 8.0	Lead-Based Paint, Section 9.0	Stormwater, Section 11.0	Solid Waste, Recycling, and P2, Section 12.0	Training, Section 3.0	Cultural Resources, Section 6.0	Permitting, Section 14.0	Air Quality, Section 4.0	Natural Resources, Section 10.0
Battery management		●					●					
Boat operation/ maintenance		●									●	
Boat, ramp, dock cleaning						●						
Boiler operation		●									●	
Building operation/ maintenance/ repair		●		●			●					
Channel dredging						●						
Chlorination		●									●	
Composting						●	●					
Construction/demo/ renovation				●	●	●	●		●			
Cooling tower operation and maintenance		●										
De-greasing		●									●	
Drinking water management		●										
Engine operation and maintenance		●									●	
Equipment operation/ maintenance/disposal		●		●			●					
Erosion/ runoff control						●						●
Fish stocking												

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

MCB Camp Lejeune 2015 Practices	Env. Emergency Response/ Spill Response, Section 5.0	HM/HW, Section 7.0	Potential Discovery of Undocumented Contaminated Sites, Section 13.0	Asbestos, Section 8.0	Lead-Based Paint, Section 9.0	Stormwater, Section 11.0	Solid Waste, Recycling, and P2, Section 12.0	Training, Section 3.0	Cultural Resources, Section 6.0	Permitting, Section 14.0	Air Quality, Section 4.0	Natural Resources, Section 10.0
Fueling and fuel mgt./ storage		●				●					●	
Grease traps							●					
Habitat management		●									●	●
HCP operation		●										
HM storage		●				●					●	
HM transportation		●					●				●	
HW disposal offsite transport		●					●					
HW satellite accumulation area		●									●	
HW storage (<90 days)		●										
HW transportation		●		●	●						●	
Land clearing						●	●		●			●
Landfill gas energy recovery system						●						
Landscaping		●				●						
Laundry		●										
Live fire range operation		●				●					●	●
Livestock operation						●	●					
Metal working		●					●				●	
Non-destructive inspection		●										
ODS/ halon management		●									●	
Packaging/unpack-aging							●					
Applicable to All Practices Conducted Aboard MCB Camp Lejeune												
Applicable to All Practices Conducted Aboard MCB Camp Lejeune												
Applicable to All Practices Conducted Aboard MCB Camp Lejeune												
Applicable to All Practices Conducted Aboard MCB Camp Lejeune												

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

MCB Camp Lejeune 2015 Practices	Env. Emergency Response/ Spill Response, Section 5.0	HM/HW, Section 7.0	Potential Discovery of Undocumented Contaminated Sites, Section 13.0	Asbestos, Section 8.0	Lead-Based Paint, Section 9.0	Stormwater, Section 11.0	Solid Waste, Recycling, and P2, Section 12.0	Training, Section 3.0	Cultural Resources, Section 6.0	Permitting, Section 14.0	Air Quality, Section 4.0	Natural Resources, Section 10.0
	Applicable to All Practices Conducted Aboard MCB Camp Lejeune		Applicable to All Practices Conducted Aboard MCB Camp Lejeune					Applicable to All Practices Conducted Aboard MCB Camp Lejeune				
Paint booth												
Paint gun cleaning		●									●	
Paint removal		●			●		●				●	
Painting		●					●				●	
Parts replacement		●		●			●					
Pesticide/herbicide mgt. and application		●				●						
Polishing		●					●				●	
Pumping station/ force main		●										
Range residue clearance		●				●	●					
Recreational facilities operation		●					●					
Road construction and maintenance						●	●		●	●	●	●
Rock-crushing operations							●				●	
Roofing kettle		●										
Sewers												
Sidewalk and road deicing		●				●						
Soil excavation/grading						●			●			●
Solid waste collection/transportatio n							●				●	
Storage tank management		●					●				●	

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

MCB Camp Lejeune 2015 Practices		Env. Emergency Response/ Spill Response, Section 5.0	HM/HW, Section 7.0	Potential Discovery of Undocumented Contaminated Sites, Section 13.0	Asbestos, Section 8.0	Lead-Based Paint, Section 9.0	Stormwater, Section 11.0	Solid Waste, Recycling, and P2, Section 12.0	Training, Section 3.0	Cultural Resources, Section 6.0	Permitting, Section 14.0	Air Quality, Section 4.0	Natural Resources, Section 10.0
Stormwater collection/ conveyance	Applicable to All Practices Conducted Aboard MCB Camp Lejeune			Applicable to All Practices Conducted Aboard MCB Camp Lejeune			●		Applicable to All Practices Conducted Aboard MCB Camp Lejeune				
Surface washing													
Swimming pool operation and maintenance			●										
Timber management													
Universal waste storage/ collection			●										
Urban wildlife management	Applicable to All Practices Conducted Aboard MCB Camp Lejeune		●	Applicable to All Practices Conducted Aboard MCB Camp Lejeune				●	Applicable to All Practices Conducted Aboard MCB Camp Lejeune				●
UXO/EOD operations			●									●	
Vehicle maintenance			●					●				●	
Vehicle parking							●						
Wash rack							●						

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Attachment 2-1
MCB Camp Lejeune's Environmental
Policy Statement

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COMMANDING GENERAL'S ENVIRONMENTAL POLICY STATEMENT

The protection and enhancement of our natural environment is a valuable tool in sustaining the training and support mission of Marine Corps Installations East-Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ). As MCIEAST-MCB CAMLEJ prepares for the increasing demands on facilities, training areas, ranges, and quality-of-life services that support the readiness of our forces, we are committed to protecting human health, conserving natural and cultural resources, and complying with regulatory requirements.

The MCIEAST-MCB CAMLEJ Environmental Management System (EMS) promotes sustained mission readiness through actively identifying and implementing solutions and opportunities for efficient resource use. Through the EMS, MCIEAST-MCB CAMLEJ will continually assess daily operations in order to identify and implement improvements to its practices that will ensure compliance with governing regulations and meet the sustainability objectives of Executive Orders 13514 and 13423. In this endeavor, MCIEAST-MCB CAMLEJ will:

- Continue proactive compliance with all environmental laws, regulations, and U. S. Marine Corps policies.
- Integrate natural and cultural resource management with the military mission whenever practical.
- Incorporate sound environmental practices into all of our operations and business decisions.
- Implement pollution prevention initiatives, waste diversion, recycling, and waste minimization programs.
- Assess and remediate contaminated sites aboard the Base that are the result of past disposal practices or spills and leaks of hazardous materials.
- Implement energy efficiency and water conservation management projects.
- Procure sustainable products, including biobased, environmentally preferable, energy efficient, water efficient, and recycled-content products.
- Collaborate with local communities and regulatory agencies to enhance stewardship of the environment, create goodwill and build trust.
- Educate our Marines, Sailors, and Civilian Marines about their responsibility to protect our natural environment, stressing the important role each individual plays in an effective EMS.

Join me in applying these environmental management principles to protect and enhance our natural environment, while strengthening the combat readiness of our forces and the quality-of-life services to our warriors and their families.

A handwritten signature in black ink, reading "R. F. Castellvi".

R. F. CASTELLVI

Brigadier General, U.S. Marine Corps
Commanding General

Marine Corps Installations East-Marine Corps Base Camp Lejeune

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3.0 TRAINING

To minimize the environmental impact of MCB Camp Lejeune operations, all contractors are required to receive both EMS and general environmental awareness training at the level necessary for their job function.

The contractor is responsible for ensuring that every employee completes a program of classroom instruction or on-the-job training that teaches the employee to perform his or her duties in compliance with Federal, State, and local regulatory requirements.

To minimize the environmental impact of MCB Camp Lejeune operations, all civilian and military personnel, including contractors, are required to

receive both EMS and general environmental awareness training at the level necessary for their job function. Use of the Contractor Environmental Guide satisfies these training requirements. A training presentation is provided in the Appendix.

NOTE: The contractor is responsible for knowing and complying with Federal, State, and local regulations. MCB Camp Lejeune environmental personnel will assist contractors with compliance issues; however, the primary burden of regulatory identification, familiarity, and compliance lies with the contractor. This training *does not*

replace any required regulatory training as per contract requirements. Required training should be completed *prior* to working at MCB Camp Lejeune.

3.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with contractor training. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

Please consult the ROICC or Contract Representative with any questions or concerns about the information in this section.

3.1.1. Key Definitions

- **Explicitly Required Training.** Training expressly required by specific laws, regulations, or policies that apply due to the nature of work assignments, job functions, and/or specific licensing or certification requirements mandated by environmental laws, regulations, or policies.
- **Implicitly Required Training.** Instruction/information that is not expressly required by laws, regulations, or policies, but that may be reasonably inferred as being required to maintain compliance or is determined through EMS to reduce overall environmental risk.

3.1.2. Key Concepts

- **Comprehensive Environmental Training and Education Program (CETEP).** The USMC training program designed to ensure that high-quality, efficient, and effective environmental training, education, and information are provided at all levels of the USMC.
- **Environmental Management System (EMS).** The part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining the Environmental Policy.
- **EMS Training.** All contractors are required to receive EMS training at the level necessary for their job function.
- **General Environmental Awareness Training.** Instruction designed to ensure that MCB Camp Lejeune and MCAS New River personnel become familiar with the installation environmental policies and programs for regulatory compliance, natural resource conservation, P2, and environmental protection. General EMS and Environmental Awareness Training for contractors and vendors is required for all MCB Camp Lejeune contractors. The training presentation is included as an Appendix to this document.

3.1.3. Environmental Management System

Training is potentially applicable to all EMS practices conducted aboard MCB Camp Lejeune.

3.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard MCB Lejeune and MCAS New River must be aware of and adhere to all applicable regulations and requirements concerning training, which include but may not be limited to the following:

- [Executive Order 13423](#). Strengthening Federal Environmental, Energy, and Transportation Management. Requires implementation of an EMS at all appropriate organizational levels.

3.3. TRAINING REQUIREMENTS

3.3.1. General Environmental Awareness

In accordance with DoD instructions and MCO, the EMD at MCB Camp Lejeune has implemented a CETEP. A major component of the CETEP is to provide general environmental awareness training to all individuals associated with the installation, including contractors and vendors. Prior to or within 30 days of beginning work onsite, all contractors and their employees performing work aboard

Prior to or within 30 days of beginning work onsite, all contractors are required to receive both EMS and general environmental awareness training.

MCB Camp Lejeune must receive general environmental awareness training.

3.3.2. Environmental Management System

In addition to CETEP requirements, MCB Camp Lejeune has implemented an installation-wide EMS per EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, and DoD and USMC EMS policy. The EMS highlights the fact that the authority and principal responsibility for controlling environmental impacts belong to those commands, units, offices, and personnel (including contractors and vendors) whose activities have the potential to impact the environment.

Prior to or within 30 days of beginning work onsite, all contractors and their employees performing work aboard MCB Camp Lejeune must receive EMS training.

3.3.3. Recordkeeping

Upon completion of the training materials included in the Appendix of the Contractor Environmental Guide, each employee must sign the Training Roster. The Contracting Representative must maintain these records in the contract file.

All training records, including other applicable environmental training, must be maintained onsite for review.

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4.0 AIR QUALITY

The Air Quality Program is responsible for ensuring that the installation complies with all applicable Federal, State, and local air quality regulations. The ROICC or Contract Representative will provide a copy of BO 5090.6A, Air Quality Management, which has additional information.

4.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with air quality. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

Please consult the ROICC or Contract Representative with any questions or concerns about the information in this section.

4.1.1. Key Definitions

- **Criteria Pollutants.** Pollutants that the U.S. Environmental Protection Agency (EPA) Administrator has determined will cause or contribute to air pollution, that may reasonably be anticipated to endanger public health and welfare, and for which air quality criteria have been established (i.e., sulfur dioxide, nitrogen oxides,

ground-level ozone, carbon monoxide, lead, and particulate matter).

- **Dust-Causing Activity.** Any activity that has the potential to generate an excess level of dust, including but not limited to construction and demolition (C&D), blasting and sanding, construction of haul roads, land clearing, or fallow fields.
- **Hazardous Air Pollutants.** Air pollutants, as identified within 42 United States Code (USC) 7412, that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects.
- **Ozone-Depleting Substance.** Chemicals, such as certain refrigerants, that cause depletion of the stratospheric ozone layer—primarily chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) and their blends.
- **Particulate Matter.** A criteria air pollutant that includes dust, soot, and other small materials that are released into and transported by air.
- **Title V Operating Permit.** Permit issued under the Clean Air Act (CAA) Amendments of 1990 for all major sources of air pollution. All emission sources at the installation must be listed on the permit.

4.1.2. Key Concepts

- **Emission Sources.** Before beginning any emitting activity, please have the ROICC or Contract

Representative contact EMD to determine whether any permitting, monitoring, reporting, testing, and/or recordkeeping requirements apply.

- **Permitted Sources.** Ensure that construction/authorization permits are in place prior to beginning construction and/or prior to the arrival onsite of new or additional emission sources (emergency generators, paint booths, etc.).

4.1.3. Environmental Management System

Contractor activities associated with air quality include the following:

- Boat operation/maintenance
- Boiler operation
- Chlorination
- Degreasing
- Engine operation and maintenance
- Fueling and fuel management/storage
- Hazardous material (HM) storage/transportation
- Hazardous waste (HW) satellite accumulation area/HW transportation
- Live fire range operations
- Metal working
- Ozone-depleting substance (ODS)/halon management

- Paint booth operations/paint gun cleaning/paint removal
- Polishing
- Road construction and maintenance
- Rock-crushing operations
- Solid waste collection/transportation
- Storage tank management
- Unexploded ordnance (UXO)/explosives and ordnance disposal (EOD) operations
- Vehicle maintenance

The potential impacts of these activities on the environment include degradation of air quality, degradation of quality of life, and depletion of nonrenewable resources.

4.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable regulations and requirements regarding air quality, which include but may not be limited to:

- [Clean Air Act Amendments of 1990.](#) Protect human health and clean air resources by establishing standards and regulations for the control of air pollutants.
- [Title V Operating Permit.](#) Operating permit required for any major stationary source that emits or

has the potential to emit 100 tons per year or more of any criteria air pollutant and outlines the requirements to address and ensure air quality compliance.

- [**BO 5090.6A, Air Quality Management.**](#) Implements policies and procedures at the installation level that all personnel must follow in order to demonstrate compliance with the Title V permit and USMC requirements.
- [**Base Bulletin 5090, Open Burning of Vegetative Debris.**](#) Outlines procedures for conducting open burning in accordance with State regulations and installation procedures.
- [**North Carolina Department of Air Quality \(NCDAQ\) Rules.**](#) Outlines all State-specific air quality rules, control requirements, procedures for permits, and approvals contained in 15A North Carolina Administrative Code (NCAC) 02D, 02H, and 02Q applicable to North Carolina entities.

4.3. PERMIT REQUIREMENTS

The installation has a single permit, the CAA Title V Construction and Operating Permit, which includes all stationary air emission sources at the facility; therefore, all permit application submittals to the NCDAQ must be coordinated through the EMD. The NCDAQ will review and process the application and then issue a permit to construct and operate or to modify the emission source(s). A permit is required prior to the construction of any emission source. Timely submittal of the permit application is required to

obtain the final permit prior to commencing construction. The most common types of emission sources at the installation are as follows:

- Boilers
- Generators
- Engine test stands
- Surface coating/painting operations
- Paint removal (chemical and mechanical), abrasive blasting, or other surface preparation activities
- Fuel storage and fuel dispensing
- Grinding
- Woodworking
- Welding
- ODS/refrigerant recovery and recycling operations (industrial chillers, refrigerators, air conditioning compressors, cleaning agents, etc.)
- Bulk chemical and flammable materials storage

A permit is required for the construction of any emission source. Timely submittal of the permit application is necessary to ensure the permit is available before commencing construction.

4.4. ADDITIONAL ACTIVITIES OF CONCERN

Contact the ROICC or Contract Representative for additional information regarding activities that do not

necessarily require modification to the Title V permit, but that must be coordinated with or tracked by EMD or the NCDAQ. Examples of these activities include, but are not limited to, the following:

- **Use, Maintenance, and Management of Refrigerants and other ODS.** Includes installation, recovery, replacement, conversion, or service of refrigerant-containing equipment (chillers, refrigerators, air conditioning condensers, etc.). All contractors will use Best Management Practices (BMPs) during refrigerant management activities. All Heating, Ventilation, and Air Conditioning (HVAC) technicians will maintain their appropriate State-specific licenses and present them to the ROICC or Contract Representative upon request.
- **Emergency Generators.** Includes the installation and temporary use of emergency generators during electrical failures and construction activities. All contractors will coordinate with the ROICC or Contract Representative to determine if the intended generator may be exempted or must be temporarily permitted for the intended use.
- **Open Burning (e.g., right-of-way clearing, storm debris burning).** Open burning activities aboard MCB Camp Lejeune and MCAS New River must be coordinated through EMD and the Fire Department. Open burning activities are only permissible for land clearing and right-of-way maintenance when the following conditions are met:

- o The wind direction at the time the burning is initiated is away from any public transport roads within 250 feet so they are not affected by smoke, ash, or other air pollutants from the burning.
- o The location of the burning is at least 500 feet from any dwelling, group of dwellings, commercial or institutional establishment, or other occupied structure not located on the property on which the burning is conducted, unless an air curtain burner is used. If an air curtain burner is used, the regional office supervisor may grant exceptions to the setback requirements.
- o Heavy oils, asphaltic materials (e.g., shingles and other roofing materials), items containing natural or synthetic rubber, or any materials other than vegetative plant growth are not burned.
- o Initial burning must begin between 0800 and 1800. After 1800, no material may be added to the fire until 0800 the following day.
- o No fires may be started, and no vegetation may be added to existing fires, when the North Carolina Division of Forest Resources has banned burning for that area.
- o Burners that have the potential to burn more than 8,100 tons per year may be subject to Title V air quality permitting requirements.

Situations that require a regulatory exemption evaluation by the NCDAQ Regional Office

Supervisors are coordinated through EMD's Environmental Quality Branch Air Quality Program Manager. The ROICC or Contract Representative will address any additional questions or provide a copy of Base Bulletin 5090, which contains a summary of the installation's open burning requirements.

The four designated sites at MCB Camp Lejeune that are permitted for storing and/or burning storm debris are in the following areas: Mainside at the borrow pit near the Piney Green landfill, Courthouse Bay, Camp Johnson, and Camp Geiger. Only storm debris may be accumulated at these sites. EMD must notify the NCDAQ if the installation intends to burn the storm debris at one of these sites. Contact the ROICC or Contract Representative for more information.

- **Fire training outside of designated fire training pits.** State approval is required to conduct fire training outside of the designated fire training pits. First, complete the Notification of Open Burning for the Training of Firefighting Personnel form. The form is available at the following site: http://daq.state.nc.us/enf/openburn/ob_firetrain.pdf.

Before the training exercise, an accredited North Carolina Asbestos Inspector must inspect any structure to be burned to ensure that it is free from asbestos. Turn in the completed form to EMD for submittal to NCDAQ and the Division of Public Health, Health Hazards Control Unit. Contact the

ROICC or Contract Representative for additional information.

- **Dust-causing activities (e.g., concrete and rock crushing).** Wet suppression is required during the entire dust-causing operation. Ensure that an adequate water supply is available, and coordinate with the Fire and Emergency Services Division if access to a fire hydrant is necessary. Applicable wet suppression may be required during temporary concrete-crushing operations during C&D activities.
- **Noise Management.** USMC commands engaged in any activity resulting in noise emissions must comply with Federal, State, interstate, and local requirements for the control and management of environmental noise to minimize disruption to the local community. To the maximum extent practicable, personnel should limit the use of power tools, machinery, construction equipment, and other noisy devices to normal working hour

5.0 ENVIRONMENTAL EMERGENCY PLANNING AND RESPONSE

Environmental emergency planning and response can reduce injuries, protect employees, reduce asset losses, minimize downtime, and minimize environmental impacts of uncontrolled releases of pollutants to air, land, and water. The purpose of emergency planning is to prepare for, mitigate, respond to, and recover from environmental emergencies while minimizing any potential impacts to human health and the environment. Contractors operating aboard MCB Camp Lejeune must be aware of and adhere to all environmental emergency response procedures and notification requirements to minimize detrimental effects from inadvertent releases.

Procedures relating to emergencies caused by unforeseen site conditions are addressed in Section 5.0 of this guide. If an environmental emergency is identified, contact 911 immediately. Additional inquiries should be directed to the ROICC or Contract Representative.

5.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with environmental emergency response and spill response requirements. If you have any

Please consult the ROICC or Contract Representative with any questions or concerns about the information in this section.

questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

5.1.1. Key Definitions

- **Berm.** A mound used to prevent the spread of a contaminant.
- **Discharge.** Any spilling, leaking, pumping, pouring, emitting, emptying, or dumping not explicitly permitted.
- **Navigable waters.** The waters of the United States and territorial seas, including waters that have been or may be used for commerce, waters subject to tidal flow, interstate waters and wetlands, and all other waters (intrastate lakes, rivers, streams, intermittent streams, flats, wetlands, sloughs, prairies, wet meadows, natural ponds, tributaries, etc.).
- **Petroleum, Oil, and Lubricant (POL).** A broad term that includes all petroleum and associated products or oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, vegetable oil, animal oil, sludge, oil refuse, and oil mixed with wastes.
- **Release.** Pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles) of any hazardous

chemical, hazardous substance, or extremely hazardous substance (EHS). Releases may be aboveground, belowground, or to water.

- **Spill Event.** The reportable discharge of oil into or upon the navigable waters of the United States or adjoining shorelines in harmful quantities, as defined by the Code of Federal Regulations (CFR) in 40 CFR 110.

5.1.2. Key Concepts

- **Environmental Emergency Response Contacts.** The following table identifies the emergency contact information for various spill scenarios. In addition to these emergency response contacts, the ROICC or Contract Representative should be notified immediately after an incident.

Table 5-1. Environmental Emergency Response Contacts

For spills of:	Call:	Follow-up:
Hazardous waste	911	Spill Report
Unknown materials	911	Spill Report
Material on a permeable surface	911	Spill Report

For spills of:	Call:	Follow-up:
Greater than 5 gallons of a material	911	Spill Report
Material that reaches stormwater inlets or waterways	911	
Nonhazardous waste	(910) 451-1482	911

- Contractors have containment and cleanup responsibilities following a spill, and there may be additional follow-up reporting or requirements. Contact the ROICC or Contract Representative for additional guidance.

5.1.3. Environmental Management System

Environmental planning and response are potentially applicable to all EMS practices conducted aboard MCB Camp Lejeune.

5.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard MCB Lejeune and MCAS New River must be aware of and adhere to all applicable regulations and requirements regarding emergency response

and spill response procedures, which include but may not be limited to the following:

- **Clean Air Act of 1970, Section 112r** Mandates the prevention and control of air emissions and specifies emergency planning where the potential exists for accidental release of hazardous air pollutants.
- **Clean Water Act (CWA) of 1972.** Establishes the basic structure for regulating discharges of pollutants into the waters of the United States. The CWA establishes that there should be no discharges of oil or hazardous substances into or upon the navigable waters of the United States or adjoining shorelines, which may affect natural resources under the management of the United States.
- **Comprehensive Environmental Response, Compensation, and Liability (CERCLA) Act of 1980.** Authorizes a Federal response to any release or threatened release of a hazardous substance into the environment. This act defines hazardous substances by reference to substances that are listed or designated under other environmental statutes.
- **Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986, Section 304.** Establishes requirements for reporting a release to ensure a quick response by local emergency responders. Notification requirements apply to two chemical lists: the CERCLA Hazardous Substance list and the EHS list. The “List of Lists” provides a comprehensive identification of hazardous

substances and EHSs. In addition, facilities may be required to submit a list of their hazardous materials inventory maintained onsite or Safety Data Sheets (SDS) to response personnel.

- **Oil Pollution Act (OPA) of 1990.** Addresses oil storage at facilities and emphasizes preparedness and response activities. This act prohibits the harmful discharge of oil and hazardous substances into waters of the United States. The OPA requires contingency planning for “worst case” discharges and demonstrated response capabilities through planning, equipment, training, and exercises.
- **Resource Conservation and Recovery Act (RCRA) of 1976.** Protects human health and the environment from the hazards associated with hazardous waste handling, generation, transportation, treatment, storage, and disposal. Subtitle C of the RCRA requires owners and operators of hazardous waste facilities to develop comprehensive management plans that address spill prevention and cleanup.

5.3. SPILL NOTIFICATION

5.3.1. POL/Hazardous Materials Spill Notification Procedures

In accordance with MCB Camp Lejeune notification requirements, any discharge of oil or hazardous materials must be immediately reported to the MCB Camp Lejeune Fire Department at 911.

MCB Camp Lejeune maintains a Spill Prevention, Control, and Countermeasures (SPCC) Plan that establishes procedures to prevent oil spills and documents existing oil spill prevention structures, procedures, and equipment. The Installation SPCC Plan provides general information for any type of response actions needed for spills aboard MCB Camp Lejeune. Contractors engaged in the handling and transfer of POL or hazardous materials must develop a Unit-Level Contingency Plan (ULCP) that addresses the spill response for their specific sites and potential spill types. This ULCP must be maintained onsite, and all personnel working within that site must be made aware of its location and use.

Contractors must develop a Unit-Level Contingency Plan that addresses the spill response for their specific sites and potential spill types.

In the event of a spill, contact the ROICC or Contract Representative (after contacting emergency responders) to obtain a spill report form. Return the completed spill report form to EMD (fax to (910) 451-3471) and to the ROICC or Contract Representative. A copy of the spill report form is included as Attachment 5-1. The following information must be provided when reporting a spill:

- Name and phone number
- Location of spill (building. number, street)
- Number and type of injuries, if any
- Type and amount of spilled material

- Source of the spill (container, vehicle, etc.)
- Action being taken, if any, to control the spill
- Estimated time of spill

Do not wait to report a spill, even if all of the required information is not immediately available.

5.3.2. Wastewater Spill and Water Line Break Notification

Contractors operating aboard MCB Camp Lejeune and MCAS New River must be aware of water and wastewater utilities in their specific work/project area.

Wastewater Spills

In the event of a wastewater spill, report the incident to the Public Works Base Utilities at (910) 451-7190 (x225). In addition, report the incident immediately to the ROICC or Contract Representative. The following information must be provided:

- Name and phone number
- Location of spill (building number, street address)
- Type and amount of spilled material
- Source of the spill
- Action being taken, if any, to control the spill
- Estimated time of spill

Water Line Breaks

In the event of a water line break, report the incident to the Public Works Base Utilities at (910) 451-7190 (x225). In addition, report the incident immediately to the ROICC or Contract Representative. The following information must be provided:

- Name and phone number
- Location of spill (building number, street address)
- Reason for the break
- Estimated time of the break

5.4. FOLLOW-UP

If surface run-off is contaminated, the contractor will, under the advisement of the Fire Department or EMD, construct a temporary berm or containment area. Contaminated surface water will be removed in accordance with all safety and environmental requirements for the installation. Notify the Resource Conservation and Recovery Section (RCRS) at (910) 451-1482; the RCRS will provide concurrence for temporary containment areas and removal of contaminated runoff.

If solid or hazardous waste was generated as the result of a spill, refer to Sections 12.0 and 7.0 of this guide for disposal requirements.

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Attachment 5-1

Spill Reporting Form

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MARINE CORPS INSTALLATIONS EAST MARINE CORPS BASE CAMP LEJEUNE UNIT LEVEL SPILL FORM



Spill Date: Spill Time:

RESPONDERS

Response Initiator: Major Command:

Phone Number: Unit Name:

Fire Department Response: Responder Name:

EMD Respond? Responder Name:

GPS Coordinates: X: Y:

SPILL IDENTIFICATION

Spilled Substance: State:

Source (Vehicle, drum, etc.): Building:

Estimated Amount:

Cause of Spill:

Containment/Clean-up Action Taken:

Parties Performing Spill Clean-up/Removal (EMD Turn-in Date):

Additional Assistance Required:

REPORT CERTIFICATION

Printed Name/Rank: Signature:

E-mail: Date:

All releases must be reported to the Base Fire Department by calling 911. The Environmental Management Division can be reached by calling (910) 451-1482. Units are required to maintain a copy of all completed spill forms, preferably in their ESOP Binder.

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6.0 CULTURAL RESOURCES

MCB Camp Lejeune enjoys a rich history, and remnants of our past may be found throughout the real properties that make up the installation. All personnel at MCB Camp Lejeune are responsible for ensuring the cultural resources entrusted to the USMC care remain intact and available for future generations. Contractors are responsible for notifying the ROICC or Contract Representative immediately if they encounter suspected archaeological sites, artifacts, or human remains.

6.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with cultural resource management. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

Please consult the ROICC or Contract Representative with any questions or concerns about the information in this section.

6.1.1. Key Definitions

- **Archaeological Resource.** Defined by the [Archaeological Resources Protection Act \(ARPA\)](#) as any material remains of past human life or activities

that are at least 100 years old and are capable of providing scientific or human understanding of past human behavior and cultural adaptation, including the site on which the remains are located. Examples include pottery, basketry, bottles, weapons, weapon projectiles, tools, structures or portions of structures, pit houses, rock paintings, rock carvings, intaglios, graves, human skeletal materials/remains, or any portion or piece of any of the foregoing items or structures. Non-fossilized and fossilized paleontological specimens, or any portion or piece thereof, are not considered archaeological resources unless found in an archaeological context. (According to the National Historic Preservation Act (NHPA) of 1966, some historic properties built within the past 50 years can achieve significance if they are of exceptional importance [National Register Criteria Consideration G].)

- **Cultural Resource.** A generic term for the collective evidence of the past activities and accomplishments of people, including buildings, structures, districts, sites, features, and objects of significance in history, architecture, archaeology, engineering, or culture, per [MCO P5090.2A](#).
- **Effect.** Any condition of a project that may cause a change in the quality of the historic, architectural, archaeological, or cultural character of a property that qualifies it for listing in the National Register of Historic Places (NRHP). A project is considered to have an effect on a historic or cultural property when any aspect of the project changes the integrity of the

location, design, setting, materials, workmanship, feeling, or association of the property that contributes to its significance.

- **Historic Property.** Any prehistoric or historic district, site, building, structure, or object significant in U.S. history, architecture, archaeology, engineering, or culture and included, or eligible for listing in, the NRHP, per the [NHPA](#) and [MCO P5090.2A](#).
- **State Historic Preservation Officer.** The person designated to administer the State Historic Preservation Program, including identifying and nominating eligible properties to the NRHP and administering applications for listing historic properties in the NRHP.

6.1.2. Key Concepts

- **Notification.** Contractors must notify the ROICC or Contract Representative if they encounter any cultural resources.
- **Policy.** DoD policy is to preserve significant historic and archaeological resources.

6.1.3. Environmental Management System

Contractor practices associated with cultural resources include the following:

- Construction/demolition/renovation
- Land clearing

- Road construction and maintenance
- Soil excavation/grading

The potential impacts of these activities on the environment include damage, destruction, alteration, theft, or demolition of historic properties.

6.2. OVERVIEW OF REQUIREMENTS

It is DoD policy to integrate the archeological and historic preservation requirements of applicable laws with the planning and management of activities under DoD control; to minimize expenditures through judicious application of options available in complying with applicable laws; and to encourage practical, economically feasible rehabilitation and adaptive use of significant historical resources.

Contractors operating aboard MCB Lejeune and MCAS New River must be aware of and adhere to all applicable regulations and requirements regarding cultural resources, which include but may not be limited to the following:

- [**BO 5090.8A**](#). Sets forth regulations and establishes responsibilities associated with management of archaeological and historic resources aboard MCB Camp Lejeune.
- [**Archaeological and Historic Preservation Act \(AHPA\) of 1974 \(16 USC 469 *et seq.*\)**](#) Amends the Reservoir Salvage Act to extend its provisions beyond the construction of dams to any terrain alteration resulting from any Federal construction

project or federally licensed project, activity, or program.

- [**Archeological Resources Protection Act of 1979 \(16 USC 470 et seq.\)**](#) Requires Federal land managers to issue permits for the excavation or removal of artifacts from lands under their jurisdiction. The ARPA requires that relevant Native American tribes be notified of permit issuance if significant religious or cultural sites will be affected. It prohibits the excavation, damage, alteration, theft, or defacement of an archaeological site or artifacts unless permitted by the Federal land manager.
- [**DoD Directive 4710.1, Archaeological and Historic Resources Management.**](#) Provides policy for the management of archaeological and historic resources on land and in water under DoD control.
- [**EO 11593, May 13, 1971.**](#) Requires all Federal agencies to administer cultural properties under their control. Agencies are required to direct their policies, plans, and programs so that significant sites and structures are preserved.
- [**Historic Sites, Buildings, and Antiquities Act of 1935 \(Public Law 74-292, 16 USC 461 et seq.\).**](#) States that it is Federal policy to preserve historic and prehistoric properties of national significance.
- [**National Environmental Policy Act \(NEPA\) of 1969 \(42 USC 4321 et seq.\).**](#) States that it is Federal government policy to preserve important historic, cultural, and natural aspects of our national heritage

and requires the consideration of environmental concerns during project planning and execution.

- **National Historic Preservation Act of 1966 (16 USC 470 et seq.)**. Establishes historic preservation as a national policy and requires Federal agencies undertaking actions that may affect NRHP-eligible historic properties to consult State historic preservation offices and the Advisory Council on Historic Preservation. Section 110 of NHPA requires Federal agencies to inventory, evaluate, identify, and protect cultural resources that are determined eligible for listing in the NRHP.
- **Public Buildings Cooperative Use Act of 1976 (Public Law 94-541)**. Encourages adaptive reuse of historic buildings as administrative facilities for Federal agencies.
- **Title 36 CFR Part 65, National Historic Landmarks Program**. Identifies and designates National Historic Landmarks, and encourages the long-range preservation of nationally significant properties that illustrate or commemorate the history and prehistory of the United States.

6.3. PROCEDURES

All contractors are expected to follow these procedures:

- Notify the ROICC or Contract Representative immediately concerning any encounter with suspected archaeological sites, artifacts, human remains, or any other suspected cultural resources during contractor activities.
- Stop work in the immediate area of the discovery until directed by the Contract Representative to resume work.

**Notify the ROICC
or Contract
Representative
immediately
concerning any
encounter with
suspected
archaeological
sites, artifacts, or
human remains
during contractor
activities.**

Be particularly aware of surroundings when working in a designated historic area. The Camp Lejeune Installation Geospatial Information & Services Office of the Geospatial Services Division can provide resource mapping of known cultural resource areas for all planners, project managers, contractors, and others, through formal request. The ROICC or Contract Representative will assist with making arrangements to request access for Geographic Information System mapping.

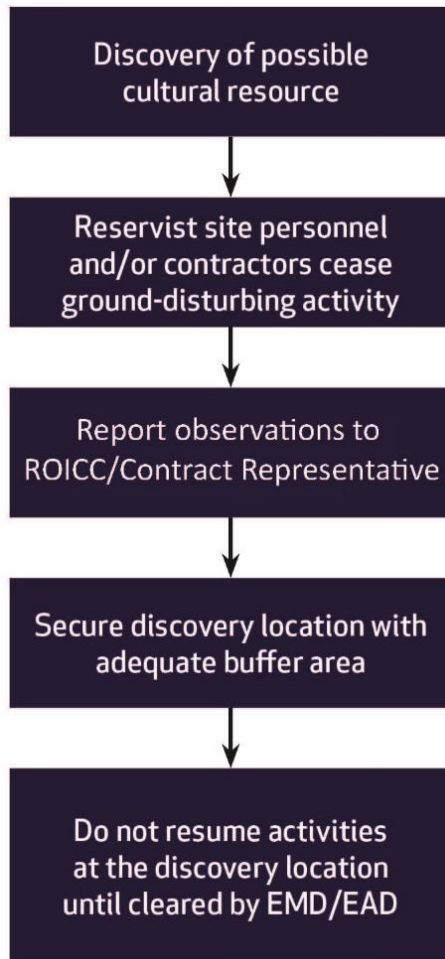


Figure 6-1. Possible Cultural Resource Discovery Flow Chart

7.0 HAZARDOUS MATERIALS/HAZARDOUS WASTE MANAGEMENT

All persons on a USMC installation are subject to compliance with Federal, State, and local regulations and permit conditions addressing the proper management of hazardous materials and waste. Mishandling these wastes and materials may result in violation notices, fines, and/or penalties. The EPA regulates hazardous wastes through the RCRA, which provides specific regulatory definitions for hazardous waste and its management. The RCRA governs all hazardous waste from the point of generation to ultimate disposal, including hazardous waste generated by contractors aboard MCB Camp Lejeune and MCAS New River. Hazardous materials, including those used by contractors aboard the installation, are also regulated by the EPCRA. Additionally, the North Carolina Department of Environmental Quality (NCDEQ) has issued more stringent rules and regulations governing hazardous materials and hazardous waste management that also apply to contractors.

7.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with hazardous materials (HM), hazardous wastes (HW), and their management. If you have any questions or concerns about the information in this section,

**Direct questions
or concerns about
the information in
this section to the
ROICC or Contract
Representative.**

please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

7.1.1. Key Definitions

- **90-day Accumulation Area.** These areas are used to store HW temporarily until it is either manifested and shipped off site for disposal or transferred to a permitted storage facility. HW may be accumulated for up to 90 days in these areas. MCB Camp Lejeune's 90-day accumulation facility is located on Michael Road.
- **Generator.** Any person whose activity or process produces HW or whose activity or process subjects HW to regulation.
- **Hazardous Material.** A chemical compound, or a combination of compounds, posing or capable of posing a significant risk to public health, safety, or the environment as a result of its quantity, concentration, or physical/chemical/infectious properties.
- **Hazardous Waste.** Any discarded material (including solid, liquid, or gas) or combination of discarded materials which, due to quantity, concentration, or physical, chemical, or infectious characteristics may:
 - o Cause or significantly contribute to an increase in mortality or cause a serious irreversible or incapacitating reversible illness; or

- o Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.
- **Manifest.** A document that allows all parties involved in HW management (e.g., generators, transporters, disposal facilities, EPA, State agencies) to track the movement of HW from the point of generation to the point of ultimate treatment, storage, or disposal. All HW manifests for waste generated aboard MCB Camp Lejeune must be reviewed and released by personnel from the Resource Conservation and Recovery Section, EMD, who can be contacted at (910) 451-1482.
- **Non-RCRA-Regulated Waste.** Waste that is not regulated or is exempt from regulation under RCRA HW requirements but has other regulatory requirements for proper management.
- **Satellite Accumulation Area (SAA).** Designated areas at or near the point of generation, where HW is accumulated. Generators may accumulate up to 55 gallons of HW or one quart of acute HW at a satellite area for an indefinite amount of time. When 55 gallons of HW (or 1 quart of acute HW) are exceeded, the generator must date the container and transfer it to an approved 90-day site or long-term HW storage facility within 72 hours. EMD authorization for an SAA must be obtained and posted at the site. EMD authorization will establish individual limits for each SAA. No SAA

authorizations will exceed 55 gallons of HW or 1 quart of acute HW. In accordance with installation policy, HW in an SAA should not be stored longer than 365 days, even if the container is not full.

- **Safety Data Sheet (SDS).** A document that provides information about (1) chemical properties, environmental hazards, and health hazards; and (2) protective measures, along with safety precautions, for handling, storing, and transporting hazardous chemical products. The Hazard Communication Standard (HCS), 29 CFR 1910.1200(g), was revised in 2012 to mandate the use of a single Globally Harmonized System of Classification and Labelling of Chemicals (GHS) by manufacturers, distributors and importers to communicate information on chemical-related hazards. The information contained in the SDS is standardized in a 16-section format. Employers must ensure that the SDSs for all hazardous chemicals in the workplace are readily accessible to employees.
- **Treatment.** Any method, technique, or process designed to change the physical, chemical, or biological character or composition of any HW to neutralize the waste; or to recover energy or material resources from the waste; or to render such waste nonhazardous or less hazardous, safer to transport, store, or dispose of, or amenable for recovery or storage, or reduction in volume.
- **Treatment, Storage, and Disposal (TSD) Facilities.** TSD facilities conduct HW treatment,

storage, or disposal operations and require an RCRA part B permit for final approval to operate. The part B permit is maintained to accurately identify the most current operations at the TSD facility. MCB Camp Lejeune does not have a TSD facility.

- **Universal Waste (UW).** UW regulations streamline HW management standards for batteries, pesticides, mercury-containing equipment, and fluorescent lamps. The regulations govern the collection and management of these widely generated wastes, thus facilitating environmentally sound collection and proper recycling or treatment. In North Carolina, batteries, thermostats, obsolete agricultural pesticides, and fluorescent lamps may be managed under the UW Rule. UW must be transferred off site within 1 year of the date when the material was first identified as waste.
- **Used Oil.** Any oil that has been refined from crude oil or synthetic oil and, as a result of use, storage, or handling, has become unsuitable for its original purpose due to the presence of impurities or loss of original properties. Used oil may be suitable for further use and is economically recyclable; therefore, it is managed as a separate category of material.

7.1.2 Key Concepts

- **HW Management.** The systematic control of the collection, source separation, storage, transportation, processing, treatment, recovery, and disposal of HW. In addition, HW Management includes processes to

reduce the HW's effect on the environment and to recover resources from it.

- **HW Minimization.** The USMC policy is to reduce the quantity of HW disposed of by source reduction, recycling, treatment, and disposal. The highest priorities are reducing HW generation, and recycling. The goal of the USMC is to achieve continuous reduction of HW generation through P2 initiatives, BMPs, and use of the best available demonstrated technology.
- **National Fire Protection Association.** The U.S. trade association that creates and maintains private, copyrighted standards and codes, including the diamond hazard label in Figure 7-1, which is used by emergency personnel to quickly and easily identify the risks posed by hazardous materials.

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

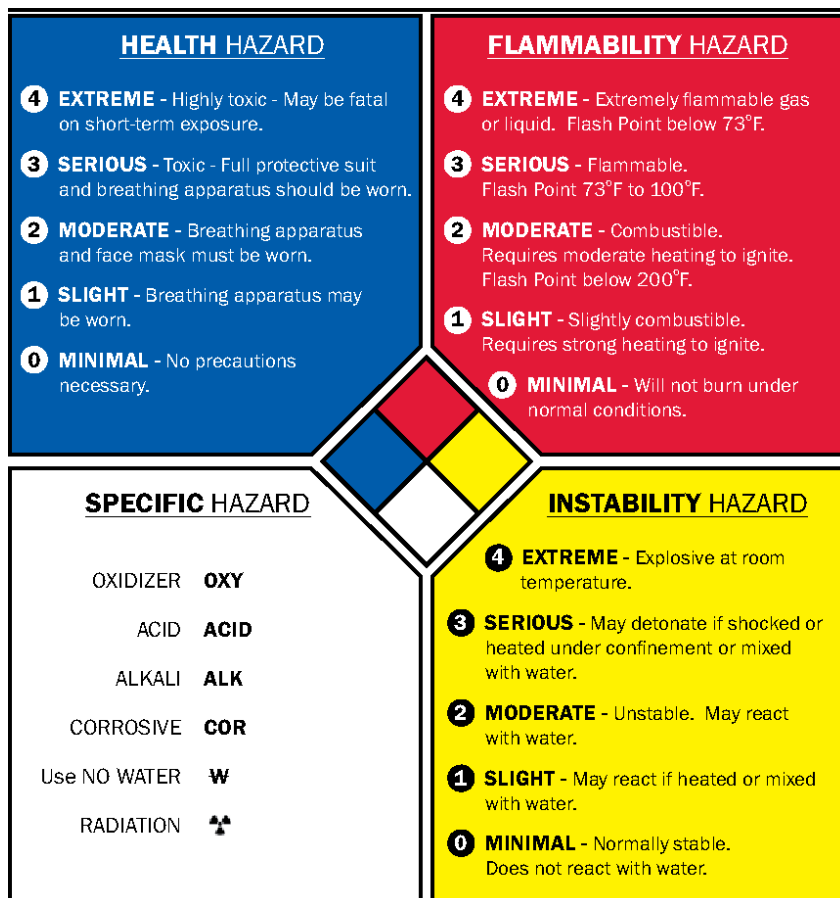


Figure 7-1. Diamond Hazard Label

7.1.3 Environmental Management System

Contractor practices associated with HM and HW management include, but are not limited to, the following:

- Battery management
- Boat operation/ maintenance
- Boiler operation
- Building operation/ maintenance/repair
- Chlorination
- Cooling tower operation and maintenance
- Construction/renovation/ demolition
- Degreasing
- Drinking water management
- Engine operation and maintenance
- Equipment operation/ maintenance/disposal
- Fueling and fuel management/storage
- Habitat management
- HCP operation
- HM storage
- HM transportation
- HW disposal offsite transport
- HW satellite accumulation area

HW storage (<90 days)
HW transportation
Laboratory
Landscaping
Laundry
Live fire range operations
Metal working
Non-destructive inspection
ODS/halon management
Paint gun cleaning
Paint removal
Painting
Parts replacement
Pesticide/herbicide management and application
Polishing
Pumping station/force main
Range residue clearance
Recreational facilities operation
Roofing kettle
Sidewalk and road deicing
Storage tank management
Swimming pool operation and maintenance

Universal waste storage/collection

UXO/EOD operations

Vehicle maintenance

The potential impacts of these activities on the environment include depletion of the HW landfill, depletion of non-renewable resources, and degradation of soil quality.

7.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard MCB Lejeune and MCAS New River must be aware of and adhere to all applicable regulations and requirements regarding HM and HW, which include but may not be limited to the following:

- [**BO 5090.9, Hazardous Material/Waste Management/Air Station Order \(ASO\) 5090.2, Environmental Compliance and Protection Program for MCAS New River.**](#) Establishes procedures and general responsibilities for the disposal of HM and HW under environmental permits and authorizations.
- [**Emergency Planning and Community Right-to-Know Act.**](#) Establishes requirements regarding emergency planning and the reporting of hazardous chemical storage and use.
- [**Hazardous Material Transportation Act \(HMTA\) of 1975.**](#) The principal Federal law regulating the transportation of HM. Established to mitigate the risks to health, property, and the environment inherent in the transportation of HM in intrastate, interstate, and foreign commerce. The HMTA is administered by the U.S. Department of Transportation (DOT) and regulates the shipping, marking, labeling, placarding, and recordkeeping requirements for HM, including HW and military munitions.

- [**Resource Conservation and Recovery Act of 1976.**](#) Establishes standards for HW generators as necessary to protect human health and the environment by instituting statutory standards for generators and transporters of HW that will ensure the following: proper recordkeeping and reporting; use of a manifest system; use of appropriate labels and containers; containerization and accumulation time; and proper management of TSD facilities. In addition, it gives the EPA and State agencies authority to access facility premises and all records regarding HW management.
- [**40 CFR Subchapter I \(Parts 260–299\), Solid Wastes.**](#) Federal regulations promulgated under the 1976 RCRA that regulate HW management, generators, transporters, and owners or operators of TSD facilities. North Carolina has adopted the Federal HW rules by reference.

Because the installation is designated as a Large Quantity Generator (LQG) of HW, all HW generated aboard MCB Camp Lejeune must meet the regulatory requirements of this generator designation. An LQG may maintain three types of HW accumulation/storage areas: satellite, 90-day, and permitted. Typically, HW is accumulated at an SAA and later transferred to a 90-day or permitted storage area.

Both MCB Camp Lejeune and MCAS New River maintain Hazardous Waste Management Plans (HWMPs) that outline the specific requirements for managing HM and HW. The HWMP identifies and provides guidance to implement all regulatory HW management activities and is available to all

personnel who accumulate, generate, transport (including on-installation transportation), treat, store, or dispose of HW.

Contractors may be required to submit a Hazardous Waste Management Plan to the ROICC or the Contract Representative prior to beginning work.

Contractors are responsible for the management of all HM and the ultimate disposition of any HW generated aboard MCB Camp Lejeune during a contract performance period. The ROICC or Contract Representative will contact Environmental personnel, who will provide additional guidance and oversight to verify compliance with applicable Federal, State, and local laws governing the generation, handling, and disposal of HM, HW, UW, used oil, petroleum-contaminated materials, RCRA-regulated HW, and non-RCRA-regulated waste.

Depending on the type of project, contractors may be required to submit a site-specific HWMP to the ROICC or the Contract Representative prior to beginning work. Additionally, the Contracting Officer may require a Contractor Hazardous Material Inventory Log and corresponding SDSs for all materials to be used during the execution of the contract. EMD/EAD will use the SDSs to help contractors establish their Hazardous Material Storage and SAAs.

7.3. HAZARDOUS MATERIALS REQUIREMENTS

If a project uses HM:

- Reduce/reuse/recycle when possible; meet contract requirements for recycling.

- Segregate incompatible materials. Consult the SDS or material manufacturers with questions about a material's compatibility. Some examples of incompatible materials likely to be used by contractors are:

Do not store large quantities of materials. Keep on hand only what can be used.

- o *Corrosives* (e.g., batteries, stripping and cleaning compounds containing acids or bases) *and* *Flammables* (e.g., fuels, oils, paints, and adhesives)
 - o *Corrosives and Oxidizers* (e.g., peroxide, perchlorates, sodium hypochlorite/bleach, or calcium hypochlorite)
 - o *Oxidizers and Flammables*
- All compatible materials should be segregated and stored within designated storage lockers or cabinets (i.e., flammable materials should be stored in designated flammable storage lockers or cabinets, and corrosives should be stored in designated corrosives storage lockers or cabinets).

- Do not store large quantities of materials. Keep on hand only what can be used.
- Maintain an inventory of all HM maintained onsite, with adequate controls in place to prevent unauthorized access.
- Do not dump any HM into floor drains, sinks, oil-water separators (OWSs), or storm drains, or onto the ground.

Stop work immediately if a project unearths a hazardous material (such as MEC/DMM/UXO) and report the situation to the ROICC or Contract Representative.

- Store containers that hold 55 gallons or more (including in-use electrical generators and portable equipment) in proper secondary containment. Permanent secondary containment must be inspected weekly, temporary secondary containment must be inspected daily; all inspections and drainage of stormwater from secondary containment must be documented.

- Maintain SDSs and appropriate spill control/cleanup materials onsite at all times.
- Provide HM storage and usage information for regulatory reporting to the appropriate environmental office upon request.
- Stop work immediately if a project unearths any unknown HM (e.g., munitions and explosives of

concern [MEC], discarded military munitions [DMM], or unexploded ordnance [UXO]), and immediately report the situation to the ROICC or Contract Representative.

- Do not leave HM (or HW) onsite once the contract is completed. Remove it from the installation or make arrangements through the ROICC or Contract Representative to contact RCRS or EAD for turn-in procedures upon completion of the contract.

7.4. UNIVERSAL WASTE REQUIREMENTS

The NCDEQ allows thermostats, obsolete agricultural pesticides, lamps, and certain types of batteries to be managed as UW. UW has less stringent requirements for storage, transport, and collection, but it must still comply with full HW requirements for final recycling, treatment, or disposal. Federal UW requirements are outlined in [40 CFR 273](#). Contact the ROICC or Contract Representative regarding any additional direction or questions on the handling of UW.

All UW must be properly containerized, stored, and labeled when the waste is first generated. Containers/areas for accumulating UW must be labeled as follows:

- Words: UNIVERSAL WASTE.
- Content: Noun name found on the specific Hazardous Waste Profile Sheet (DRMS Form 1930), which is available from EMD (e.g., *batteries*,

fluorescent lamps, pesticides, mercury-containing equipment).

- Accumulation Start Date (ASD): The ASD must be marked on the subject container as soon as the UW item is placed in the container. Storage of UW cannot exceed 365 days.
- Number of Containers: The number of containers marked reflects the total number of containers disposed of within the current document (i.e., 1 of 1, etc.).

Contractors who need UW accumulation areas should contact the ROICC or Contract Representative, who will contact RCRS or EAD personnel to help contractors establish an accumulation area for UW. Key points for this process:

- The containers must be under the control of the contractor generating the waste and must be closed at all times except when waste is being adding.
- Per installation policy, UW containers/areas must be inspected weekly using the *Weekly Hazardous Waste (HW) Site Inspection Form*, included as Attachment 7-1 and Attachment 7-2. Written records noting discrepancies and corrective actions must be maintained onsite for 3 years. Copies of inspection reports should be provided to the ROICC or Contract Representative.
- When the ASD reaches 1 year, or when the container is full, the waste generator has 72 hours (3 days) to arrange for the transportation of the UW to an RCRA

Part B permitted storage area. Contact the ROICC or Contract Representative to coordinate the removal of the UW when the container is full or the contract is finished.

7.5. HAZARDOUS WASTE REQUIREMENTS

The appropriate environmental office must be notified before any HW is generated on projects managed by the ROICC or the Facilities Support Contracts (FSC). Have the ROICC or Contract Representative contact RCRS or EAD with questions regarding whether or not a waste meets the definition of HW. Installation personnel must approve all regulated waste and HW storage locations.

The appropriate environmental office must be notified before any hazardous waste is generated on projects managed by the ROICC or the FSC.

If a project generates HW:

- Minimize generation through waste minimization and P2 techniques.
- Have the ROICC or Contract Representative contact RCRS or EAD with questions regarding how to manage the waste. Do not mix waste types (e.g., used oil rags and solvent rags).
- Have the ROICC or Contract Representative contact RCRS or EAD for turn-in procedures as wastes are

generated, to determine if waste can be disposed of on the installation.

- Do not dump any HW into floor drains, sinks, OWSs, or storm drains, or onto the ground. Do not place HW into general/municipal trash dumpsters.
- Ensure that HW drums are properly labeled and lids are secured (wrench tight).
- Ensure that SAAs are managed properly and storage limits are not exceeded; have the ROICC or Contract Representative consult RCRS or EAD prior to creating a new SAA.

7.5.1. Storage

All HW must be properly containerized, stored, and labeled at the time the waste is first generated. HW must be stored in containers that meet applicable DOT specifications. HW labels, as required by the EPA and the NCDEQ, must contain the following information:

- Words: HAZARDOUS WASTE.
- Content: Noun name found on the specific Hazardous Waste Profile Sheet (DRMS Form 1930) provided by RCRS or EAD.
- ASD: For HW accumulated in an SAA, the ASD will be affixed once the container is filled or at the 1-year anniversary, whichever comes first.
- Number of Containers: Reflects the total number of containers (e. g., 1 of 1, etc.).

Any HW generated by contractors must be stored in an SAA. Contractors who need an SAA should contact the ROICC or Contract Representative, who will contact RCRS or EAD personnel to help the contractor establish each SAA. A summary of procedures follows:

- The HW generator may accumulate as much as 55 gallons of a specific HW stream (or up to one quart of acute HW) in a container at or near the point of generation.
- The containers must be under the control of the contractor generating the waste and must be kept closed (wrench tight) at all times except when waste is being added.
- HW containers must be inspected weekly using the *Weekly Hazardous Waste (HW) Site Inspection Form*, included as Attachment 7-1 and Attachment 7-2. Written records noting discrepancies and corrective actions must be maintained for a period of 3 years. Copies of inspection reports should be provided to the ROICC or Contract Representative.
- The generating contractor must monitor the level of waste in the SAA container and contact the ROICC or Contract Representative to coordinate disposal or determine if the contractor can turn in the HW to RCRS or EAD before the container is full. If the SAA container becomes full, the generating contractor has 72 hours (3 days) to arrange for the transport of the HW to an RCRA Part B permitted

storage area. Storage of HW in an SAA should not exceed 365 days, even if the container is not full.

7.5.2. Manifesting and Disposal

All disposal of HW generated by contractors must be coordinated with the installation. HW and UW generated aboard MCB Camp Lejeune and MCAS New River must be transported off the installation by a permitted HW transporter and must include a *Uniform Hazardous Waste Manifest* form (EPA Form 8700-22) or an equivalent approved manifest. The following procedures must be followed for disposal of HW:

- Use the MCB Camp Lejeune or MCAS New River EPA identification number for disposal of all contractor-generated HW.
- HW may only be transported by authorized personnel or permitted companies. Prior to

Only personnel from EMD who have been designated in writing by the MCB Camp Lejeune Commanding General can sign the hazardous waste manifest.

transportation offsite, the HW generator must ensure that all DOT requirements for labeling, marking, placarding, and containerizing are met. The HW generator must also ensure that the transporter has obtained the installation's EPA identification number for the transportation of HW and that an appropriate waste manifest accompanies each shipment.

- The HW manifest can only be signed by personnel from the installation who have been designated in writing by the CG. The ROICC or Contract Representative should contact RCRS or EAD about manifesting regulated and non-regulated wastes offsite. Under **NO** circumstances can a contractor, ROICC, or Contract Representative sign a HW manifest or use another EPA identification number for wastes generated at the installation.
- All HW must be submitted to a permitted TSD facility. HW generators must certify that the facility receiving the waste employs the most practical and current treatment, storage, or disposal methods for minimizing present and future threats to human health and the environment.

7.6. NON-RCRA-REGULATED WASTE REQUIREMENTS

Non-RCRA-regulated wastes include used oil (when recycled), non-terne (tin and lead alloy) plated oil filters (not mixed with listed waste), CFC refrigerants (from totally enclosed equipment), certain wastes containing Polychlorinated Biphenyl (PCB), asbestos, and batteries not managed as UW.

7.6.1. Used Oil and Oil Filters

Used motor oil itself is *not* regulated as HW in North Carolina if it is recycled or burned for energy recovery. If used oil is not recycled, the generator must determine prior to disposal whether it is HW. Used oil must be collected in

drums or another approved container marked “Used Oil.” If the used oil storage container has a volume of 55 gallons or more, it must be stored in secondary containment.

- Do not dump used oil into drains, sinks, or trash containers, or onto the ground.
- Do not store used oil in open buckets or drip pans, damaged or rusted containers, or containers that cannot be fully closed.
- Do not mix used oil with other waste materials.

Terne plated oil filters contain an alloy of tin and lead. They are considered a hazardous waste due to their lead content and are typically located on industrial and heavy duty vehicles and equipment. All other used oil filters are not regulated as HW in North Carolina, as long as they are not mixed with listed HW. To qualify for this exclusion, the following conditions must be met:

- Used oil filters must be gravity hot-drained by puncturing the filter anti-drain back valve or filter dome and hot draining into a “Used Oil” storage drum. “Hot-drained” means that the oil filter is drained at a temperature that approximates the temperature at which the engine operates.
- Any incidental spillage that occurs must be cleaned up with a dry sweep, rags, or “absorbent matting.”
- Drained used oil filters must be collected in a container that is in good condition and is labeled with the words “Drained Used Oil Filters.”

- No other waste streams should be deposited in containers collecting used oil filters for disposal.
- Coordinate with the ROICC or Contract Representative to determine if the drained used oil filters can be given to RCRS or EAD.

7.6.2. Used Antifreeze

Antifreeze is composed of regulated chemicals, including ethylene glycol and propylene glycol, and during typical use may become contaminated with traces of fuel or metal particles (i.e., lead, cadmium, or chromium). It may also become HW if it has been mixed with other wastes, such as gasoline or solvents. Additional characterization may be required to determine whether or not used antifreeze is HW. Used antifreeze that is not recycled may be regulated as HW if the results from the Toxic Characteristics Leaching Procedure (TCLP) indicate metal contents that meet or exceed RCRA thresholds.

The State of North Carolina does not regulate used antifreeze as HW, as long as it is recycled by reuse, distillation, filtration, or ion exchange. Used antifreeze must be stored in closed containers on an impermeable concrete surface with adequate spill controls (secondary containment, appropriate stocked spill kits, etc.). Contact the ROICC or Contract Representative to determine if used antifreeze can be given to RCRS or EAD.

7.6.3. Petroleum-Contaminated Wipes and Oily Rags

Petroleum-contaminated wipes and oily rags are to be managed as non-regulated waste. Follow these procedures:

- Store oil-contaminated wipes and oily rags in metal containers because of their flammability/combustibility and to protect them from the weather.
- Do not throw these non-regulated waste items into solid waste dumpsters or garbage cans.
- Contact the ROICC or Contract Representative to determine if petroleum-contaminated wipes and oily rags can be given to RCRS or EAD.

7.6.4. Used Electronic Equipment

Used electronic equipment may contain lead solder or PCB oils (e.g., light ballast). Turn in these items as they are generated. Have the ROICC or Contract Representative contact RCRS or EAD for proper handling and/or turn-in procedures.

7.6.5. New and Used Batteries (Not Regulated as Universal Waste)

- Store compatible batteries together (i.e., lithium batteries should be stored with other lithium batteries).

- Store batteries off the ground to prevent them from coming into contact with water.
- Store lead-acid batteries away from an open flame.
- Place rechargeable batteries in plastic bags before storing them with other rechargeable batteries.
- Do not dispose of batteries unless authorized.
- Have the ROICC or Contract Representative contact RCRS or EAD for proper handling and/or turn-in procedures.

Attachment 7-1
Weekly Hazardous Waste (HW) Site
Inspection Form
MCB Camp Lejeune

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CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

MCB Camp Lejeune Weekly Hazardous Waste (HW) Site Inspection Universal Waste (UW)/Satellite Accumulation Area (SAA)

Building Number/location of HW Site: _____

Unit Evaluated: _____

Evaluation Date: ____/____/____

Evaluation By (Site Manager): _____

Evaluation Time: _____

QUESTION	YES	NO	Location of Discrepancy <u>and</u> Proposed Corrective Action
1. Is housekeeping maintained in acceptable manner?			
2. Is any HW present at the site?			
3. Are HW containers properly marked?			
4. Are HW containers in serviceable condition?			
5. Are container bungs, caps, and openings properly secured?			
6. Is a unit spill plan/activation prominently posted?			
7. Is 911 spill response sign posted?			
8. Are " Danger-Unauthorized Personnel Keep Out " signs posted so they may be seen from any approach?			
9. Are " No Smoking " signs posted?			

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

QUESTION	YES	NO	Location of Discrepancy <i>and</i> Proposed Corrective Action
10. Does the site have emergency communication system or two-man rule in effect? If the two-man rule is implemented, is a sign posted with the legend " Two-Man Rule in Effect "?			
11. Are properly charged fire extinguishers, as well as eye wash stations, present and inspected at least monthly?			
12. Is the post indicator valve in good operating condition and secured in the closed position, and are there any structural defects such as cracked concrete?			
13. Is the proper spill response equipment readily available?			
14. Is the site designated and recognizable, and is the EMD Authorization posted within the site as to be visible to personnel placing waste into the container? (SAA site only)			
15. Are all HWs properly segregated and stored in the designated site?			
16. Are any hazardous materials being stored in the Satellite Accumulation Area or < 90-day storage site?			

Attachment 7-2
Weekly Hazardous Waste (HW) Site
Inspection Form
MCAS New River

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CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

Weekly Hazardous Waste Storage Area Inspection Form

Squadron: _____

Inspector: _____

Date: _____

Signature: _____

<u>Question</u>	<u>Yes</u>	<u>No</u>	<u>Corrective Actions or N/A</u>
1. Is the HW container located at or near the point of generation?			
2. Is the HW container DOT approved?			
3. Is the HW container marked correctly with the words "Hazardous Waste," correct noun name of contents, NSN'S and unit designator?			
4. Is the HW container closed and wrench tight when no one is adding to the container?			
5. If a funnel is left in place, does that funnel have a plug or ball valve to be considered closed or secured?			
6. Is the HW container in good condition? (No excessive rust or dents in critical areas, seals are in place, no bulging or collapsing and no signs of spillage or leakage)			
7. Is the Spill Contingency Plan posted and in plain view?			
8. Is the SAA Site approval letter from EAD posted at the SAA site?			
9. Is the SAA Site limited to Authorized Personnel only?			

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

<u>Question</u>	<u>Yes</u>	<u>No</u>	<u>Corrective Actions or N/A</u>
10. Is the HW container below the proper ullage for a liquid to expand? (4 inches from the top)			
11. Are SAA HW containers moved to the 90-Day Site within 72 hours when filled to the proper ullage or weight capacity of the container?			
12. (90-Day Site only) Are all palletized waste streams correctly marked with "Hazardous Waste" or "Universal Waste," noun name of the waste, NSN and unit designator on the pallet or wall of the waste structure?			
13. (90-Day Site only) Are all HW containers turned in prior to the 90 th day after the ASD?			
14. Are adequate spill response supplies readily available for use in case of spill or leakage?			
15. Is there a means of emergency communication between storage facilities and working spaces?			
16. Is the SAA site or 90-Day Site in a good state of police?			



HCC SECTION	GROUP NAME	EXAMPLES	INCOMPATIBLE MATERIALS	REACTION IF MIXED
1	ACIDS	Battery Acid Paint Removers Dr-Rest Spray	FLAMMABLES/COMBUSTIBLES ALKAL/BASES/CAUSTICS OXIDIZERS (MAUG Groups 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21)	HEAT VIOLENT REACTION Gas Generation
2	ADHESIVES	Epoxyes Isocyanates Chloride Resins	ACIDS ALKAL/BASES/CAUSTICS OXIDIZERS (MAUG Group 1, 3, 18)	HEAT FIRE HAZARD
3	ALKALIS/ BASES/ CAUSTICS	Ammoxia Sodium Hydroxide Cleaners	ACID/OXIDIZERS FLAMMABLES/COMBUSTIBLES (MAUG Groups 1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21)	HEAT Gas Generation VIOLENT REACTION
4	CLEANING COMPOUNDS	Degreasers Carbon Removers Anti-fogging Compounds	DEREGENT SCUMPS OXIDIZERS (MAUG Group 1, 7, 18)	HEAT FIRE HAZARD
5	COMPRESSED GASES	Azetylene, Propane, Nitrogen, Argon, Helium, Oxygen	HEAT SOURCES Consult paragraph C23 for specific handling and storage guidance (MAUG Groups 8, 9, 10, 11, 12, 13, 14, 15)	FIREHAZARD EXPLOSION HAZARD
6	CORROSION PREVENTIVE COMPOUNDS	Corrosion Inhibitors Chemical Conversion Compounds	ACID/BASES OXIDIZERS IGNITION SOURCES (MAUG Groups 1, 3, 18, 20)	FIREHAZARD
7	DETERGENTS/ SOAPS	Triturations Phosphate Scouring Powders Dish-detergents	KOOLICION FORMING COMPOUNDS (MAUG Group 4, 14)	VIOLENT REACTION HEAT
8	GREASES	Lithium Grease Silicone Metaldomum	OXIDIZERS ALKAL/BASES/CAUSTICS (MAUG Groups 3, 5, 18)	FIREHAZARD HEAT
9	HYDRAULIC FLUIDS	Petroleum-Based Synthetic Fire-Retardant	CORROSIVES, OXIDIZERS (MAUG Groups 1, 3, 5, 18)	VIOLENT REACTION
10	INSPECTION PENETRANTS	Petroleum-Based Dyes	CORROSIVES, OXIDIZERS (MAUG Groups 1, 3, 5, 18)	VIOLENT REACTION
11	LUBRICANTS/ OILS	General Purpose, Gear, Turbine, Hydraulic	ACIDS, OXIDIZERS (MAUG Group 1, 5, 18)	HEAT FIRE HAZARD
12	PAINT MATERIALS	Primers, Enamels, Urethanes, Lacquers, Varnishes, Non-SMG, Thinner	ACIDS, OXIDIZERS (MAUG Group 1, 5, 18)	HEAT FIRE HAZARD
13	PHOTO CHEMICALS	Developers, Stopbath, Toner, Bleaches, Reducers	ACIDS HEAVY METALS (MAUG Groups 1, 18, 20)	HEAT FIRE HAZARD
14	POLISH/WAX COMPOUNDS	Buffing Compounds Metal Polishes General Purpose Waxes	CORROSIVES OXIDIZERS (MAUG Groups 1, 3, 18)	HEAT, FIRE HAZARD VIOLENT REACTION
15	SOLVENTS	Methyl Ethyl Ketone (MEK) Toluene, Xylene Acetone	CORROSIVES OXIDIZERS BATTERIES (MAUG Groups 1, 3, 18, 20, 22)	HEAT FIRE HAZARD
16	THERMAL INSULATION	Adhesives Fiberglass Glass Wool	MATERIAL IS NOT REACTIVE KEEP DRY	NO REACTION
17	WATER TEST/ TREATMENT CHEMICALS	Nitric Acid Mercuric Nitrate Caustic Soda	CORROSIVES OXIDIZERS HEAVY METALS (MAUG Groups 1, 3, 18, 20, 21)	HEAT VIOLENT REACTION
18	OXIDIZERS	Calcium Hypochlorite Laundry Bleach OSA Catalysts	PETROLEUM-BASCO NITRATES FUELS, SOLVENTS, CORROSIVES, HEAT (MAUG Groups 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 22)	FIREHAZARD VIOLENT REACTION EXPLOSION HAZARD TOXIC GAS GENERATION
19	FUELS	JPL, JFS Diesel Fuel	CORROSIVES OXIDIZERS (MAUG Groups 1, 3, 5, 18)	TOXIC GAS GENERATION
20	HEAVY METALS	Mercury Lead Benzilium	CORROSIVES OXIDIZERS WATER TREATMENT/PHTHO CHEMICALS (MAUG Groups 1, 3, 5, 17, 18, 20)	VIOLENT REACTION GENERATION OF TOXIC AND FLAMMABLE GAS
21	BATTERIES	Lead-Acid Dry-Cell Alkaline	HEAVY METALS OXIDIZERS (MAUG Groups 15, 17, 18, 20)	HEAT VIOLENT REACTION TOXIC GAS GENERATION
22	PESTICIDES	Insect Killers, Fungicides Rodent Killers Fungicides	CORROSIVES OXIDIZERS (MAUG Groups 1, 3, 14, 18)	TOXIC GAS GENERATION

- www.safetycenter.navy.mil/training

7-35

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8.0 ASBESTOS

Asbestos was widely used in many products (especially building parts) prior to 1990 for its fire resistance, strength, and affordability. However, exposure to friable asbestos can lead to lung diseases including cancer. Contractors working aboard the installation must follow all Federal, State, and local regulations/specifications for the proper notification, removal, disposal, and management of all asbestos-containing materials (ACM) associated with demolition and renovation projects.

8.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with asbestos and its management. If you have any questions or concerns about the information in this section, please consult the ROICC or

Contract Representative, who will contact the appropriate EMD program if additional clarification is necessary.

Please consult the ROICC or Contract Representative with any questions or concerns about the information in this section.

8.1.1. Key Definitions

- **Abatement.** Work performed to repair, maintain, remove, isolate, or encapsulate ACM.
- **Asbestos.** Asbestos is the generic term for a group of naturally occurring fibrous silicate minerals, including those that typically exhibit high tensile

strength, flexibility, and resistance to thermal, chemical, and electrical conditions. Asbestos was commonly used in installed products such as roofing shingles, floor tiles, cement pipe and sheeting, roofing felts, insulation, ceiling tiles, fire-resistant drywall, and acoustical products.

- **Asbestos-Containing Material.** Any material containing more than 1 percent asbestos, per 29 CFR 1926.1101.
- **Category I Non-friable ACM.** Asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos, per 40 CFR 61, Subpart M.
- **Category II Non-friable ACM.** Any material, excluding Category I non-friable ACM, containing more than 1 percent asbestos that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure, per 40 CFR 61, Subpart M.
- **Demolition.** The wrecking or removal of any load-bearing walls or structure with any related handling operations.
- **Friable.** Any ACM that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure (may include damaged ACM that was previously identified as non-friable), per 40 CFR 763.
- **Glove Bag.** A sealed compartment with attached inner gloves that is used for handling ACM. Glove bags provide a small work area enclosure typically used for small-scale asbestos stripping operations.

- **Presumed Asbestos-Containing Material (PACM).** Thermal system insulation (TSI) and surfacing material found in buildings constructed no later than 1980, per 29 CFR 1926.1101.
- **Regulated Asbestos-Containing Material (RACM).** Includes friable ACM, Category I non-friable ACM that has become friable, Category I non-friable ACM that has been sanded, ground, cut, etc., and Category II non-friable ACM that has a high probability of becoming crumbled, pulverized, or reduced to powder during demolition or renovation, per 40 CFR 61, Subpart M.
- **Removal.** Stripping, chipping, sanding, sawing, drilling, scraping, sucking, and other methods of separating material from its installed location in a building.
- **Renovation.** Altering a facility or its components in any way, including stripping or removal of RACM, per 40 CFR 61, Subpart M.

8.1.2. Key Concepts

- **Demolition Notification.** North Carolina law requires notification for all demolition, regardless of whether asbestos is present, 10 working days prior to starting demolition.
- **Disposal.** ACM waste can be accepted at the MCB Camp Lejeune Sanitary Landfill. Work with the ROICC or Contract Representative to coordinate the disposal through the MCB Camp Lejeune Sanitary

Landfill. Asbestos waste is only accepted on Mondays through Thursdays from 0700 to 1000.

- **Removal Requirements.** Permits for asbestos removal or demolition must be obtained when the ACM present exceeds 260 linear feet, 160 square feet, or 35 cubic feet. Additionally, proper work practice procedures must be followed during demolition or renovation operations.
- **Renovation Notification.** If ACM is present within a structure, North Carolina law requires notification of renovation 10 working days prior to starting renovation.

8.1.3. Environmental Management System

Contractor practices associated with asbestos management include the following:

- Building operation/maintenance/repair
- Construction/demolition/renovation
- Equipment operation/maintenance/disposal
- HW transportation
- Parts replacement

The potential impacts of these activities on the environment include soil contamination, degradation of water quality and air quality, and the potential exposure of installation occupants.

8.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable regulations and requirements regarding ACM, which include but may not be limited to the following:

- [Asbestos General Standard, 29 CFR 1910.1001 – Asbestos.](#) Applies to all occupational exposures to asbestos in all industries covered by the Occupational Safety and Health Administration (OSHA).
- [Asbestos Hazard and Emergency Response Act \(AHERA\), 1986.](#) AHERA was written primarily to provide officials in schools, grades K-12, with rules and guidance for the management of ACM.
- [Asbestos School Hazard Abatement Reauthorization Act, 1992.](#) This act extended AHERA regulations to cover public and commercial buildings.
- [National Emission Standards for Hazardous Air Pollutants \(NESHAP\), Subpart A, General Provisions, and 40 CFR 61 – Subpart M – National Emission Standard for Asbestos.](#) Includes standards for asbestos demolition, renovation, and disposal, and administrative requirements.
- [Naval Facilities Engineering Service Center, Facilities Management Guide for Asbestos and Lead.](#) Summarizes asbestos and lead requirements

that routinely affect facilities operations, to protect workers, building occupants, and the environment.

- [Naval Facilities Guide Specifications and Engineering Control of Asbestos Materials.](#)
Covers the requirements for safety procedures and requirements for the demolition, removal, encapsulation, enclosure, repair, and disposal of ACM.
- [North Carolina Asbestos Hazard Management Program, NC General Statutes, Chapter 130A, Article 19; 10A NCAC 41C.0601–.0608 and .0611.](#)
Incorporates 40 CFR 763 and 29 CFR 1926.1101 by reference and outlines criteria for asbestos exposures in public areas, accreditation of persons conducting asbestos management activities, and asbestos permitting and fee requirements.
- [Safety and Health Regulations for Construction, Asbestos, 29 CFR 1926.1101.](#) Regulates asbestos in the construction, demolition, alteration, repair, maintenance, or renovation of structures that contain asbestos.

8.3. RESPONSIBILITIES BEFORE A DEMOLITION OR RENOVATION PROJECT

Prior to starting a demolition or renovation project, contractors must:

- Determine whether ACM, PACM, and/or RACM are present in the buildings involved in the project.
- Complete the necessary notifications to the State of North Carolina and obtain any necessary permits for the removal of ACM, PACM, and/or RACM.
- Understand what actions to take if ACM, PACM, and/or RACM are unexpectedly encountered during project execution.
- Remove all non-friable and friable ACM in accordance with all Federal, State, and local regulations, prior to demolition activities.
- Know how to properly dispose of ACM, and provide any waste disposal manifests generated for disposal.

The ROICC or Contract Representative is required to notify Camp Lejeune's Asbestos Program Manager of all work involving asbestos removals, including glove bag projects.

8.3.1. Identification of ACM and PACM

Form DHHS 3768 must be posted onsite during all permitted projects.

Contract documents will identify the presence of known ACM, PACM, and RACM. Contact the ROICC or Contract Representative with questions regarding the presence of these materials as identified in the contract

documents. An inspection conducted by a Health Hazards

Control Unit (HHCU)-licensed asbestos inspector may be necessary to confirm the location and quantities of any ACM, PACM, and/or RACM and determine if any previously unidentified materials are present.

8.3.2. Notification

To maintain accurate files and records, the ROICC or Contract Representative is required to notify the Asbestos Program Manager, who is part of the Installations and Environment Department, of all work involving asbestos removals, including glove bag projects.

The North Carolina Department of Health and Human Services (DHHS) Form 3768, *Asbestos Permit Application and Notification for*

Demolition and Renovation, must be submitted to the North Carolina HHCU 10 working days in advance of demolition activities, regardless of whether asbestos is present. This form must be posted onsite during the entire duration of the project. Have the ROICC or Contract Representative contact the Asbestos Program Manager with questions or concerns about requirements for notification of demolition or renovation.

A demolition/renovation notification form, DHHS 3768, must be submitted to the NC HHCU 10 working days before demolition activities, regardless of whether asbestos is present.

8.3.3. Removal

Any ACM, PACM, and/or RACM present must be removed before the area is disturbed during renovation or demolition

activities (except in certain rare instances). Certification and handling requirements for asbestos removal are provided in 10A NCAC 41C and the Asbestos NESHAP. Refer to these regulations for detailed requirements.

8.3.4. Training

North Carolina regulations require that all persons who perform asbestos management activities in the State of North Carolina must be accredited by the North Carolina HHCUC under the appropriate accreditation category (i.e., Building Inspector, Project Supervisor, and/or Abatement Worker). Training documentation should be available upon request.

8.4. RESPONSIBILITIES DURING A DEMOLITION OR RENOVATION PROJECT

North Carolina regulations require that DHHS Form 3768, *Asbestos Permit Application and Notification for Demolition and Renovation*, be acquired by the contractor and posted onsite during all permitted projects. Contractors must post this form when the project will remove the following: at least 260 linear feet, 160 square feet, or 35 cubic feet of RACM or asbestos that might become regulated as a result of handling. The form must also be posted for nonscheduled asbestos removal that will exceed these numbers in a calendar year.

During a renovation or demolition project, if the contractor suspects the presence of additional ACM (other than the materials identified in contract documents), the contractor

must immediately report the suspected area to the ROICC or Contract Representative. Before proceeding, the facility must be inspected by an asbestos inspector licensed by the North Carolina HHCU. The individual performing the asbestos survey will coordinate with the ROICC or Contract

During a renovation or demolition project, a contractor who suspects additional ACM is present must immediately report the suspected area to the ROICC or Contract Representative.

Representative throughout the process. A legible copy of the building inspection report must be provided to the North Carolina HHCU prior to each demolition and upon request for renovations; a building inspection report will be acceptable only if the inspection was performed during the 3 years prior to the demolition. A copy of the report should also be forwarded to the Asbestos Program Manager.

For specific work procedures and requirements for glove bag projects, refer to 29 CFR 1926.1101.

8.5. DISPOSAL OF ACM WASTE

Contractors can dispose of ACM waste at the MCB Camp Lejeune Sanitary Landfill after first coordinating with the MCB Camp Lejeune Landfill office through the ROICC or Contract Representative. The contractor must provide the MCB Camp Lejeune Landfill with Form DHHS 3787, *North Carolina Health Hazards Control Unit's Asbestos*

Waste Shipment Record. The contractor must submit this form to the North Carolina HHCU for all permitted asbestos removal projects.

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9.0 LEAD-BASED PAINT

Lead was used in paint for its color and water-resistant properties until it was banned in 1978 for its highly toxic properties that may cause a range of health problems, especially in young children. Improper removal of lead-based paint (LBP) may result in paint chips and dust, which may contaminate a structure inside and out. The North Carolina DHHS regulations require any person who performs an inspection, risk assessment, or abatement to be certified. North Carolina DHHS also requires a person to obtain a permit for conducting an abatement of a child-occupied facility or target housing.

9.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with LBP activities. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate Environmental Department or Safety Representative if additional clarification is necessary.

9.1.1. Key Definitions

- **Abatement.** The permanent removal or elimination of all LBP hazards.
- **Demolition.** The removal of any load-bearing walls or structure.

- **Inspection.** A surface-by-surface investigation to determine the presence of LBP, and a report explaining the results of the investigation.
- **Lead-Based Paint.** Surface coatings that contain lead in amounts equal to or in excess of 1.0 milligram per square centimeter, as measured by X-ray fluorescence (XRF) or laboratory analysis, or more than 0.5 percent by weight, per 40 CFR 745.
- **Lead-Containing Paint.** Surface coatings that contain lead in any amount greater than the laboratory reporting limit but less than 1.0 milligram per square centimeter, or less than 0.5 percent by weight, per 29 CFR 1926.62 and 29 CFR 1910.1025 (also contained in 40 CFR 745 Subpart L, and adopted by the State of North Carolina under North Carolina General Statute Chapter 130A, Article 19A).
- **Renovation.** Alteration of a facility or its components in any way.
- **Target Housing.** Any housing constructed before 1978, with the exception of housing for the elderly and persons with disabilities (unless a child under the age of 6 lives there) and residential dwellings where the living areas are not separated from the sleeping areas (efficiencies, studio apartments, dormitories, etc.).

9.1.2. Key Concepts

- **Disposal.** Analysis is required to determine proper disposal of waste (non-hazardous or hazardous). A Toxic Characteristic Leaching Procedure (TCLP) analysis must be conducted to determine whether lead levels have exceeded 5 parts per million (ppm), which is the RCRA threshold for HW determination.
- **LBP Survey.** A LBP survey is required prior to disturbing painted surfaces, to determine whether the paint meets the criteria of lead containing over 1.0 milligram per square centimeter or over 0.5 percent by weight.
- **Training.** LBP training requirements set forth by the OSHA must be followed by all personnel involved in all LBP removal activities. MCB Camp Lejeune Base Safety tracks this training for contract staff, as the Safety Office houses the Lead Program Manager.

9.1.3. Environmental Management System

Contractor practices associated with LBP include the following:

- Construction/demolition/renovation
- HW transportation
- Paint removal

The potential impacts of these activities on the environment include the potential degradation of soil, water, and air

environments, and the potential exposure of installation occupants.

9.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable Federal, State, and local regulations and requirements regarding LBP activities, which include but may not be limited to the following:

- [Naval Facilities Engineering Service Center, Facilities Management Guide for Asbestos and Lead.](#) Summarizes asbestos and lead requirements that routinely impact facilities operations, in order to protect workers, building occupants, and the environment.
- [Lead-Based Paint Hazard Management Program, NC General Statutes, Chapter 130A, Article 19A, Section 130A-453.01 through 453.11.](#) Requires a person who performs an inspection, risk assessment, abatement, or abatement design work in a child-occupied facility (daycare center, pre-school, etc.) or housing built before 1978 to be certified and establishes the requirements for certification, including the oversight of required training. It also requires a person who conducts an abatement of a child-occupied facility or target housing to obtain a permit for the abatement; establishes work practice standards for LBP abatement activities; and has adopted requirements included in 40 CFR Part 745, Subpart L and 40 CFR Part 745, Subpart D.

- **Lead-Based Paint Hazard Management Program for Renovation, Repair, and Painting (RRP), 10A NCAC 41C.0900.** Common renovation activities may create hazardous lead dust and chips by disturbing LBP, which may be harmful to adults and children. This article requires that dust sampling technicians, firms, and individuals performing renovation, repair, and painting projects for compensation that disturb LBP in housing and child-occupied facilities built before 1978 be certified and follow specific work practices to prevent lead contamination. Child-occupied facilities include, but are not limited to, child care facilities and schools (with children under the age of 6) that were built before 1978.
- **10A NCAC 41C.0800, Lead-Based Paint Hazard Management Program.** Requires (1) all individuals and firms involved in LBP activities to be certified and (2) all LBP activities to be carried out in accordance with 40 CFR 745.
- **29 CFR 1926, Safety and Health Regulations for Construction.** Contains the OSHA requirements for construction activities where workers may come into contact with lead.
- **40 CFR Part 745, Lead-Based Paint Poisoning Prevention in Certain Residential Structures.** Ensures that (1) LBP abatement professionals, including workers, supervisors, inspectors, risk assessors, and project designers, are well trained in conducting LBP activities; and (2) inspections for the

identification of LBP, risk assessments for the evaluation of LBP hazards, and abatements for the permanent elimination of LBP hazards are conducted safely, effectively, and reliably by requiring certification of professionals.

9.3. RESPONSIBILITIES BEFORE RENOVATION OR DEMOLITION

**Buildings
constructed prior
to 1978 are
assumed to
contain LBP.**

Ordinary renovation and maintenance activities may create dust that contains lead, but following lead-safe work practices may help mitigate or prevent lead hazards. The North Carolina RRP Program (10A

NCAC 41C.0900) mandates that contractors, property managers, and others working for compensation in homes and child-occupied facilities built before 1978 be trained in and use lead-safe work practices. In addition, it mandates that contractors provide the owner and occupants with *The Lead-Safe Certified Guide to Renovate Right* information pamphlet, which is found at the following website: <http://epi.publichealth.nc.gov/lead/pdf/RenovateRight.pdf>

Individuals must be certified by the State of North Carolina to perform RRP activities for compensation in housing and child-occupied facilities built before 1978. A firm engaged in regulated renovation activities (such as RRP that disturbs more than 6 square feet of interior painted surfaces or 20 square feet of exterior painted surfaces, or dust sampling after renovation) must be a certified renovation firm.

To address the hazards associated with the improper abatement or removal of LBP, any person who performs an inspection, risk assessment, abatement, or abatement design work in a child-occupied facility (child development centers, preschools, etc.) or housing built before 1978 must be certified by the State of North Carolina. Any person who conducts an abatement of a child-occupied facility or target housing must also obtain a permit for the abatement. Individuals conducting LBP abatement activities in North Carolina, such as inspections, risk assessments, LBP hazards abatement, clearance testing, or abatement project design in housing and child-occupied facilities built before 1978, must be certified by the State of North Carolina. A firm engaged in abatement activities must be a certified lead abatement firm.

Prior to any renovation or demolition aboard the installation that involves the disturbance of painted surfaces, a LBP survey must be completed by an inspector certified in North Carolina, retained through the ROICC or Public Works Division (PWD). Certain projects will use PWD staff to conduct the sampling, and other projects will use contracted personnel. Buildings constructed prior to 1978 are assumed to contain LBP; therefore, no LBP survey is necessary. The LBP survey (through sampling and analysis) will determine whether painted surfaces meet the criteria of LBP (lead content equal to or greater than 1.0 milligram per square centimeter as measured by XRF or lab analysis, or 0.5 percent by weight). Naval Facilities Guide Specifications and contract documents must be implemented for contracts where LBP is to be abated/removed prior to demolition or renovation.

If the area is to be reoccupied, final clearance must be conducted, including a visual inspection and sample collection, prior to reoccupation. Clearance on all projects involving abatement must be provided by a certified risk assessor or a certified LBP inspector. Clearance for RRP projects may be conducted by a certified risk assessor, certified LBP inspector, or certified dust sampling technician.

9.4. PERMITS

Contractors must obtain a North Carolina LBP Abatement Permit from North Carolina DHHS when lead paint is removed from targeted structures (child-occupied facilities or housing built prior to 1978).

9.5. DISPOSAL

If the LBP survey determines that LBP will be abated as part of a renovation or demolition project, the contractor must take analytical samples to determine whether the waste material is hazardous. Usually, a TCLP sample is collected from a “representative” sample of the material removed. The

If the LBP survey determines that LBP will be abated as part of a renovation or demolition project, analytical samples must be taken to determine whether the material is hazardous.

The laboratory conducting the sample analysis must be accredited by the Environmental Lead Laboratory Accreditation Program. A list of these accredited labs is available by contacting (703) 849-8888 or visiting

http://apps.aiha.org/qms_aiha/public/pages/reports/publicScopeView.aspx?ProgramCode=37&Version=2.

If the LBP is removed from the underlying building material, then the paint is the waste stream. If the LBP is removed with the building material, then both materials are considered the waste stream.

If the lead content is below HW regulatory disposal levels, consult the ROICC or Contract Representative to determine whether if the contract allows for the disposal of the material in the MCB Camp Lejeune Sanitary Landfill. Lead waste is only accepted on Mondays through Thursdays from 0700 to 1000.

If the abated LBP is above HW regulatory levels, refer to Section 7.0 of this guide for information on HW management and disposal requirements.

9.6. TRAINING

Before the project begins, workers who are subject to lead exposure during abatement or removal activities must be trained according to the OSHA regulations in 29 CFR 1926.62 concerning lead exposure in construction, and they must receive all training and certification specified by 10A NCAC 41C.0800 and 10A NCAC 41C.0900. The contractor is responsible for providing this training before initiating any work aboard MCB Camp Lejeune.

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10.0 NATURAL RESOURCES

The installation has stewardship and recovery responsibilities over the natural resources on the installation. These responsibilities are regulated under numerous laws described in this section. The installation ensures compliance with these laws through an interdisciplinary process of review and coordination of all activities occurring on the installation.

Contractors working on the installation are responsible for complying with conditions and measures imposed on their work as a result of this process; these responsibilities include preserving the natural resources within the project boundaries and outside the limits of permanent work, restoring work sites to an equivalent or improved condition after the work is complete, and confining construction activities to the limits of the work indicated or specified. The contractor is advised that the installation is subject to strict compliance with Federal, State, and local wildlife laws and regulations. The contractor must not disturb wildlife (birds, nesting birds, mammals, reptiles, amphibians, and fish) or the native habitat adjacent to the project area except when indicated or specified.

10.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with natural resources management. If you have any questions or concerns

**Please consult the
ROICC or Contract
Representative
with any
questions or
concerns about
the information in
this section.**

about the information in this section or require assistance regarding any wildlife matters (snakes, nesting birds, nuisance wildlife, etc.) on the site or within the project area, please consult the ROICC or Contract Representative, who will contact the Environmental Conservation Branch.

10.1.1. Key Definitions

- **Conservation.** The planned management, use, and protection of natural resources to provide their sustained use and continued benefit to present and future generations.
- **Ecosystem.** A dynamic, natural complex of living organisms interacting with each other and with their associated nonliving environment.
- **Habitat.** An area where a plant or animal species lives, grows, and reproduces, and the environment that satisfies its life requirements.
- **Natural Resource.** Soil, water, air, plants, and animals, according to the Natural Resources Conservation Service.
- **Endangered or Threatened Species.** Federally listed taxon that is “in danger of extinction throughout all or a significant portion of its range” or “likely to become endangered within the foreseeable future throughout all or a significant portion of its range.”
- **Riparian Buffer.** Vegetated area bordering a body of water, such as a stream, lake, or pond.

- **Wetland.** Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas, per the EPA.

10.1.2. Key Concepts

- **Coastal Zone Management Act (CZMA) of 1972.** Requires each installation to ensure that its operations, activities, projects, and programs affecting the coastal zone in or on coastal lands or waters are consistent with the federally approved Coastal Zone Management Plan of the State.
- **Ecosystem Management.** A goal-driven approach to managing natural and cultural resources that supports present and future mission requirements; preserves ecosystem integrity; is at a scale compatible with natural processes; is cognizant of natural processes' time scales; recognizes social and economic viability within functioning ecosystems; is adaptable to complex, changing requirements; and is realized through effective partnerships among private, local, State, tribal, and Federal interests. Ecosystem management is a process that considers the environment as a complex system functioning as a whole, not as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole.

- **Integrated Natural Resources Management Plan (INRMP).** A planning document using ecosystem management principles to direct the management and conservation of installation natural resources, which includes all elements of natural resources management applicable to the installation.
- **National Environmental Policy Act.** Requires Federal agencies, including the USMC, to consider the environmental impacts of projects prior to implementation. All projects that support military training, minor and major military construction, maintenance, and natural resources management actions are reviewed for potential environmental impacts. Contractors must obtain and review any NEPA documentation associated with their projects. All NEPA documentation can be obtained from the ROICC or Contract Representative.
- **Threatened and Endangered Species.** Specific requirements regarding protected areas on the installation apply to contractor activities. Eight federally threatened and endangered species are currently managed at MCB Camp Lejeune – red-cockaded woodpecker, green sea turtle, loggerhead sea turtle, rough-leaved loosestrife, seabeach amaranth, piping plover, red knot, and American alligator. In addition, as of March 25, 2015, the U.S. Fish and Wildlife Service lists six species as threatened and nine as endangered for Onslow County, NC. Consult the ROICC or Contract Representative to determine if there are any project

requirements regarding threatened or endangered species.

- **Timber.** Contractors must ensure that the ROICC or Contract Representative notify the EMD's Forest Management Program prior to conducting site work. Timber will not be released to contractors without the approval of the Forest Management Program.
- **Waters of the United States.** All waters that are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce; interstate waters; the territorial seas; impoundments; tributaries; adjacent waters including wetlands, ponds, lakes, oxbows, and impoundments; waters determined to have a significant nexus; Carolina bays; Pocosins; and waters within the 100-year floodplain or within 4,000 feet of the high tide line or ordinary high water mark; per 33 U.S.C. 1251 *et seq.* Section 328.3.
- **Wetlands.** Any work in installation waters or wetlands requires a permit prior to the start of an activity.

10.1.3. Environmental Management System

Contractor practices associated with natural resources include the following:

- Erosion/runoff control
- Fish stocking
- Habitat management

- Land clearing
- Live fire range operations
- Road construction and maintenance
- Soil excavation/grading
- Timber management
- Urban wildlife management

The potential impacts of these activities on the environment include air emissions, sedimentation, eutrophication of surface waters (addition of nutrients that stimulate aquatic plant growth and depletes oxygen), degradation of habitat, impacts to marine mammals, damage to commercial and noncommercial timber, impacts to endangered species and natural resources, and degradation of soil quality.

10.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable regulations and requirements regarding natural resources, which include but may not be limited to the following:

- [**Bald and Golden Eagle Protection Act of 1940, as Amended \(16 USC 688 *et seq.*\)**](#). Prohibits taking, possessing, and transporting bald eagles and golden eagles and importing and exporting their parts, nests, or eggs. The definition of “take” includes pursue, shoot, shoot at, poison, wound, capture, trap, collect, molest, or disturb.

- **BO 5090.11A, Protected Species Program.** Sets forth regulations and establishes responsibilities to ensure the conservation of threatened and endangered species and species at risk aboard MCB Camp Lejeune.
- **BO 5090.12, Environmental Impact Review Procedures.** Implements NEPA 1969 and NEPA policy and guidance in Chapter 12 of MCO P5090.2A.
- **Clean Water Act of 1972.** Establishes the basic structure for regulating wastewater discharges and placing fill materials into the waters of the United States.
- **CZMA of 1972 (16 USC 1451 *et seq.*).** Requires that Federal actions affecting any land/water use or coastal zone natural resource be implemented consistent with the enforceable policies of an approved State coastal management program. Requires concurrence from the State before taking an action affecting the use of land, water, or natural resources of the coastal zone.
- **Endangered Species Act of 1973 (16 USC 1531 *et seq.*).** Requires all Federal agencies to carry out programs to conserve federally listed endangered and threatened species of plants and wildlife.
- **EO 11990, Protection of Wetlands, 24 May 1977.** Addresses Federal agency actions required to identify and protect wetlands, minimize the risk of wetlands destruction or modification, and preserve

and enhance the natural and beneficial values of wetlands.

- **EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, 10 January 2001.**
Requires each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement a plan to promote the conservation of migratory bird populations.
- **Marine Mammal Protection Act of 1972 (MMPA), as Amended (16 USC 1361 *et seq.*).**
Mandates a moratorium on the killing, capturing, harming, and importing of marine mammals and marine mammal products. The MMPA also prohibits the taking of any marine mammal, including to harass, hunt, capture, collect, or kill any marine mammal, including any of the following: collection of dead animals or their parts, restraint or detention of a marine mammal, tagging a marine mammal, the negligent or intentional operation of an aircraft or vessel, or any other negligent or intentional act that results in disturbing or molesting a marine mammal.
- **Migratory Bird Treaty Act of 1918, as Amended (16 USC 703 *et seq.*).** Protects migratory birds (listed in 50 CFR 10.13) and their nests and eggs and establishes a permitting process for the taking of migratory birds by establishing a Federal prohibition to “pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause

to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird or any part, nest, or egg of any such bird.”

- **MCO P5090.2A, Environmental Compliance and Protection Manual.** Provides guidance and instruction to installations to ensure the protection, conservation, and management of watersheds, wetlands, natural landscapes, soils, forests, fish and wildlife, and other natural resources as vital USMC assets.
- **NEPA 1969 (42 U.S.C. 4321 *et seq.*)**. Requires Federal agencies, including the USMC, to consider the environmental impacts of projects before the decisionmaker proceeds with the implementation. All projects that support military training, major and minor military construction, maintenance, and natural resources management actions are reviewed for potential environmental impacts.
- **Rivers and Harbors Act of 1899.** Prohibits the excavation, filling, or alteration of the course, condition, or capacity of any port, harbor, or channel without prior approval from the Chief of Engineers.
- **Sikes Act of 1960, as Amended (16 USC 670 *et seq.*)**. Requires military installations to manage natural resources for multipurpose uses and public access appropriate for those uses, as well as ensuring no net loss to training, testing or other defined

missions of the installation through the development and implementation of an INRMP.

- [Neuse River Basin Riparian Buffer Rules \(15A NCAC 02B.0233\)](#). Require a 50-foot riparian buffer that is divided into two zones. The 30 feet closest to the water (Zone 1) must remain undisturbed. The outer 20 feet (Zone 2) may include managed vegetation, such as lawns or shrubbery. The riparian buffer rules also require diffuse flow of stormwater runoff. The buffers apply to intermittent streams, perennial streams, lakes, ponds, estuaries, and modified natural streams that are depicted on the most recent printed version of the soil survey map prepared by the Natural Resources Conservation Service or the 1:24,000 scale quadrangle topographic map prepared by the U.S. Geologic Survey.

10.3. NATIONAL ENVIRONMENTAL POLICY ACT

Staff specialists from various installation departments participate in the NEPA process, which coordinates the review of projects and documents environmental impacts (or lack thereof) for projects before implementation.

The documentation of this review process occasionally includes mandatory conditions affecting the design and construction/ implementation of the project. The documentation, when completed, is provided to the action proponent, who is expected to provide it to the ROICC or Contract Representative.

Consult the ROICC or Contract Representative to obtain or review any NEPA documentation associated with the project. The documentation marks the end of the NEPA review process; it does not constitute approval for the proponent of the action to implement the action. Some contracts may include stipulations from the NEPA document that must be implemented prior to the onset of work to

**Consult the ROICC
or Contract
Representative to
obtain or review
any NEPA
documentation
associated with
the project.**

prevent environmental impacts and violations of Federal or State rules and regulations. Stipulations could include replacing monitoring wells if damages occur from contractor operations, stopping work if contamination is encountered, notification that a wetlands permit is required, seasonal restrictions, etc.

10.4. TIMBER

Potential timber resources are identified during the NEPA process. The contractor is responsible for advising the ROICC or Contract Representative to notify EMD's Forest Management Program prior to beginning site work. Additionally, the ROICC or Contract Representative and/or contractor is required to notify the Forest Management Program if the contract has been amended with modifications to the site location.

MCB Camp Lejeune manages its forest in accordance with the installation INRMP. The Forest Management Program

maintains first right of refusal for all timber products on construction projects and will determine whether the Government will harvest the timber or release it to the contractor. The Government retains exclusive rights to all forest products on construction projects. If the Government elects to harvest the timber, only merchantable timber will be removed.

Contractors must adhere to the following requirements when performing site work that may impact timber resources:

- Do not remove, cut, deface, injure, or destroy trees or shrubs without authorization from the ROICC or Contract Representative.
- Do not fasten or attach ropes, cables, or guy wires to nearby trees for anchorages without authorization from the ROICC or Contract Representative. (If these actions are authorized, the contractor is responsible for any resultant damage.)
- Protect trees that are to remain in place and that may be injured, bruised, defaced, or otherwise damaged by construction operations.
- With the ROICC or Contract Representative's approval, use approved methods of excavation to

Protect existing trees that are to remain in place and that may be injured, bruised, defaced, or otherwise damaged by construction operations.

remove trees with 30 percent or more of their root systems destroyed.

- With the ROICC or Contract Representative's approval, remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features.

Please refer to Section 12.0 for disposal information for land-clearing debris.

10.5. THREATENED AND ENDANGERED SPECIES

Entry into a threatened or endangered species site or shorebird nesting area marked with signs and/or white paint is prohibited without written permission from installation personnel.

With the exception of improved roadways, entry into a threatened or endangered species site or shorebird nesting area marked with signs and/or white paint is prohibited without written permission from installation personnel. BO 5090.11A lists threatened and endangered species that may be encountered at the installation. The following restrictions apply on the installation unless written permission is explicitly provided:

- Work on Onslow Beach or Brown's Island is not permitted between April 1 and October 31. Traffic

on the beaches should be limited to below the high tide line.

- Vehicles and lighting are prohibited on the beaches overnight between May 1 and October 31.
- Construction activities are prohibited within 1,500 feet of a bald eagle's nest (JD, MC, and IF Training area).
- Cutting or damaging pine trees is not permitted.
- Altering hydrology through excavation, ditching, etc., is prohibited.
- Fish and wildlife must not be disturbed.
- Water flows may not be altered; the native habitat adjacent to the project and critical to the survival of fish and wildlife may not be significantly disturbed, except as indicated or specified.

10.6. WETLANDS

10.6.1. Avoidance

In accordance with MCO P5090.2A, all facilities and operational actions must avoid, to the maximum degree feasible, wetlands destruction or degradation, regardless of the wetlands size or legal necessity for a permit. Prior to the onset of

Contractors must incorporate avoidance and minimization measures to comply with the national policy to permit no overall net loss of wetlands.

construction, coordination with the Environmental Conservation Branch of EMD should have taken place during project design to ensure CWA permitting issues are addressed by the contractor at the earliest opportunity. Contractors must incorporate avoidance and minimization measures to comply with the national policy to permit no overall net loss of wetlands, as well as meeting concept design criteria while incorporating avoidance and minimization measures to protect wetlands, streams, and waters of the United States. Any proposed action that would significantly affect wetlands must be coordinated with the CG of MCB Camp Lejeune.

The contractor must ensure that construction of all buildings, facilities, and related amenities, including earthwork, grading, landscaping, drainage, stormwater management, parking lot and paved roadway, sidewalks, site excavation, sanitary sewer system extensions, and domestic water extensions, avoids, to the maximum degree feasible, wetlands destruction or degradation.

Identified and mapped boundaries of the legally defined wetlands on all USMC lands within the project area will be distributed to the ROICC or Contract Representative for use (if available) and included in all design products, including drawings, plans, and figures.

10.6.2. Permits

All unavoidable potential impacts to wetlands or waters of the United States require prior coordination as described in this section. Failure to acquire written authorization for

If work in wetlands is required, know who is responsible for obtaining permits, and what the terms and conditions of the permits require.

impacts to wetlands and/or waters of the United States may result in significant project delays or design modifications.

No discharge of fill material, mechanized land clearing, or any other activity is allowed in jurisdictional wetlands or waters of the United States without the proper approvals. The contractor

may be responsible for obtaining the following permits (including pre-permit coordination, preparation, and submission of all permit applications after review and concurrence by the installation) and complying with all regulations and requirements stipulated by the State of North Carolina as conditions upon issuance of the permits:

- U. S. Army Corps of Engineers (USACE), Section 404 Permit (individual or applicable nationwide permit); CWA of 1977, as Amended (Public Law 95-217, 33 U. S. C. 1251 et seq.)
- North Carolina Division of Water Resources (NCDWR), Section 401 Water Quality Certification – (15A NCAC 02H) NCDEQ; CWA of 1977, as Amended (Public Law 95-217, 33 U. S. C. 1251 et seq.)
- North Carolina Division of Coastal Management (NCDQM), Federal Consistency Determination (15A NCAC 07) NCDEQ; CZMA of 1972 (16 USC 1451 et seq.)

Two types of activities generally require a permit from the USACE:

- **Activities within navigable waters.** Activities such as dredging, constructing docks and bulkheads, and placing navigation aids require review under Section 10 of the Rivers and Harbors Act of 1899 to ensure that they will not cause an obstruction to navigation.
- **Activities in wetlands and waters of the United States (regulated by Section 404 of the CWA of 1972).** A major aspect of the regulatory program under Section 404 of the CWA is determining which areas qualify for protection as wetlands. Contractors should contact the USACE, the NCDWR, or the NCDCM if there is any question about whether activities could impact wetlands, streams, or protected buffers.

Contractors working on the installation will not perform any work in waters of the United States or wetlands without an approved permit (even if the work is temporary).

Contractors working on the installation will not perform any work in waters of the United States or wetlands without an approved permit (even if the work is temporary). Examples of temporary discharges include dewatering of dredged material prior to final disposal and temporary fills for access roadways, cofferdams, storage, and work areas.

10.6.3. Impacts

Any disturbance to the soil or substrate (bottom material) of a wetland or water body, including a stream bed or protected buffer, is an impact and may adversely affect the hydrology of an area. Discharges of fill material generally include the following, without limitation:

- Placement of fill material that is necessary for the construction of any structure or impoundment requiring rock, sand, dirt, or other material for its construction; site-development fills for recreational, industrial, commercial, residential, and other uses; and causeways or road fills
- Dams and dikes
- Artificial islands
- Property protection or reclamation devices such as riprap, groins, seawalls, breakwaters, revetments, and beach nourishment
- Levees
- Fill for intake and outfall pipes and subaqueous utility lines
- Fill associated with the creation of ponds
- Any other work involving the discharge of fill or dredged material

10.6.4. Mitigation

Any facility requirement that cannot be sited to avoid wetlands must be designed to minimize wetlands degradation and must include compensatory mitigation as required by wetland regulatory agencies (USACE and NCDWR) in all phases of project planning, programming, and budgeting.

The contractor may be required to develop onsite mitigation, consisting of wetland/stream restoration or creation, for all unavoidable wetland and stream impacts, whenever possible and feasible.

The contractor may be required to develop onsite mitigation, if appropriate, consisting of wetland/stream/buffer restoration or creation, for all unavoidable wetland, stream, and buffer impacts, whenever possible and feasible. Use of USMC lands and lands of other entities may be permissible for mitigation purposes for USMC projects when consistent with EPA and USACE guidelines or permit provisions. Land within the project area suitable for

establishment of mitigation may be evaluated by the contractor and used for mitigation where compatible with mission requirements and approved by the CG. Proposals for permanent resource areas must be approved by the Assistant Secretary of the Navy (Installations and Environment) or his/her designee.

Offsite mitigation is preferred and should be coordinated through the North Carolina Division of Mitigation Services or an approved private mitigation bank.

10.7. TEMPORARY CONSTRUCTION

Traces of temporary construction facilities, such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other signs of construction, should be removed upon completion of a contract or project. Temporary roads, parking areas, and similar temporarily used areas should be graded to conform to surrounding contours and the area restored, to the degree practical, to its state prior to any disturbing activities.

11.0 STORMWATER

MCB Camp Lejeune is responsible for stormwater permits associated with construction, industrial, or municipal activities that discharge to outfalls leading to receiving waters. The most applicable permit for contractors is the construction permit, since the majority of the contractor activities are affiliated with construction/renovation.

However, the contractor is also responsible for adhering to the requirements of the industrial and municipal permits held by MCB Camp Lejeune for all of the contractor activities on the installation. In essence, all contractors for the installation need to know and implement the

necessary measures to prevent stormwater runoff and pollution runoff from land-disturbing activities (LDAs) and associated construction permit requirements, as well as industrial and municipal activities. The general requirements for each area, as they apply to contractors, are discussed in the following subsections.

Please consult the ROICC or Contract Representative with any questions or concerns about the information in this section.

11.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with stormwater. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the

appropriate environmental office if additional clarification is necessary.

11.1.1. Key Definitions

- **Best Management Practices.** Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States. BMPs include structural and nonstructural stormwater controls, operation and maintenance procedures, treatment requirements, and practices to control site runoff (e.g., sediment, spillage or leaks, sludge or waste disposal, or drainage from material storage). See the following website for more information: <http://deq.nc.gov/about/divisions/energy-mineral-land-resources/stormwater>
- **Certificate of Stormwater Compliance.** A document providing approval for development activities that meet the requirements for coverage under a stormwater general permit.
- **Discharge (Pollutant).** The addition of any pollutant or combination of pollutants to waters of the United States from any point source, including, but not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, or dumping of any pollutant; this excludes discharges in compliance with a National Pollution Discharge Elimination System (NPDES) permit.

- **Erosion and Sedimentation Control Plan.** Any plan, amended plan, or revision to an approved plan submitted to the North Carolina Division of Land Resources or its delegated authority in accordance with North Carolina General Statute 113A-57. Erosion and Sedimentation Control Plans show the devices and practices that are required to retain sediment generated by the land-disturbing activity within the boundaries of the tract during construction and upon development of the tract. *Note that in North Carolina, the Erosion and Sedimentation Control Plan and the NCG010000 Construction General Permit are considered the Stormwater Pollution Prevention Plan (SWPPP, or SPPP) for a construction site.* See the following website for more information:

<http://deq.nc.gov/about/divisions/energy-mineral-land-resources/stormwater>

- **Land Disturbance.** Areas that are subject to clearing, excavating, grading, stockpiling, and placement/removal of earth material.
- **Nonpoint Source Discharge.** All discharges from stormwater runoff that cannot be attributed to a discernible, confined, and discrete conveyance. (*See also point source discharge, below.*)
- **Point Source Discharge.** Any discernible, confined, and discrete conveyance, including but specifically not limited to, any pipe, ditch, channel, tunnel conduit, well, discrete fissure, container, rolling stock, or concentrated animal feeding operation from

which pollutants are or may be discharged to waters of the State. (*See also nonpoint source discharge, above.*)

- **Stormwater (Runoff).** The portion of precipitation (rain and/or snowmelt) that does not naturally infiltrate into the ground or evaporate but flows via overland flows, channels, or pipes into a defined surface-water channel or stormwater system during and immediately following a storm event. As the runoff flows over the land or impervious surfaces (such as streets, parking lots, and building rooftops), it accumulates sediment and/or other pollutants that could pollute receiving streams.
- **Stormwater Associated with Construction Activities.** The discharge of stormwater from construction activities, including clearing, grading, and excavating, that result in a land disturbance of equal to or greater than 1 acre, per 40 CFR 122.
- **Stormwater Associated with Industrial Activities.** The discharge from any conveyance that is used for collecting and conveying stormwater and which is directly related to manufacturing, processing, or raw materials storage areas from an applicable industrial plant or activity, per 40 CFR 122.
- **Stormwater Associated with Municipal Activities.** The discharge of stormwater from municipal activities, including public works shops, vehicle maintenance shops, and other municipal activities, with the potential to cause stormwater pollution.

11.1.2. Key Concepts

- **Energy Independence and Security Act (EISA).** In December 2007, Section 438 of EISA was issued. This section requires that Federal facility projects over 5,000 square feet must “maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to temperature, rate, volume, and duration of flow.” In January 2010, the DoD Policy of Implementing Section 438 of the EISA was issued; this document includes a flowchart with implementation steps.
- **Good Housekeeping.** Good housekeeping practices refer to the maintenance of a clean and orderly facility to prevent potential pollution sources from coming into contact with stormwater. The practices include procedures to reduce the possibility of mishandling materials or equipment. Good housekeeping practices benefit stormwater quality and also provide for a clean, safe place for employees and clients. *Note that good housekeeping is one of the six minimum control measures (MCMs) of the MS4 permit requirements.*
- **Low Impact Development (LID).** LID is a holistic approach that incorporates site-specific ecosystem and watershed-based considerations for planning and design. The goal of LID is to mimic a site’s predevelopment hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to the source. LID seeks to control

non-point source pollutants “nature’s way,” through the application of plant-soil-water mechanisms that maintain and protect the ecological and biological integrity of receiving waters and wetlands.

- **National Pollution Discharge Elimination System.**

The national program for issuing, modifying, revoking, reissuing, terminating, monitoring, and enforcing permits. The NPDES stormwater program regulates stormwater discharges from three potential stormwater sources, as follows:

- **Construction Activities.** LDAs that disturb 1 or more acres need an NPDES permit. At a minimum, these permits require the development of a site-specific Erosion and Sedimentation Control Plan to address sediment controls during construction and upon development of the tract. As previously noted, the Erosion and Sedimentation Control Plan and the NCG010000 Construction General Permit are considered the SWPPP for a construction site in North Carolina. In the applicable areas of the installation, a State Stormwater Management Permit and coverage under the Construction General Permit may be required. *Note that construction site runoff control is also one of the six MCMs of the Municipal Separate Storm Sewer Systems (MS4) permit requirements.*
- **Industrial Activities.** Owners and operators of industrial facilities that fall into any of the 30 industrial sectors identified by EPA stormwater

regulations need an NPDES Phase I permit if stormwater is discharged directly into surface water (or MS4). The permit regulations specify steps that facility operators must take prior to becoming eligible for permit coverage and actions that must be taken to continue coverage under an existing permit. These steps and actions include, but are not limited to, effluent limits, monitoring, inspection, sampling, reporting, and corrective action requirements.

- o **Municipal Separate Storm Sewer Systems.** Owners and operators of MS4s need an NPDES Phase II permit. An MS4 is a system of pipes and drainage ditches within an urbanized area used to collect storm runoff and convey it to receiving waters. Polluted runoff is commonly transported through MS4s, from which it is often discharged untreated into local waterbodies.
- **Operational Requirements.** Equipment, discharge, and material use requirements that apply to all construction and industrial activities.
- **Post-Construction Requirements.** The management of stormwater generated on a stable, established site after the construction process is complete. The State Stormwater Management Program sets forth requirements for post-construction stormwater runoff control. *Note that post construction is one of the six MCMs of the MS4 permit requirements.*

- **Stormwater Pollution Prevention Plan.** A plan required by permits provided under NPDES that provides guidance to prevent stormwater pollution from construction, industrial, or municipal activities. *Note that the terminology for this plan (and associated acronym) varies somewhat from State to State.*

11.1.3. Environmental Management System

Contractor practices associated with stormwater include the following:

- Boat, ramp, dock cleaning
- Channel dredging
- Composting
- Construction/demolition/renovation
- Erosion/runoff control
- Fueling and fuel management/storage
- HM storage
- Land clearing
- Laundry
- Landscaping
- Livestock operations
- Pesticide/herbicide management and application
- Range residue clearance

- Road construction and maintenance
- Sewers
- Sidewalk and road deicing
- Soil excavation/grading
- Stormwater collection/conveyance
- Surface washing
- Vehicle parking
- Wash rack

Other activities that contractors could be involved in that may cause stormwater pollution include:

- Grounds maintenance (herbicide, pesticides, fertilizer, etc.)
- Outdoor material storage
- Building/roof repairs
- Industrial activities

The potential impacts of these activities on the environment include degradation of water quality and damage to public and private property due to flooding.

11.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable regulations and requirements regarding potential stormwater contamination, which include but may not be limited to:

- **Clean Water Act of 1972.** Establishes the basic structure for regulating discharges of pollutants into the waters of the United States. The CWA establishes that no oil or hazardous substances should be discharged into or upon the navigable waters of the United States or adjoining shorelines, which may affect natural resources under the management of the United States through the following goals: (1) eliminate the introduction of pollutants into waters of the United States, and (2) develop water quality, which protects and propagates fish, shellfish, and wildlife and provides for recreation in and on the water.
- **40 CFR 122, National Pollutant Discharge Elimination System.** Requires industrial, construction, and municipal stormwater permits for the discharge of pollutants from any point source into waters of the United States.
- **15A NCAC Chapter 4.** Requires all persons conducting a land-disturbing activity to take all reasonable measures to protect all public and private property from damage caused by the release of sediments from the activity. The primary tool used to accomplish the objective is the development of an Erosion and Sedimentation Control Plan.
 - o Identify critical areas
 - o Limit exposure areas
 - o Limit time of exposure
 - o Control surface water

- o Control sedimentation
- o Manage stormwater runoff

More information can be found at:

<http://reports.oah.state.nc.us/ncac.asp?folderName=\Title%2015A%20-%20Environmental%20Quality\Chapter%2004%20-%20Sedimentation%20Control>

- **15A NCAC 02H.1000 Stormwater Management.**

The State Stormwater Management Program requires all persons conducting LDAs that (1) require a Coastal Area Management Act (CAMA) Major Development Permit or an Erosion and Sedimentation Control Plan, and (2) are located within coastal counties or drain to specific classifications of water bodies, to protect surface waters and highly productive aquatic resources from the adverse impacts of uncontrolled high-density development or the potential failure of stormwater control measures. To receive permit approval, projects must limit the density of development, reduce the use of conventional collection systems in favor of vegetative systems, and incorporate post-construction, structural BMPs.

11.3. PRIOR TO SITE WORK

Contractors are required to address the following in the below section prior to beginning site work.

11.3.1. Construction Notifications

Any project involving LDAs aboard the installation must be reviewed by the installation's NEPA Review Board prior to the onset of work so that potential impacts of the project and associated mitigation measures (if necessary) can be

Any project involving LDAs aboard the installation must be reviewed by the installation's NEPA Review Board prior to the onset of work.

determined. Documentation of this review should have been provided to the ROICC or Contract Representative and may include mandatory conditions affecting the construction/implementation of the project. Consult the ROICC or Contract Representative to obtain or review any NEPA documentation associated with the project in the contract.

11.3.2. Familiarity with the Stormwater Phase I Industrial Permit

Discharges of industrial stormwater have the potential to contain contaminants from industrial activity. Because of this, MCB Camp Lejeune holds a Stormwater Phase I industrial permit. This type of discharge is defined and regulated in 40 CFR 122, the EPA final rule regarding NPDES stormwater permitting.

Contractors are responsible for preparing project-specific permit applications and related plans and for coordinating the permit review schedule with the ROICC or Contract Representative.

Daily industrial operations discharging stormwater aboard MCB Camp Lejeune and MCAS New River are covered under an individual NPDES permit. In accordance with the permit, the installation maintains an industrial SWPPP that identifies potential sources of pollution that may affect the water quality of stormwater discharges associated with an industrial activity. Refer to Section 11.4 for more information on contractor responsibilities associated with this permit.

11.3.3. Familiarity with the Stormwater Phase II Municipal Permit

Discharges of municipal stormwater have the potential to contain contaminants from municipal activity. Because of this, MCB Camp Lejeune holds a Stormwater Phase II municipal permit. This type of discharge is defined and regulated in 40 CFR 122, the EPA final rule regarding NPDES stormwater permitting.

Daily municipal operations discharging stormwater aboard MCB Camp Lejeune and MCAS New River are covered under an NPDES permit. In accordance with the permit, the installation maintains a municipal Stormwater Plan to address the six MCMs of the permit, as well as other requirements. Refer to Section 11.4 for more information on contractor responsibilities associated with this permit.

11.3.4. Project-Specific Construction Permits

Contractors are responsible for preparing all project-specific stormwater permit applications and related plans and for coordinating the permit review schedule with the ROICC or

Contract Representative. MCB Camp Lejeune is the responsible party for all project-specific stormwater permits

All permit-required plans and applications must go through internal approval before being submitted to the appropriate State agency.

located outside of Public-Private Venture (PPV) housing. All permit-required plans and applications must be submitted to the appropriate MCB Camp Lejeune organization to go through internal approval prior to submission to the appropriate State agency. The permit review schedule should allow adequate time for internal review prior to State submission deadlines.

Adequate review time fluctuates and is based on the type of permit application. Stormwater compliance should be coordinated with the appropriate PPV partner for housing-related projects outside the jurisdiction of MCB Camp Lejeune.

Permit coverage is required under the North Carolina General Permit No. NCG010000 (General Permit) for construction activities that disturb 1 acre or more of land. Three copies of a proposed Erosion and Sedimentation Control Plan must be prepared and submitted to the NCDEQ Sedimentation Control Commission (or to an approved local program) at least 30 days prior to beginning construction activity to obtain coverage under the General Permit. A copy of the plan will be kept on file at the job site at all times while the site is active. **Coverage under the permit becomes effective when a plan approval is issued. No LDAs may take place prior to receiving the plan approval.** The

approved plan is considered a requirement or condition of the General Permit; deviation from the approved plan will constitute a violation of the terms and conditions of the permit unless prior approval for the deviations has been obtained.

A State Stormwater Management Permit, issued in accordance with 15A NCAC 02H.1000, is required for all development activities that require a CAMA Major Development Permit or an Erosion and Sedimentation Control Plan and that meet any of the following criteria:

- Development within the 20 coastal counties
- Development within 1 mile of and draining to any waters classified as High Quality Water (HQW) and rated “excellent” based on biological and physical/chemical characteristics through the NCDWR monitoring or special studies, primary nursery areas designated by the Marine Fisheries Commission, and other functional nursery areas designated by the Marine Fisheries Commission
- Development that drains to an Outstanding Resource Water, which is a subset of HQW that is intended to protect unique and special waters having excellent water quality and being of exceptional ecological or recreational significance to the State or Nation

A State Stormwater Management Permit is required for all activities that will disturb 1 acre or more of land.

Because the installation is in a coastal county, any project that disturbs greater than 1 acre of land (requiring coverage under the General Permit for construction activity) will also require a State Stormwater Management Permit. A State Stormwater Management Permit application must be submitted and filed with the NCDEQ, Division of Water Quality, after the construction plans and specifications are complete and before construction activities begin. Additional information is available on the NCDEQ website:

<http://deq.nc.gov/about/divisions/energy-mineral-land-resources/stormwater>

State Stormwater Management Permits typically specify design standards for conveyance systems and structural BMPs, a schedule of compliance, and general conditions to which the permittee must adhere.

11.4. RESPONSIBILITIES DURING SITE WORK

The contractor is responsible for maintaining the quality of the stormwater runoff and preventing pollution of stormwater at the construction/job site. The job site may be inspected by installation environmental personnel to ensure compliance with the contractor's construction and/or the installation's industrial SWPPP, municipal stormwater plan, and applicable permits. The following requirements apply to all projects at the installation that have the potential to impact water quality:

- Any changes to the project area that do not comply with the approved Erosion and Sedimentation Control Plan, alter the approved post-construction stormwater conveyance system, or could otherwise significantly change the nature or increase the quantity of pollutants discharged should be immediately communicated to the ROICC or Contract Representative.
- All permitted erosion and sedimentation control projects will be inspected by the contractor at least once every 7 calendar days (unless discharges to a 303(d)-listed water body are occurring) and within 24 hours after any storm event greater than 0.5 inch of rain per 24-hour period, as required by the North Carolina General Permit No. NCG010000. Inspection results shall be maintained by the designated contractor throughout the duration of an active construction project.
- Equipment used during the project activities must be operated and maintained in such a manner as to prevent the potential or actual pollution of the surface or ground waters of the State.
- No POL products (e.g. fuels, lubricants, hydraulic fluids), coolants (e.g., antifreeze), or any other substance shall be discharged onto the ground, into surface waters, or down storm drains (to include leaking vehicles, heavy equipment, pumps, and/or structurally deficient containers of hazardous materials).

- Spent fluids shall be disposed of in a manner so as not to enter surface or ground waters of the State, or storm drains. Disposal of spent fluids is outlined in Section 7.0.
- Implement spill prevention measures, clean up all spills immediately, and follow the spill reporting requirements presented in Section 5.0. Any spilled fluids shall be cleaned up to the extent practicable and disposed of in a manner so as not to allow their entry into the water (surface or ground) of the State. Refer to Section 5.0 for emergency and spill response procedures.
- Herbicide, pesticide, and fertilizer use shall be consistent with the Federal Insecticide, Fungicide, and Rodenticide Act and shall be used in accordance with label restrictions. Refer to Section 7.0 for additional information on Hazardous Material/Hazardous Waste Management.
- Particular care must be used when storing materials outside. Materials and equipment stored outside that could potentially affect the quality of stormwater runoff include, but are not limited to, garbage dumpsters, vehicles, miscellaneous metals, chemical storage, fuels storage, wood products, and empty storage drums. These materials should be stored under cover whenever practicable. Contact the ROICC or Contract Representative with any questions about whether an outdoor storage practice is acceptable.

- Use good housekeeping practices to maintain clean and orderly work areas, paying particular attention to those areas that may contribute pollutants to stormwater. For industrial activities, refer to the link below for more information on best management practices to prevent stormwater pollution. EPA Industrial Fact Sheet Series for Activities Covered by EPA's multi-sector general stormwater permit: <http://www.epa.gov/npdes>

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12.0 SOLID WASTE, RECYCLING, AND POLLUTION PREVENTION (P2)

Contractors should minimize the amount of solid waste requiring disposal in a landfill.

The installation has a proactive P2 and recycling program, and contractors should minimize the amount of solid waste requiring disposal in a landfill. This section addresses solid waste, including both municipal solid waste (MSW) and construction and demolition (C&D) waste. HM and HW are discussed in Section 7.0 of this guide. Contractors are required to comply with all Federal, State, and local laws and regulations for proper disposal and recycling of all solid wastes.

12.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with solid waste, recycling, and pollution prevention. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

Please consult the ROICC or Contract Representative with any questions or concerns about the information in this section.

12.1.1. Key Definitions

- **Construction and Demolition Debris.** Inert materials generated during the construction, renovation, and demolition of buildings, roads, and bridges. C&D waste often contains bulky, heavy materials such as concrete, lumber (from buildings), asphalt (from roads and roofing shingles), gypsum (the main component of drywall), and glass (from windows).
- **Green Procurement (GP).** The purchase of products and services that are environmentally preferable, when compared with competing products that serve the same purpose, in accordance with federally mandated “green” procurement preference programs. GP is intended to have a lesser or reduced negative effect on human health and the environment, and to permit fulfilling the social, economic, and other requirements of present and future generations.
- **Pollution Prevention.** Reducing the amount of pollution entering waste streams or otherwise released to the environment through source reduction and process efficiencies.
- **Recycling.** Activities that may include collection, separation, and processing, by which products or other materials are recovered from the solid waste stream for use as raw materials in the manufacturing of new products. Recycling also includes using, reusing, or reclaiming materials, as well as processes

that regenerate a material or recover a usable product from it.

- **Municipal Solid Waste.** Any solid materials discarded, including garbage, construction debris, commercial refuse, non-hazardous materials, non-recyclable wood, or other non-recyclable material per BO 11350.1, Refuse Disposal Procedures.

12.1.2. Key Concepts

- **Pollution Prevention/Green Procurement.** Installation contractors are strongly encouraged to use P2 and GP practices.
- **Qualified Recycling Program (QRP).** An organized operation that diverts or recovers scrap or waste streams and that identifies, segregates, and maintains the integrity of the recyclable materials in order to maintain or enhance the marketability of the materials.
- **Recycling.** Recycling is required on the installation. The MCB Camp Lejeune Landfill (Base Landfill) Recycling Center accepts specified recyclables according to the schedule in Table 12-1. Call (910) 451-4214 prior to a bulk turn-in.
- **Solid Waste.** Solid waste is disposed of in accordance with contract specifications (off the installation or at the Base Landfill). Data related to disposal off the installation (to include C&D waste) must be provided to the ROICC or Contract Representative on a monthly basis.

- **Source Reduction.** Any practice that reduces the amount of any HM, pollutant, or contaminant entering any waste stream or released into the environment prior to recycling, treatment, and disposal that could reduce the hazard to public health and the environment. Source reduction may include equipment or technology modification; process or procedure modification; reformulation or redesign of products; substitution of raw materials; and improvements in housekeeping, maintenance, training, or inventory control.

12.1.3. Environmental Management System

Contractor practices associated with solid waste, recycling, and P2 include the following:

- Battery management
- Building operation/maintenance/repair
- Composting
- Construction/demolition/renovation
- Equipment operation/maintenance/disposal
- Grease traps
- HW disposal offsite transport
- Land clearing
- Livestock operations
- Metal working
- Packaging/unpackaging

- Paint removal
- Painting
- Parts replacement
- Polishing
- Range residue clearance
- Recreational facilities operation
- Road construction maintenance
- Rock crushing operations
- Solid waste collection/transportation
- Storage tank management
- Urban wildlife management
- Vehicle maintenance

The potential impacts of these activities on the environment include soil degradation, surface water quality degradation, depletion of landfill space, and depletion of nonrenewable resources.

12.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable regulations and requirements regarding solid waste disposal, recycling, and P2, which include but may not be limited to the following:

- [**BO 5090.17, Solid Waste Reduction – Qualified Recycling Program.**](#) Provides guidance for solid

waste reduction, P2, and management of recyclable materials.

- **BO 11350.2D, Refuse Disposal Procedures.** Establishes procedures for the separation, collection, and disposal of refuse and the disposal of waste wood products.
- **DoD Instruction 4715.4, Pollution Prevention.** Establishes the DoD requirement for installation QRP and calls for GP.
- **EO 13423, Strengthening Federal Environmental, Energy and Transportation Management.** Integrates prior practices, strategies, and requirements to further enhance the environmental and energy performance and compliance requirements. The EO sets goals in several environmental areas, including recycling.
- **EO 13514, Federal Leadership in Environmental, Energy, and Economic Performance.** Expands on the environmental performance requirements for Federal agencies, to include setting goals for solid waste diversion.
- **Pollution Prevention Act of 1990 (42 USC 13101 et seq.).** Establishes the national policy that “pollution should be prevented or reduced at the source whenever feasible,” and establishes the following hierarchy: source reduction, recycling, treatment, and disposal.
- **Resource Conservation and Recovery Act of 1976.** Governs the disposal of solid waste and establishes

Federal waste disposal standards and requirements for State and regional authorities. The objectives of Subtitle D are to assist in developing and encouraging methods for the disposal of solid waste that are environmentally sound and that maximize the utilization of valuable resources recoverable from solid waste.

- **Solid Waste Disposal Act (SWDA) of 1965.** Requires Federal facilities to comply with all Federal, State, interstate, and local requirements concerning the disposal and management of solid wastes, including permitting, licensing, and reporting requirements. The SWDA encourages the reuse of waste through recycling and requires the procurement of products that contain recycled materials.

12.3. SOLID WASTE REQUIREMENTS

Contractors must follow all Federal, State, and local requirements regarding the collection, storage, and disposal of solid waste. Contact the ROICC or Contract Representative for additional information regarding solid waste requirements.

At a minimum, the following actions are required for all contractors:

1. Prior to performing work that will or may generate solid waste at the installation, all contractors must provide their ROICC or Contract Representative with a copy of their Solid Waste Disposal Permit

unless the use of the Base Landfill is authorized for disposal. If the Base Landfill is authorized, the contractor must contact the Base Landfill Operations Clerk to ensure the contract is registered in the Landfill Tracking System. Recycling should be coordinated with the ROICC or Contract Representative and the Landfill Manager.

2. Provide the weight of ALL waste, both MSW and C&D, that is either disposed of or recycled, to the ROICC or Contract Representative, with a copy to the Landfill Manager. This requirement does not apply if the landfill/recycling facility picks up or accepts materials directly from the contractor. If contractors transport waste offsite for disposal, it is mandatory that they track the material weight and provide that information to their ROICC or Contract Representative for input into the annual Pollution Prevention Annual Data Summary.

In addition, contractors producing solid waste on the installation are required to take these steps:

- Pick up solid waste, separate it according to material type, and place it in covered containers of the correct type that are regularly emptied for recycling or landfiling.
- Verify that the solid waste contains no HM or HW.
- Prevent contamination of the site and the surrounding areas when handling and disposing of waste.

- Leave the project site clean upon completion of a project.

12.3.1. MCB Camp Lejeune Landfill Acceptable Waste Streams

To dispose of waste at the Base Landfill, contractors must be authorized with a valid construction pass and placard representing the related contract. Contractors must also contact the Landfill Operator prior to unloading refuse. Contact the ROICC or Contract Representative with any questions regarding use of the landfill or to coordinate disposal.

The Base Landfill accepts certain types of solid waste under the conditions specified in Table 12-1. Base Landfill hours of operation are 0730 to 1530, Monday through Friday, but ACM waste must be delivered between 0700 and 1000, Monday through Thursday. Each material must be separated into different loads.

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Table 12-1. Base Landfill Requirements

No Personal Property/ Off-Base Trash Accepted	
Landfill Operating Hours	
0700-1500 Monday – Thursday 0700-1400 Friday	
Wood Products	
<p>The following products may be mixed together and delivered to the landfill:</p> <ul style="list-style-type: none"> • Scrap lumber (unpainted) • Embark boxes (broken down) • Pallets (broken/untreated) <p>The following products must be separated and delivered to the landfill:</p> <ul style="list-style-type: none"> • Trees (cut to 10 feet or less and free of soil) • Leaves and scrubs • Serviceable pallets 	
Lead Based Painted Wood Products	
<ul style="list-style-type: none"> • Delivered before 1400 Monday – Thursday • Not accepted on Friday • Cut in less than 8-foot lengths • Wrapped in 6-millimeter plastic bags/sealed 	
Asbestos (all types)	
<ul style="list-style-type: none"> • Appointment needed (910-451-5011 / 2946) • Delivered by 1000 (Mon – Thurs.) • Not accepted on Friday • Double wrapped in 6-millimeter plastic bags 	

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE

FINAL

<ul style="list-style-type: none">• Sealed with duct tape• Labeled and manifested prior to delivery
Organic Products
<ul style="list-style-type: none">• Leaves, pine straw, grass, and shrub clippings• No bags or containers allowed• No twigs or limbs over 2 inches in diameter• Less than 6-foot lengths
Concrete
<ul style="list-style-type: none">• Delivered separately from other items• Wire and rebar must be cut off flush with exposed surfaces• Concrete and culverts• Bricks and blocks• Mortar products
Soil
Non-contaminated soil accepted
Recyclable Products (Must be separated and dropped off at a designated recycling drop-off point or at a Recycling Center)
<ul style="list-style-type: none">• Wood pallets (delivered separately)• White paper (mixed flat or shredded)• Newspaper• Magazines• Military publications (binders removed)• Phone books• Plastic and glass (containers or bottles)• Toner cartridges• Cardboard (delivered separately if in bulk)

CAMP LEJEUNE CONTRACTOR ENVIRONMENTAL GUIDE FINAL

<ul style="list-style-type: none">• Vinyl siding (delivered separately, in less than 6-foot lengths)• Asphalt shingles (delivered separately) Scrap metals
Other Related Information
Asphalt may be accepted in small quantities, as needed, at the discretion of the Landfill Manager (large quantities of asphalt must be taken off the installation).
All furniture must be accompanied by a DD Form 1348, with a classification of rejected by the Base Property Office AND downgraded to scrap by Defense Logistics Agency Disposition Services (DLADS).
All other Base or USMC property must be accompanied by a DD Form 1348 and downgraded to scrap by DLADS.
Scrap materials related to ordinance, ammunition or dangerous items , including containers, tubes, and packing, must also be accompanied by Ammunition, Explosives, and Other Dangerous Articles (AEDA) certifications and copies of the certifier and verifier's appointment letters.
Phone Numbers: (area code 910) <ul style="list-style-type: none">• Landfill Manager 451-4998• Recycling Manager 451-4214• Landfill Fax 451-9935 • Landfill Clerk 451-2946• EMD 451-5837• EOD 451-0558

Unacceptable Items

- Hazardous Waste
- Liquid Waste
- Useable Appliances
- Paint and Paint Cans
- Appliances
- Electronics
- Computer Equipment
- Batteries
- Wire (Communication/Barbed/ Concertina)
- Oyster Shells
- Contaminated Soil
- Tires
- 55-Gallon Drums
- Oil Filters
- Petroleum Containers
- Regulated Medical Waste
- PCBs or PCB containers
- Demilitarized Waste
- Construction and Demolition Debris (unless specified in the contract)

12.4. RECYCLING REQUIREMENTS

The installation's QRP is managed by the EMD in collaboration with the Public Works Division. Reducing solid waste saves money and helps protect the environment by conserving natural resources. Additionally, USMC facilities are mandated to recycle, and the installation must meet solid waste diversion goals specified in EO 13514, the

DoD Strategic Sustainability Performance Plan, and the EMS.

12.4.1. Recycling Center

The MCB Camp Lejeune Recycling Center, Building 982, is co-located with the Base Landfill on Piney Green Road. Normal working hours are Monday through Thursday, 0700–1500, and Friday, 0700–1400. All materials should be brought to the Recycling Center. Have the ROICC or Contract Representative contact the Recycling Center at (910) 451-4214 for additional details. Call Recycling Coordinator at (910) 451-4214 for specific types and categories of materials accepted.

The following types and categories of materials are accepted for recycling but must be delivered to the Recycling Center on Piney Green Road:

- Scrap metal
- Steel (high temperature, corrosion resistant)
- Brass (includes spent/fired munitions, but excludes brass casings above .50 caliber; please call the Recycling Coordinator at (901) 451-4214 for details and documentation requirements)
- Copper and copper wire
- Aluminum (plate, sheet, scrap) and aluminum cans
- Paper (white, news, magazine)
- Cardboard

- Glass bottles (no window, windshields, or drinking glass)
- Plastic bottles
- Toner cartridges

Special arrangements may be made for other materials (C&D waste) or larger volumes of commonly recycled materials from events such as C&D. Regulations set forth in BO 11350.1 must be followed.

12.4.2. Other Recyclables

- **Asphalt Pavement.** Asphalt must be removed and delivered to an asphalt recycling facility. Contractors must provide a record of the total tons of asphalt recycled and the corporate name and location of the recycling facility to their ROICC or Contract Representative, with a copy to the Landfill Manager.
- **Empty Metal Paint Cans.** Take empty metal paint cans to Building S-962 for recycling. Turn in all HM cans or HM containers that are generated from MCB Camp Lejeune or MEF contracts to Building S-962 on Michael Road on the scheduled contractor turn-in day. Have the ROICC or Contract Representative contact EMD for more information. Any waste generated from this process must be managed appropriately.
- **Other Metals.** Take other metals to the DLADS disposal area in Lot 201, following the guidelines of BO 5090.17.

- **Red Rag Recycling.** Contractors should seek a red rag program to supply and launder shop rags. This service supplies clean rags and picks them up after use. The rags are laundered offsite and returned.
- **Universal Waste.** See Section 7.0 of this guide for management procedures.
- **Unused Hazardous Materials.** Turn in these materials to the HM Free Issue Point, Building 977 on Michael Road. Have the ROICC or Contract Representative contact the Free Issue Point at (910) 451-1482.
- **White Rag Recycling.** White rags are used in painting (these have no dye and thus do not interfere with these types of operations) and may be laundered offsite in a program analogous to the red rag recycling service.

12.5. POLLUTION PREVENTION AND GREEN PROCUREMENT

MCB Camp Lejeune is subject to GP requirements. GP implements environmentally protective principles in the procurement arena and includes preferential use of the following:

- Products made from recovered materials
- Biobased products
- Water- and energy-efficient products
- Alternatives to ozone-depleting substances

- Non-toxic and less-toxic products
- Electronics that meet Electronic Product Environmental Assessment Tool standards
- Products that do not contain toxic chemicals, hazardous substances, or other pollutants targeted for reduction and elimination by the DoD
- Products with alternative fuel use/increased fuel efficiency
- Environmentally preferable purchasing practices

Contractors are encouraged to employ GP practices whenever feasible.

13.0 POTENTIAL DISCOVERY OF UNDOCUMENTED CONTAMINATED SITES

MCB Camp Lejeune was placed on the EPA National Priorities List, effective November 4, 1989. To ensure the protection of human health and the environment, a proactive Installation Restoration Program has been established to assess and remediate various sites on the installation. Numerous investigations have been performed to ensure that all of the installation's contaminated sites have been found, but additional contaminated areas may still exist. It is the contractor's responsibility to notify the ROICC or Contract Representative of any unforeseen site conditions while on the installation. It is recommended that any contractors performing intrusive activities on the installation be properly trained in accordance with the OSHA standards in 29 CFR 1910.120(e). If intrusive activities are planned for known contaminated areas, all required environmental training should be completed *prior* to working at MCB Camp Lejeune. Copies of training records should be available upon request by Federal or State regulators.

**Contact the ROICC
or Contract
Representative
with questions or
concerns about
the information in
this section.**

13.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with unforeseen site conditions. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

13.1.1. Key Definitions

- **Free Product.** A discharged HM/HW, POL, or environmental pollutant that is present in the environment as a floating or sinking non-aqueous phase liquid that exists in its free state (i.e., exceeds the solubility limit of liquids or saturation limit of soil/solids).
- **National Priorities List.** List of sites of national priority among the known releases or threatened releases of hazardous substances, pollutants, or contaminants.
- **Petroleum, Oil, and Lubricants.** A broad term that includes all petroleum and associated products or oil of any kind or in any form, including, but not limited to, petroleum, fuel oil, vegetable oil, animal oil, sludge, oil refuse, and oil mixed with wastes.
- **Unforeseen Site Condition.** A potentially hazardous or unanticipated site condition encountered on a job site.

- **Munitions and Explosives of Concern.** Military munitions that may pose explosives safety risks, including MEC, UXO, DMM, and munitions constituents present in a high enough concentration to present an explosives hazard.

13.1.2. Key Concepts

- **Notification.** Contractors must notify the ROICC or Contract Representative, in writing, of any unforeseen site conditions prior to disturbing them.
- **Response.** Contractors must stop working and evacuate work areas if unforeseen site contaminants, HM, or MEC/DMM/UXO are suspected to be present.

13.1.3. Environmental Management System

Unforeseen site conditions are potentially applicable to all EMS practices conducted aboard MCB Camp Lejeune.

13.2. OVERVIEW OF REQUIREMENTS

Contractors operating aboard the installation must be aware of and adhere to all applicable regulations and requirements regarding unforeseen site conditions, which include but may not be limited to the following:

- [**CERCLA of 1980 and Superfund Amendments & Reauthorization Act \(SARA\) of 1986.**](#) Establishes the Nation's HW site cleanup program.

- [Occupational Safety and Health Standards, 29 CFR 1910.](#) Federal standards that govern occupational health and safety to ensure the protection of employees from recognized hazards, such as exposure to toxic chemicals, excessive noise levels, mechanical dangers, heat or cold stress, or unsanitary conditions. The standards include provisions for many facets of employee safety and health, including, but not limited to, employee training, personal protective equipment, HM communication, medical surveillance, and emergency planning.

13.3. UNFORESEEN SITE CONDITION PROCEDURES

Contractors must promptly, before the conditions are disturbed, give a written notice to the ROICC or Contract Representative of (1) any subsurface or latent physical conditions at the site that differ materially from those indicated in the contract, or (2) any unknown physical conditions at the site, of an unusual nature, that differ materially from those ordinarily encountered.

The ROICC or Contract Representative will investigate the site conditions promptly after receiving the notice.

The most common unforeseen conditions at MCB Camp Lejeune typically relate to POL contamination and MEC/DMM/UXO. Procedures for these scenarios are provided in the following sections.

13.3.1. Petroleum, Oil, and Lubricants

The most frequently encountered condition that requires EMD assistance is the presence of a POL odor while excavating. If an odor or any free product is encountered during construction or excavation activities, take the following actions:

- Stop work.
 - Immediately clear the area of all personnel to a safe distance upwind of the suspected area.
 - Call the Fire and Emergency Services Division (911) immediately if personnel are affected or injured by the suspected contaminant.
 - Call the Fire and Emergency Services Division to properly secure the area.
 - Notify the ROICC or Contract Representative so that the EMD Spill Response Team will be contacted to determine the appropriate course of action.
- If there is an odor, stop work and immediately clear the area of all personnel to a safe distance upwind of the suspected area.**

Please note that if contaminated soil is removed during excavation activities, the soil will have to be characterized prior to disposition. While it is staged and awaiting characterization sampling results, contaminated soil is to be placed within a bermed area on an impervious surface or barrier and securely covered with plastic or appropriate

material. Sample results and characterization will determine the ultimate disposition of the soil. In accordance with installation policy, contaminated soil is not permitted to be reintroduced into excavations.

13.3.2. Munitions and Ordnance

MCB Camp Lejeune has been in operation as a military training installation since the early 1940s. As such, munitions or an ordnance item may be encountered during site excavation or construction activities. MEC, DMM, or UXO at MCB Camp Lejeune and its outlying areas typically include flares, mines, grenades, rockets, artillery projectiles, bulk explosives, fuses, or blasting caps. These items may vary in condition from very good/easily recognizable to unrecognizable, fragmented, or corroded scrap metal. MEC, DMM, or UXO may be encountered on the ground surface, partially buried, or completely buried.

Contractors operating aboard the installation should follow the “3R” concept if a possible munitions or ordnance item is discovered: **“Recognize, Retreat, and Report.”**

- **Recognize.** Contractors with the potential to encounter any possible MEC, DMM, or UXO should have a basic knowledge of these items. The item does not have to

Recognize

Retreat

Report

Recognize

Retreat

Report

be specifically recognized or identified, but it is important for personnel to recognize the potential hazard.

- **Retreat.** If a suspected MEC, DMM, or UXO item is encountered, leave the immediate area and DO NOT DISTURB the item. If possible, note the general size and shape of the item, any markings, and the location.
- **Report.** Report all occurrences to the appropriate authority, including any observations (e.g., size, shape, markings, and location).

Stop work immediately if a project unearths a hazardous material, such as MEC/DMM/UXO, and report the situation to the ROICC or Contract Representative.

If a project unearths any potential MEC/DMM/UXO, recognize the potential hazard. Stop work immediately, and have all personnel clear the immediate area. Report the situation and any observations to the ROICC or Contract Representative, who will then report the item to Range Control and Explosive Ordnance Disposal (EOD). The following

link is to a 6-minute “UXO Safety” awareness training video that provides additional guidance.

<http://www.lejeune.marines.mil/OfficesStaff/ExplosivesSafety/%20trainingandguides.aspx>

For other emergency response procedures, please refer to Section 5.0 of this guide.

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14.0 PERMITTING

Contractors operating aboard the installation must ensure that all relevant environmental permits are obtained before work commences onsite. Contractors must work with their ROICC or Contract Representative to determine permitting responsibilities prior to beginning work. Contractors must adhere to all permit conditions. Examples of permits related to the environment are provided in Section 14.3.

14.1. KEY DEFINITIONS AND CONCEPTS

The following key definitions and concepts are associated with contractor permitting requirements. If you have any questions or concerns about the information in this section, please consult the ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

Please consult the ROICC or Contract Representative with any questions or concerns about the information in this section.

14.1.1. Key Definitions

- **Major Source.** Any source that emits or has the potential to emit 100 tons per year or more of any criteria air pollutant in accordance with Title V of the CAA.

- **Permit.** A legally enforceable document required by statutory regulation for potential sources of pollution that is required for operations that may have an environmental impact. Permits may be administered at the Federal, State, or local level.
- **Target Housing.** Any housing constructed before 1978, with the exception of housing for the elderly and persons with disabilities (unless a child under the age of 6 lives or is expected to live there) and residential dwellings where the living areas are not separated from the sleeping areas (efficiencies, studio apartments, dormitories, etc.).

14.1.2. Key Concepts

- **Permits.** Prior to beginning work aboard the installation, consult applicable permit requirements and ensure that they are met before work begins. Copies of all applicable permits/authorizations should be retained onsite for the life of the project. Additional information on North Carolina permits is found on the following webpage: <http://deq.nc.gov/about/divisions/environmental-assistance-customer-service/deacs-permit-guidance/environmental-permit-assistance>

Consult the ROICC or Contract Representative for additional information concerning the contract's permit requirements. The contractor is responsible for ensuring that all required permits are acquired prior to any work aboard MCB Camp Lejeune.

14.1.3. Environmental Management System

Currently, no practices are associated with permitting under the EMS.

14.2. OVERVIEW OF REQUIREMENTS

Please refer to the individual sections of this Guide for applicable permitting regulations and requirements for each environmental media. Many permits have specific timetables for submittal prior to project initiation. Contractors must consult the permit requirements and ensure that all pertaining permits are obtained in the required timeframe.

14.3. PROJECT PERMITS AND APPROVALS

The NCDEQ website (<http://deq.nc.gov/>) is a useful reference for determining required permits and obtaining necessary forms.

Prior to work being awarded, EMD's NEPA Section should have performed an environmental review of the installation-associated action proponent to comply with NEPA 1969. The outcome of this review would be either a Decision Memorandum or an Environmental Assessment. Contractors must refer to their contract and the requirements

outlined in the NEPA documentation for specific permitting requirements. EMD Program Managers are available for

guidance; however, if the contractor is tasked with preparing permit applications, the contractor is expected to have the capability and expertise required to complete the submittals in accordance with the guidance provided by the regulatory agency that issues the permit. In addition, EMD must be provided with copies of all permits submitted to the NCDEQ. In some cases, EMD must submit the permit application. Please direct questions to the ROICC or Contract Representative.

Some permits that may be required are discussed in applicable sections of this Guide. The following list of permits is not meant to be all-inclusive; please be aware that other permits may also be required. The NCDEQ website (<http://deq.nc.gov/>) is a useful reference for determining required permits and obtaining necessary forms. In addition, any inspection and/or data collection required by the permits must be retained onsite for review upon request.

14.3.1. Stormwater (Section 11.0)

- **[NPDES Stormwater Discharge Permit for Construction Activities \(also referred to as General Permit No. NCG010000\)](#)**. Required for all LDAs that exceed 1 acre; also requires an accompanying Erosion and Sedimentation Control Plan.
- **[General Permit SWG050000](#)**. Required for residential development activities within the 20 coastal counties (including Onslow County) located within 1/2 mile and draining to class SA waters (waters classified as SA are tidal salt waters that are

used for commercial shellfishing or marketing purposes) that disturb less than 1 acre if adding more than 10,000 square feet of built-upon area that will result in a built-upon area greater than 12 percent of the total project area.

- **High-Density Stormwater Permit.** Required when (1) the LDA exceeds 1 acre and impervious surfaces are greater than or equal to 25 percent of the total project area adjacent to non-SA waters or greater than or equal to 12 percent of the total project area adjacent to SA water; or (2) total development exceeds 10,000 square feet of impervious surface.
- **Low-Density Stormwater Permit.** Required when the LDA exceeds 1 acre and impervious surfaces are less than 25 percent of the total project area when adjacent to non-SA waters or less than 12 percent of the total project area when adjacent to SA waters.

14.3.2. Asbestos (Section 8.0)

- **Asbestos Permit Application and Notification for Demolition/Renovation.** DHHS Form 3768, available at the following website (under *Forms & Applications*):

<http://epi.publichealth.nc.gov/asbestos/ahmp.html>

14.3.3. Lead-Based Paint (Section 9.0)

- **North Carolina Lead-Based Paint Abatement Permit Application.** Any person or firm conducting an abatement of a child-occupied facility or target

housing is required to obtain a Lead Hazard Management Plan Permit. The application is available at the following website: <http://epi.publichealth.nc.gov/lead/pdf/LeadAbatePermit08-07.pdf>

14.3.4. Air Quality (Section 4.0)

- **Construction Permits.** Construction permits are required for all new stationary sources and all existing stationary sources that are added to or are modified with new equipment that may emit air pollutants. Permits may be required for the construction or modification of the following types of emission sources:
 - o Boilers
 - o Generators
 - o Engine test stands
 - o Surface coating/painting operations
 - o Refrigerant recovery and recycling operations for other ozone-depleting substances, such as industrial chillers, refrigerators, air conditioning compressors, or cleaning agents.
 - o Chemical or mechanical paint removal, abrasive blasting, grinding, or other surface preparation activities
 - o Fuel storage and fuel dispensing
 - o Woodworking shops

- o Welding shops
- o Bulk chemical or flammables storage
- o Open burning
- o Fire training
- o Rock crushing or other dust-causing activities
- **New Source Review Permit.** A New Source Review permit is a pre-construction permit that authorizes the construction of new major sources of air pollution or major modifications of existing sources.

14.3.5. Wetlands (Section 10.6)

- **Section 404 Clean Water Act Permit.** Contractors working aboard the installation will not perform any work in waters of the United States or wetlands (see definition below) without an approved permit (even if the work is temporary). Unavoidable impacts to wetlands or waters of the United States will require coordination and written approval from the USACE for a Section 404 CWA permit (individual or applicable nationwide permit), the NCDWR for a Section 401c Water Quality certification, and the NCDCM for a Federal Consistency Determination. Failure to acquire written authorization for making impacts to wetlands and/or waters of the United States may result in significant project delays or design modifications. See the following website for more information:

<http://www.epa.gov/laws-regulations>

14.3.6. Drinking Water/Wastewater

- **Approval of Engineering Plans and Specifications for Water Supply Systems.** Applicants must submit engineering plans and specifications at least 30 days prior to the date upon which the Authorization to Construct is desired. Authorization to Construct must be obtained prior to onset of work.
- **Wastewater Extension Permit.** NCDEQ Form FTA 02/03 – Rev. 3 04/05. Applicants submitting Form FTA 02/03 should plan to allow the State approximately 90 days to issue the permit. The Wastewater Extension Permit must be obtained prior to onset of work.

Appendix

General EMS & Environmental Awareness Training for Contractors & Vendors

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**MCB Camp Lejeune, NC/
MCAS New River**



**General EMS and
Environmental Awareness
Training
for
Contractors and Vendors**

Revised: April 2008





Disclaimer

- This training does not replace any required regulatory environmental training as per your contract
- Required environmental training should be completed *prior* to working aboard the Installation
- Training records should be available for review upon request





Training Overview

- EMS and the Environmental Policy
- Environmental Management Division
- General Environmental Awareness
- Spill Response Basics
- Summary





EMS and the Environmental Policy





What is an EMS?

- MCB Camp Lejeune and MCAS New River have implemented an Environmental Management System (EMS) that is founded on the principles of our respective **Environmental Policy**.
- The purpose of the EMS is to sustain and enhance mission readiness and access to training areas through effective and efficient environmental management.
- The EMS emphasizes that the authority and principal responsibility for controlling environmental impacts belong to those commands, units, offices, and personnel, *including contractors and vendors*, whose activities have the potential to impact the environment.





Why have an EMS?

“To sustain our operations and training capabilities, and to safeguard land-use availability, will comply with environmental laws and conserve the natural and cultural resources with which it has been entrusted.”

Excerpt from the Commanding Officer's Environmental Policy Statement





What YOU Need to Know

- The Installation has an EMS
- These three goals are the foundation of our **Environmental Policy**:
 1. **Comply** with regulatory requirements
 2. **Protect** human health
 3. **Conserve** natural and cultural resources





YOUR EMS Responsibilities

- Be aware of the Environmental Policy
- Be familiar with spill procedures
- Keep your eyes open for potential problems
- Report any environmental problems or concerns promptly and notify your ROICC or Contract Representative





Environmental Management Division (EMD), MCBCL

**Environmental Affairs
Department
(EAD), MCASNR**





EMD/EAD can help!

- The appropriate environmental office works with your ROICC or Contract Representative to ensure:
 - Proper management of waste
 - Compliance with regulations
 - Required environmental plans are developed and followed, if applicable
 - Required environmental training material is provided for contractor use





What Does EMD/EAD Do for You?



- If you have EMS or environmentally related questions, contact your ROICC or Contract Representative who will then work with EMD & EAD to determine how to proceed





Remember...

ALL environmental program requirements are applicable to **ALL** contractors and vendors working aboard the Installation!





General Environmental Awareness





Water Quality

■ Construction/demolition and other projects can result in:

- Stormwater pollution
- Erosion and sedimentation



■ If a project could impact water quality:

- Don't dispose of oil, chemicals, or any other material/debris down storm drains
- Keep sediment, leaves, and construction debris away from storm drains (use barriers)
- Sediment Erosion Control Plans are required for sites when more than 1 acre will be disturbed





Used Oil

■ Oil handling/changing operations can result in:

- Spills
- Waste
- Groundwater, stormwater, or soil contamination



■ If a project involves the use of oil:

- Perform maintenance in paved, designated areas
- Recycle used oil, oil filters, and other fluids...don't dump down storm drain or dispose of in the trash
- Clean up spills immediately and properly!





Air Quality

If a project could impact air quality:

- Prior to beginning operations, have your ROICC or Contract Representative contact the Installation Air Quality Program representative for applicable Federal and state permitting requirements
- Follow all permit requirements, including material usage recordkeeping for Title V permit sources
- Notify your ROICC or Contract Representative before bringing new equipment on site
- Notify your ROICC or Contract Representative before modifying an existing permitted source (including physical changes and material changes). Examples of permitted sources include boilers, generators, fuel tanks, and welding/soldering operations





Hazardous Waste Management

■ Hazardous waste generation can result in:

- Consumption of natural resources
- Increased Regulatory Burden

■ If a project generates hazardous waste:

- Reduce/Minimize the generation of hazardous waste
- Contact your ROICC or Contract Representative if unsure how to manage a waste
- Don't put hazardous wastes into general trash dumpsters
- Ensure satellite accumulation areas (SAA) are managed properly
 - Notify your ROICC or Contract Representative prior to creating a new SAA!
- Ensure hazardous waste drums are labeled and lids are secured





Hazardous Materials

- **If a project requires the use hazardous material (HAZMAT):**
 - Keep flammable materials in HAZMAT lockers
 - Don't store large quantities – keep on hand only what you will use
 - Maintain MSDSs for each material on-site
 - Place materials stored outside in secondary containment to prevent spill/reduce releases
 - Stop work if you unearth a hazardous material (i.e., ordnance) and report to your ROICC or Contract Representative





PCB and Asbestos

■ If a project generates or involves the removal of PCB or asbestos:

- Manage and handle PCB and asbestos only if you are properly trained



- Manage PCB and asbestos in proper containers with appropriate labeling





Solid Waste Management

- **Solid waste generation can result in:**
 - Consumption of natural resources
 - Decreased landfill space
- **If a project generates regulated or solid waste:**
 - Reduce/Reuse/Recycle when possible; meet contract requirements for recycling
 - Contact your ROICC or Contract Representative if unsure how to manage a waste
 - Don't put unauthorized wastes into general trash dumpsters – Recyclable products should be placed in appropriate containers & not co-mingled with solid waste
 - Don't use government-owned dumpsters for your contractor waste and debris





Good Housekeeping

■ Poor housekeeping can result in:

- Fines, termination of contract
- Environmental contamination, spills
- Injuries



■ Maintain good housekeeping:

- **DO** store flammable materials in HAZMAT lockers
- **DO** ensure containers are labeled and lids are secured
- **DO** keep stormwater drains clear of debris
- **DO** clean up work sites at the end of *each* day
- **DO** clean up spills immediately and properly
- **DO** clean up work area after job completion
- **DON'T** pour material down storm or floor drains
- **DON'T** stockpile waste – put it where it belongs!





Spill Response Basics





If You Have or See a Spill...

Call 911





Natural Resources – Threatened & Endangered Species

- The Installation is currently home to nine federally listed endangered species: red-cockaded woodpecker (RCW), green sea turtle, loggerhead sea turtle), rough-leaved loosestrife, seabeach amaranth, piping plover, American alligator, and American bald eagle and Hirst's panic grass.



- The following restrictions apply:
 - Construction activities are restricted within 1500 ft of a bald eagle's nest
 - Vehicles & lighting are prohibited on the beaches overnight = 1 May -31 Oct
 - Cutting or damaging pine trees in not permitted
 - Fish & wildlife must not be disturbed





Natural Resources – Wetlands

- The US Army Corps of Engineers defines a wetland as " areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."
- No discharge of fill material, mechanized land clearing, or any other activity is allowed in jurisdictional wetlands or Waters of the United States without the proper approvals.
- Permits will be required





Natural Resources – Timber

There are over 127,000 acres of forested land aboard the Installation

- The MCBCL Forest Management Program has 1st right of refusal for all timber products on construction projects

- The following restrictions apply:

- Do not cut or deface trees w/o authorization
- Protect existing trees that are to remain in place
- Do not fasten or attach ropes or cables to existing nearby trees for anchorages w/o authorization





Cultural Resources

The Installation manages a variety of historic and prehistoric archaeological sites, as well as historic structures.

- **IF YOU FIND A BONE, BOTTLE OR PIECE OF POTTERY THAT YOU THINK MIGHT HAVE ARCHAEOLOGICAL OR HISTORIC INTEREST, DON'T PICK IT UP. IF YOU FIND ANY OF THESE THINGS, MARK THE AREA & NOTIFY THE BASE ARCHAEOLOGIST, EMD AT 451-5063.**





Summary





Summary

- MCB Camp Lejeune and MCAS New River protect, preserve, and enhance their natural resources through their EMS and Environmental Policies
 - **We comply** with relevant environmental laws and regulations
 - **We prevent pollution**
 - **We continually improve** the EMS
- **YOU** are responsible for complying with applicable environmental requirements too
- If you aren't sure what to do...**ASK!**
 - Your ROICC or Contract Representative and EMD/EAD are here to help





Remember...

Consult the *Contractor Environmental Guide* for more detailed information pertaining to environmental requirements applicable to the work you do.

If you have any questions or concerns about the information in this training, please consult with your ROICC or Contract Representative, who will contact the appropriate environmental office if additional clarification is necessary.

