

SECTION 00 01 01

PROJECT MANUAL
FOR
UM KEYO BUILDING ELECTRICAL SERVICE UPGRADE

UNIVERSITY OF MAINE

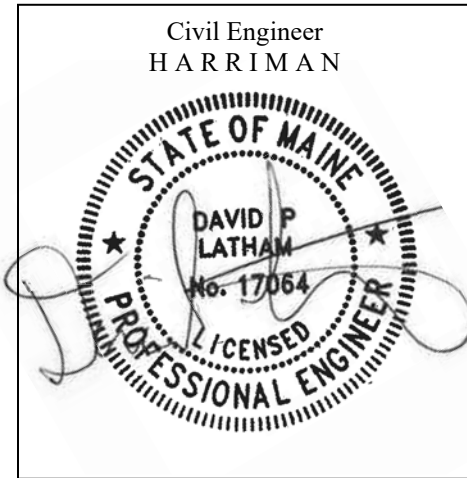
January 8, 2026

Prepared by:
University of Maine System
&
Harriman Associates

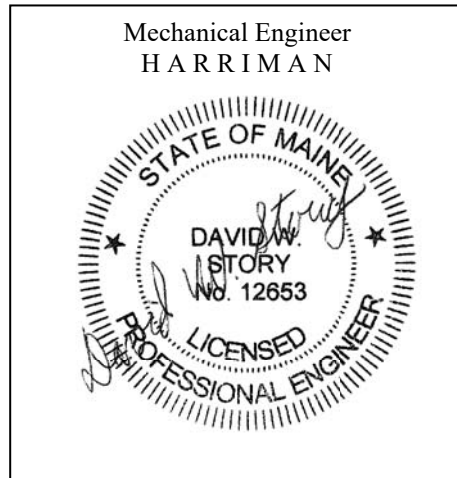
END OF SECTION 00 01 01

SECTION 00 01 07
PROFESSIONAL SEAL PAGE

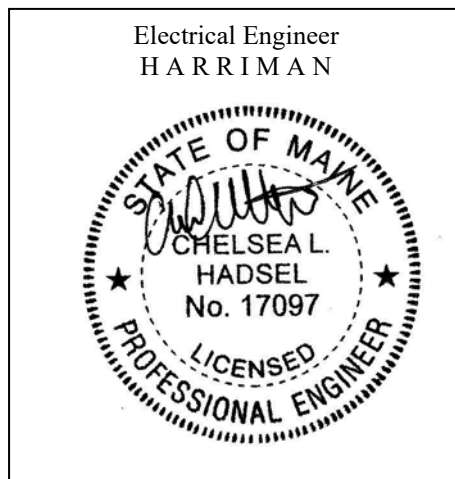
Civil Engineer
HARRIMAN



Mechanical Engineer
HARRIMAN



Electrical Engineer
HARRIMAN



SECTION 00 01 10
TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP			<u># of Pages</u>
DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS			
Introductory Information			
00 01 01	Project Title Page		1
00 01 07	Seals Page		1
00 01 10	Table of Contents		2
00 01 15	List of Drawing Sheets		1
00 02 00	Information Available to Bidders-Transformer Cut Sheets		6
Procurement Requirements			
00 11 13	Advertisement for Bids		1
00 21 13	Instructions to Bidders		2
00 41 13	Bid Form		1
00 43 13	Bid Security Form		2
Contracting Requirements			
00 51 00	Notice of Award		1
00 52 13	Construction Contract Agreement Form		2
00 61 13.13	Performance Bond Form		1
00 61 13.16	Payment Bond Form		1
00 62 16	G715 Supplemental Attachment for ACORD Certificate of Insurance		2
00 62 16.10	Certificate of Liability Insurance (ACORD)		2
00 62 16.11	Commercial General Liability Coverage Form (ISO CG 00 01 12 04)		15
00 62 16.12	Additional Insured – Owners, Lessees or Contractors – Scheduled Person or Organization (ISO CG 20 10 07 04)		1
00 62 16.13	Additional Insured – Owners, Lessees or Contractors – Completed Operations (ISO CG 20 37 07 04)		1
00 62 16.14	Designated Location(s) General Aggregate Limit (ISO CG 25 04 03 97)		2
00 62 73	G703 Schedule of Values Form (Continuation Sheet)		1
00 62 76	G702 Application for Payment Form		1
00 62 76.13	Sales Tax Form		1
00 62 76.16	G707A Consent of Surety to Reduction in or Partial Release of Retainage Form		1
00 62 79	Stored Material Form		2
00 63 14	G716 Request for Information Form		1
00 63 33	G710 Architect’s Supplemental Instructions Form		1
00 63 46	G714 Construction Change Directive Form		1
00 63 57	G709 Proposal Request Form		1
00 63 63	G701 Change Order Form		1
00 65 16	G704 Certificate of Substantial Completion Form		1
00 65 19	Certificate of Completion Form		1
00 65 19.13	G706 Contractor’s Affidavit of Payment of Debts and Claims Form		1
00 65 19.16	G706A Contractor’s Affidavit of Release of Liens Form		1
00 65 19.17	Waiver of Lien		1
00 65 19.18	Subcontractor/Supplier Conditional Release and Waiver of Lien		2
00 65 19.19	G707 Consent of Surety to Final Payment Form		1
00 72 00	A201 General Conditions of the Contract for Construction		43
00 73 00.11	Schedule of Liquidated Damages		1
00 73 16	Insurance Requirements – A101 Exhibit A Insurance and Bonds		8
00 73 46	Wage Determination Schedule		1
SPECIFICATIONS GROUP			
GENERAL REQUIREMENTS SUBGROUP			
DIVISION 01 - GENERAL REQUIREMENTS			
01 10 00	- Summary of Work		
01 14 00	- Work Restrictions		
01 22 00	- Unit Prices		

01 23 00 - Alternates
01 26 00 - Contract Modification Procedures
01 29 00 - Payment Procedures
01 31 00 - Project Management and Coordination
01 32 00 - Construction Progress Documentation
01 33 00 - Submittal Procedures
 Electronic Document Release Agreement
01 40 00 - Quality Requirements
01 42 00 - References
01 50 00 - Temporary Facilities and Controls
01 60 00 - Product Requirements
01 63 00 - Substitutions and Product Options
01 73 29 - Cutting and Patching
01 74 19 - Construction Waste Management and Disposal
01 77 00 - Closeout Procedures
01 78 23 - Operations and Maintenance Data
01 78 39 - Project Record Documents
01 79 00 - Demonstration and Training
01 91 13 – General Commissioning Requirements

DIVISION 02 - EXISTING CONDITIONS

02 41 19 - Selective Demolition and Alterations

DIVISION 03 –DIVISION 06 – NOT USED

DIVISION 07

07 84 13 - Through-Penetration Firestop Systems

DIVISION 08 –DIVISION 22 – NOT USED

DIVISION 23 - HEATING VENTILATING AND AIR CONDITIONING

23 05 00 - Common Work Results for HVAC
23 05 13 - Common Motor Requirements for HVAC Equipment
23 05 29 - Hangers and Supports for HVAC Piping and Equipment
23 05 53 - Identification for HVAC Piping and Equipment
23 07 13 - Duct Insulation
23 31 13 - HVAC Ducts
23 33 00 - Air Duct Accessories
23 34 00 - HVAC Fans
23 37 00 - Air Outlets and Inlets

DIVISION 26 – ELECTRICAL

26 00 10 - Supplemental Requirements for Electrical
26 05 00 - Service Entrance Switches and Cabinets
26 05 13 - Medium-Voltage Cables
26 05 19 - Low-Voltage Electrical Power Conductors and Cables
26 05 26 - Grounding and Bonding for Electrical Systems
26 05 29 - Hangers and Supports for Electrical Systems
26 05 33 - Raceway and Boxes for Electrical Systems
26 05 43 - Underground Ducts and Raceways for Electrical Systems
26 05 44 - Sleeves and Sleeve Seals for Electrical Raceways and Cabling
26 05 53 - Identification for Electrical Systems
26 05 73.13 - Short-Circuit Studies
26 05 73.16 - Coordination Studies

26 05 73.19 - Arc-Flash Hazard Analysis
26 09 13 - Electrical Power Monitoring
26 12 19 - Pad-Mounted, Liquid-Filled, Medium-Voltage Transformers
26 22 13 - Low-Voltage Distribution Transformers
26 24 13 - Switchboards

DIVISION 27

27 00 00 - Communications

DIVISION 28 – NOT USED

DIVISION 31 – EARTHWORK

31 10 00 - Site Clearing

31 20 00 - Earth Moving

DIVISION 32 –DIVISION 33 – NOT USED

END OF SECTION 00 01 10

SECTION 00 01 15
LIST OF DRAWING SHEETS

GENERAL DRAWINGS

Sheet Title

COVER SHEET

Sheet Number

G00-1

CIVIL DRAWINGS

Sheet Title

SITE NOTES

SITE EROSION CONTROL NOTES

EXISTING SITE CONDITIONS AND DEMOLITION PLAN

SITE LAYOUT PLAN

SITE UTILITY PLAN

SITE DETAILS

Sheet Number

C00-1

C00-2

C10-1

C20-1

C40-1

C50-1

MECHANICAL DRAWINGS

Sheet Title

LEGEND & GENERAL NOTES

FIRST FLOOR DUCTWORK

Sheet Number

M00-1

M10-1

ELECTRICAL DRAWINGS

Sheet Title

SYMBOLS AND ABBREVIATIONS

BASEMENT FLOOR PLAN DEMOLITION

BASEMENT FLOOR PLAN POWER AND SYSTEMS

DIAGRAMS

DIAGRAMS

DETAILS

SITE PLAN

Sheet Number

E00-1

E05-0

E20-0

E50-1

E50-2

E70-1

E80-1

END OF SECTION 00 01 15

SECTION 00 02 00
INFORMATION AVAILABLE TO BIDDERS

PART 1 GENERAL

1.01 INFORMATION FOR BIDDERS

- A. The information being provided is for the bidder's convenience and does not relieve the bidders from doing their own investigation to determine the accuracy of the information.

1.02 TRANSFORMER

- A. The transformer cutsheets are provided for reference.

PART 2 – NOT USED

PART 3 – NOT USED



Certificate of Compliance

FIRE PROTECTION EQUIPMENT

This certificate is issued for the following equipment:

Less or Nonflammable liquid-Insulated Substation and Pad-Mounted Three Phase and Single Phase Transformers

Approval Guide Listing: Category:

Electrical Equipment - Less or Non-Flammable Liquid Insulated Transformers

WEG Transformers USA
One Pauwels Drive
Washington MO 63090
United States

This certifies that the equipment described has been found to comply with the applicable requirements, as stated in the Approval Report(s), of the following FM Approval Standards and other documents:

Approval Standards

Class Number
3990

Date
January 2018

Other Standards

Organization, Designation
IEEE C57.12.00
IEEE C57.12.90

Date
2015
2015

Original Approval Job Identification: PR449654

Approval Granted: 27 February 2020

Related Report: None

Subsequent Revisions: None

To verify the availability of the Approved product, please refer to www.approvalguide.com


J.E. Marquedant
VP, Manager of Electrical Systems
FM Approvals
1151 Boston-Providence Turnpike,
Norwood MA, 02062 USA

27 February 2020

Date



Member of the FM Global Group



Certificate of Compliance

Distribution Transformers, Oil Immersed (Envirotemp ® FR3 TM), 45kVA to 3000kVA, KNAN, System Voltages up to 34.5 kV

SPECIFIED DATA	UNITS/OTHER	DATA SHOWN PER UNIT QUANTITY
Phase	Φ	3
Frequency	Hz	60
Location		Indoor/Outdoor
Parallel Operation		Yes
Type of Load		Various
Type of Supply (Utility, Generator)		Utility
Transformer Class / Design Standard		Distribution, ANSI/IEEE C57.12.00
KVA Rating	KVA	45 -3000
Cooling Method		KNAN
Cooling Fluid		Envirotemp ® FR3 TM less flammable transformer fluid
Fans		No
Vector Group		Dyn1, Dyn11, YNyn0, Yy0, Dd0, Yd1 or others
Primary Voltage	kV	Up to 34.5
Taps	Yes	5, off load tap changer, 2.5% or 5%
Secondary Voltage	V	Up to 690/398
Neutral		Solid/Floating Ground
Primary Connection		Delta/Wye
Secondary Connection		Wye/Delta
Secondary Accessible Neutral		Yes
Primary BIL Level	kV	150 or below
Secondary BIL Level	kV	30 or below
Neutral BIL Level	kV	N/A
Temperature Rise Winding	°C	65 °C (can vary by customer request)
Temperature Rise Insulation	°C	65 °C (can vary by customer request)
Cover		Bolted or welded
Cover thickness	in	1/4
Tank thickness walls	gauge	7



Member of the FM Global Group

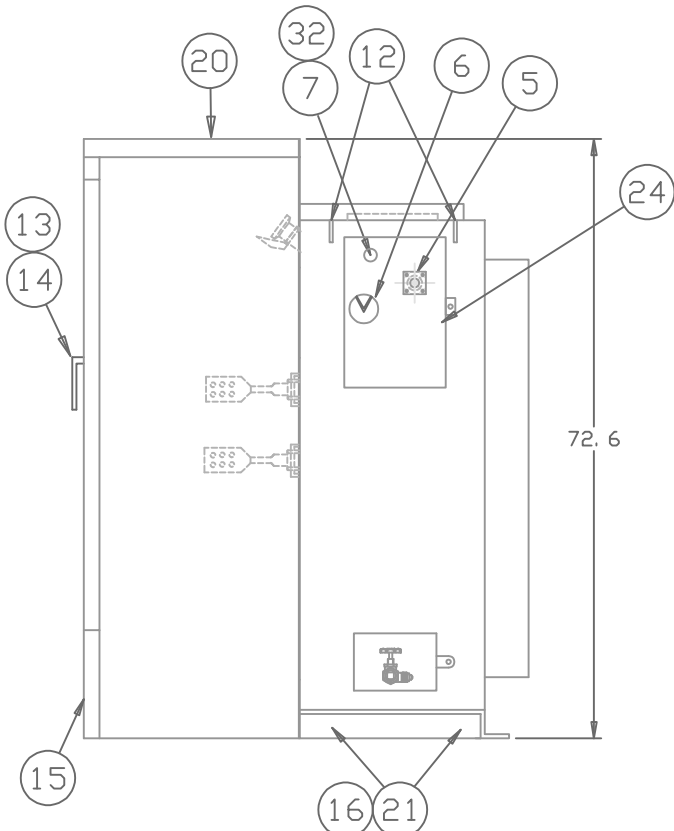
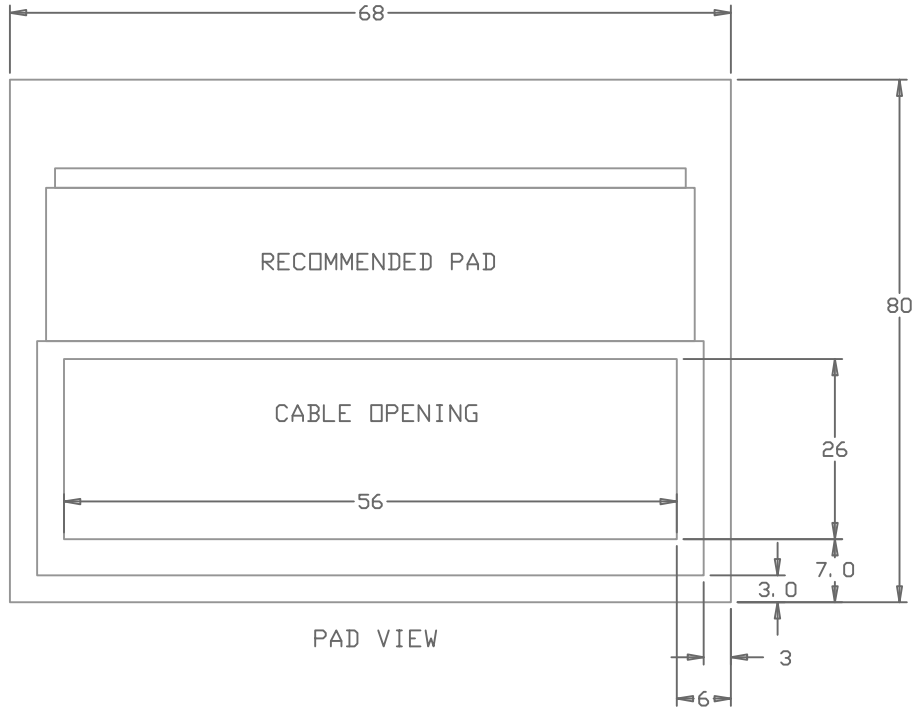
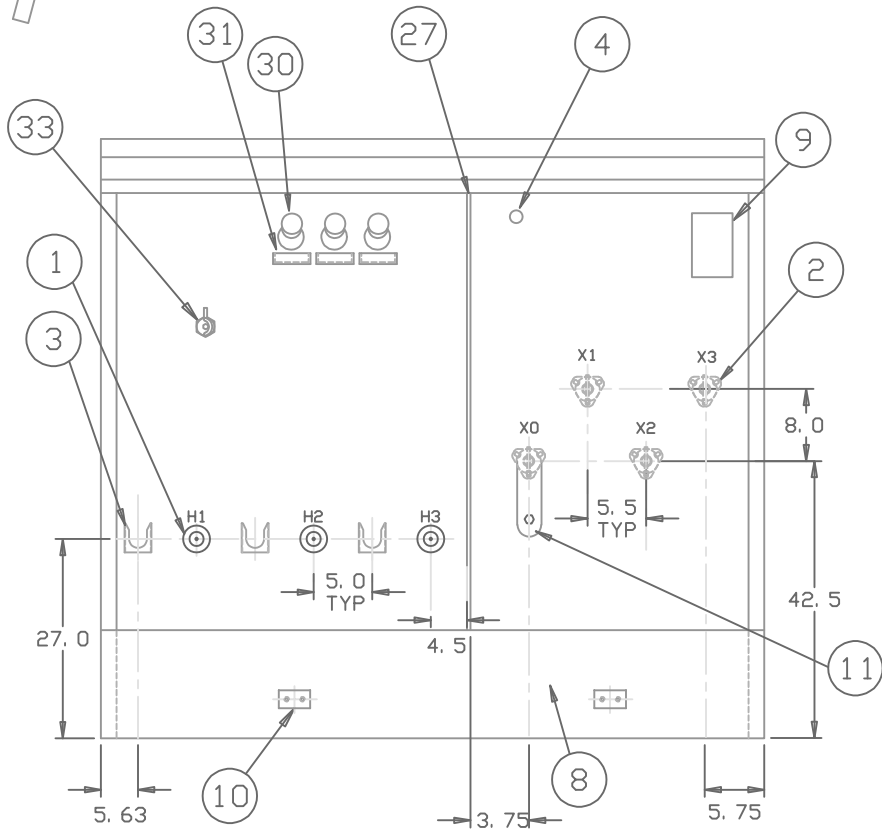
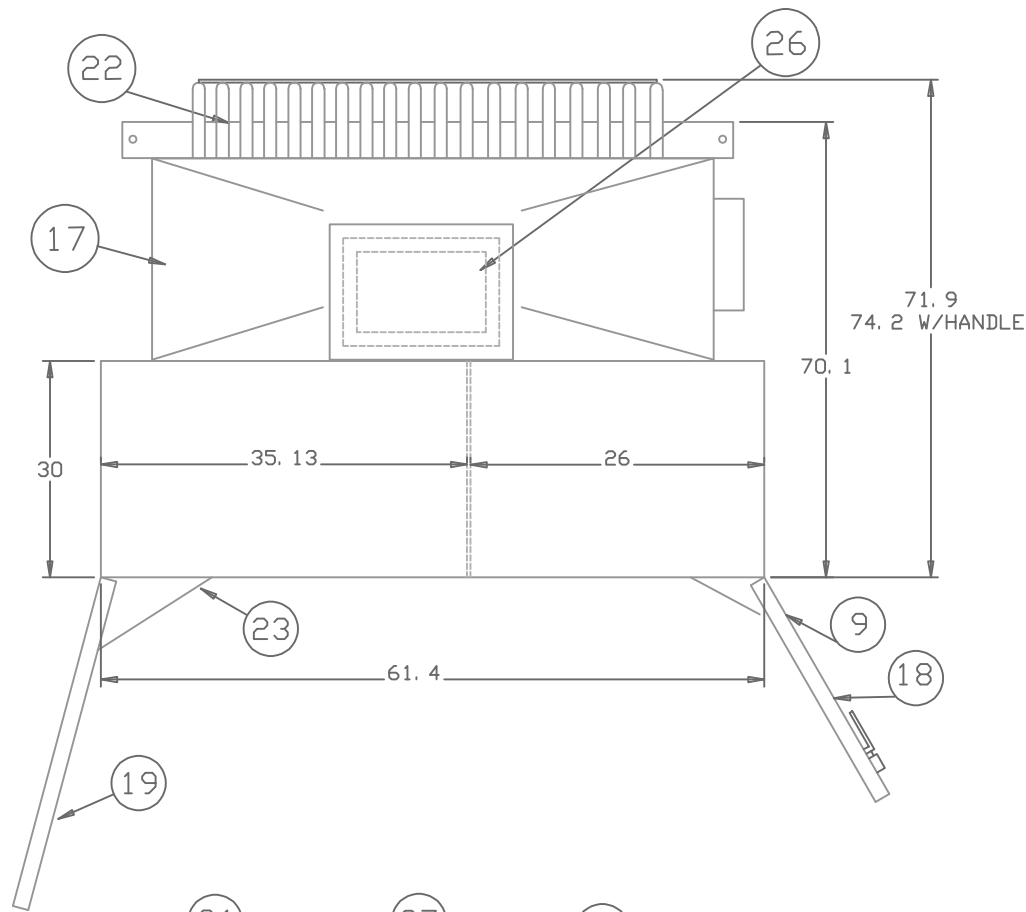


Certificate of Compliance

Tank thickness ventilation	gauge	18
Impedances Base MVA (Primary to Secondary)	%	2-7
Pressure Relief Devices (PRD)		Yes
Liquid Level Gages (LLG)		Yes
Liquid Temperature Gages (LTG)		Yes
Sudden Pressure Relief Device (SPD)		N/A
Pressure Vacuum Gages (PVG)		N/A
Fuses		External (defined by AHJ/installer) Integrated internal fuses installed
Circuit Breakers		External (defined by AHJ/installer)
Current Transformers		External, Type CMV, 3000Amp



Member of the FM Global Group



THIS OUTLINE IS FOR ERECTION OR MOUNTING PURPOSES. IT IS NOT TO SCALE AND SHOULD NOT BE REGARDED AS INDICATING THE EXACT DETAILS OF CONSTRUCTION.

- 01 High Voltage Non-Loadbreak Bushings (125 BIL/600 Amp)(Cooper DB625B125)
- 02 LOW VOLTAGE EPOXY BUSHINGS WITH THREAD-ON 6-HOLE ALUMINUM NEMA SPADE
- 03 PARKING STAND
- 04 PRESSURE RELIEF VALVE (VIAT 302-060-01N)
- 05 LIQUID LEVEL GAUGE (VIAT 805.6)
- 06 LIQUID TEMP GAUGE (VIAT 113)
- 07 OIL FILL PLUG (1")
- 08 OIL DRAIN VALVE WITH SAMPLER (HJ ENT.)(IN EXTERNAL LOCK BOX)
- 09 NAMEPLATES (AL)
- 10 2-2 HOLE GROUND PADS
- 11 COPPER GROUND STRAP
- 12 LIFTING LUGS
- 13 PADLOCK FACILITY AND DOOR BOLT WITH PENTAHEAD BOLTS
- 14 LV DOOR HANDLE
- 15 REMOVEABLE FRONT LOWER SILL
- 16 BASE ARRANGEMENT FOR ROLLING IN 2 DIRECTIONS
- 17 TRANSFORMER TANK
- 18 LOW VOLTAGE COMPARTMENT DOOR
- 19 HIGH VOLTAGE COMPARTMENT DOOR
- 20 DOMED & RAISED AIR COMPARTMENT TOP
- 21 JACKING PROVISIONS
- 22 COOLING FINS
- 23 DOOR HOLDING BARS IN 120° OPEN POSITION
- 24 GAUGE BOX ASY (22.0 W x 20.0 H x 10.2 D)
- 25 PAINT MUNSELL GREEN 7GY3.29/1.5
- 26 15"X24" HANDHOLE
- 27 HIGH-LOW BARRIER
- 28 STAINLESS STEEL HINGES
- 29 ALL BUSHINGS ARE EXTERNALLY CLAMPED
- 30 BAYONET FUSE HOLDER WITH FLAPPER VALVE/ DUAL-SENSING FUSE (COOPER 4000358C14M)
- 31 PLASTIC DRIPSHIELD
- 32 PRESSURE VACUUM GAUGE WITH SCHRADER VALVE (VIAT 131)
- 33 DUAL VOLTAGE SWITCH (150 AMP) (COOPER 2237403B06M)
- 34 PARTIAL RANGE CURRENT LIMITING FUSES(x2) (15KV/200AMP) (HITECH HTDS342200)
- 35 WEAK-LINK FUSES (15KV/146 AMP/CURVE 34)(ERMCO 9F54WLD402)

* NOTE: SWITCHED FUSING INTERNAL WEAK LINK CARTRIDGES IN SERIES WITH PRCLF @4160, BAYONETS IN SERIES WITH PRCLF @ 12470 S. O. # 496921811-010

S. O. # 496921811-010
1000 KVA
4160 DELTA/12470 DELTA
480Y/277

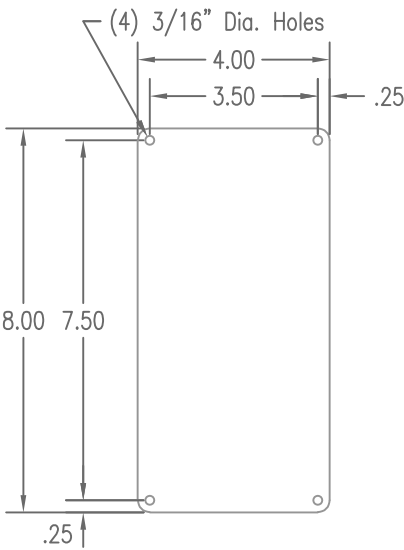
Approval Block	
☐ Approved as Submitted	
☐ Approved as Noted	
☐ Resubmit	Sign & Date

JOB NAME: EL FLOWERS/KEYO,ME	EQUIPMENT DESIGNATION: 1000 KVA – 65 DEG RISE
JOB LOCATION: KEYO,ME	EQUIPMENT TYPE: FR3 FLUID FILLED TRANSFORMER
DRAWN BY: RTS	DRAWING TYPE: OUTLINE
ENGR: TM	WEG TRANSFORMERS, USA
DATE: 10/23/25	
DRAWING STATUS: APPROVAL	
DWG# RF04277A	PG 2 OF 2
REV 000	

S.O.#496921811-01

S.N.:

* = ACTUAL TESTED VALUE



MATERIAL: ALUMINUM
(4).1875" DIA. MTG.
HOLES ON CENTERLINE
3.5" x 7.5" APART.
SIZE OF PLATE 4.0"
x 8.0" WITH .25"
CORNER RADIUS.



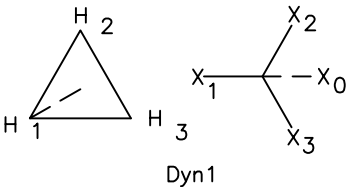
MANUFACTURED IN WASHINGTON MO 63090 USA
THREE PHASE TRANSFORMER 65°C RISE 60 HZ. CLASS KNAN ENVIROTEMP FR3 FLUID

1000kVA HV(AL) 4160 DELTA/12470 DELTA
LV(AL) 480Y/277

S/N
MODEL M0216220-01

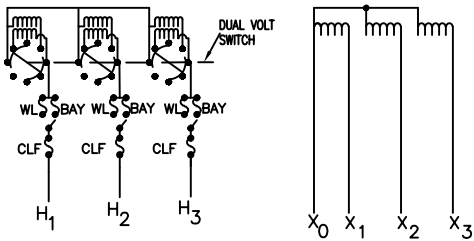
CORE & COIL (UNTANKING) 3141 LBS
TANK & FITTINGS 2008 LBS
LIQUID 392 GALS 3009 LBS
TOTAL 8158 LBS
DATE OF MFG. ---

* %IMP.	
RATED VOLTAGE	SWITCH POS
4160	1
12470	2



H.V.BIL. 95 K.V.
L.V.BIL. 30 K.V.

LIQUID CONTAINS LESS THAN 1 PPM PCB AT TIME OF MANUFACTURE
25°C LIQUID LEVEL IS 6 IN BELOW TOP OF HANDHOLE FLANGE.
LIQUID LEVEL CHANGES 0.5 IN PER 10°C CHANGE IN LIQUID TEMPERATURE.
OPERATING PRESSURES OF LIQUID PRESERVATION SYSTEM ARE 7 PSIG MAX
AND -2 PSIG MIN. TANK IS DESIGNED FOR 3 PSIG VACUUM FILLING.
REFER TO INSTRUCTION BOOK NO. +7-8102.



496921811-010

DOE 2016 COMPLIANT



WASHINGTON, MO 63090, USA

DECIMAL	ANGULAR	FRACTIONAL	SCALE	TOLERANCES (except as noted)	DRAWN BY:	APPROVED
± .032	± 2'	± 1/32	1:1	± .032	RTS	**

NAME: D-Y NAMEPLATE		
MAT'L: 38018692A01		
DATE: 10/23/25	PART NUMBER: RF04277N	REV: 000

SECTION 00 11 13
ADVERTISEMENT FOR BIDS

Bids for: UM KEYO ELECTRICAL SERVICE UPGRADE

Shall be submitted electronically to cppmquestions@maine.edu
With the following Email Subject Line: **UM Keyo Electrical Service Upgrade**

Bids will be received until **2:00PM** on **Thursday, February 12, 2026**, at which time Bids will be opened and read aloud via Zoom.

Bid opening attendance is available via PC, Mac, Linux, iOS or Android:
[Zoom](https://maine.zoom.us/j/82059156801?pwd=fv0bLzFIqRLVomfmk8Zc2URov1dGmK.1&jst=3) <https://maine.zoom.us/j/82059156801?pwd=fv0bLzFIqRLVomfmk8Zc2URov1dGmK.1&jst=3>
Password: 601937
Or via telephone US: +1 312 626 6799

Bids received after the stated time will not be considered and will be returned unopened.

Electronic bid submission must be accompanied by a copy of a satisfactory Bid Bond for 5% of the Bid (checks will not be accepted) which shall be in conformity with the form of Bond contained in Section 00 43 13 of the Specifications. Upon determination of the apparent low bidder, the University will contact the low bidder and request an original hard copy of the bid bond be delivered within 72 hours. The University reserves the right to waive all formalities and reject any or all bids or to accept any bids. Scholarships, donations or gifts to the University will not be considered in the evaluation of responses.

Electronic Bid Submission Requirements:

A **SIGNED** virus-free electronic bid form must be submitted as follows:

- The bid and bid bond must be submitted electronically as a single PDF file to the email address shown above.
- Electronic submission must be received by the required **Date/Time** reflected above.

The successful Bidder will be required to furnish a 100% Performance Bond and a 100% Payment Bond to cover the execution of the Contract which shall be in conformity with the form of Bonds contained in Sections 00 61 13.13 and 00 61 13.16, respectively, of the Specifications and shall be for the Contract amount.

Bidders may attend a non-mandatory pre-bid meeting on Thursday, January 15, 2026 at 10:00AM. Attendees are to meet in Service Building room 109. Copies of plans and specifications will not be available at the pre-bid meeting. Acquiring or reviewing plans and specifications prior to the meeting is advised.

Project Summary: The project consists of the removal and replacement of existing building electrical equipment and associated feeders to the Keyo Building.

Any questions related to the plans and specifications must be submitted prior to 2:00PM Monday, January 26, 2026, via email to Sarah Cline, Project Manager, University of Maine; cppmquestions@maine.edu

The University of Maine System is an EEO/AA institution and does not discriminate on the grounds of race, color, religion, sex, sexual orientation, transgender status, gender, gender identity or expression, ethnicity, national origin, citizenship status, familial status, ancestry, age, disability physical or mental, genetic information, veteran or military status in employment, education, and all other programs and activities. The following person has been designated to handle inquiries regarding non-discrimination policies: Director of Equal Opportunity, 5713 Chadbourne Hall, Room 412, University of Maine, Orono, ME 04469-5754, 207.581.1226, TTY 711 (Maine Relay System). The University provides reasonable accommodation to qualified individuals with disabilities upon request. General contractors, subcontractors, and product suppliers bidding on this project must subscribe and adhere to the same.

UNIVERSITY OF MAINE SYSTEM
by and through
UNIVERSITY OF MAINE

Jenny Boyden, Vice President of Finance and Chief Business Officer, for
University of Maine System Board of Trustees

END OF SECTION 00 11 13

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

1. At the time of the opening of bids, each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and contract documents, including all addenda. The failure or omission of any bidder to receive or examine any form, instrument, or document shall not relieve any bidder from any obligation in respect to the bid. The Owner reserves the right to accept or reject any or all bids as may best serve the interests of the University of Maine System.
2. Subject to the University System's right, reserved herein, to accept or reject any or all bids, the General Contractor will be selected on the basis of the sum of the lowest base bid, plus such of the alternates as the University System desires to use.
3. The University System is exempt from the payment of Federal Excise Taxes on articles not for resale and the Federal Transportation Tax on all shipments. The Contractor shall quote less these taxes. Upon application, exemption certificates will be furnished when required.
4. No proposal may be withdrawn during a period of thirty (30) calendar days immediately following the opening thereof.
5. No contract may be assigned, sublet or transferred without the written consent of the University of Maine System.
6. All individuals not residents of this State must comply with the provisions of 14 MRSA §704-A.
7. The successful bidder, or bidders, will be required to furnish 100% Contract Bonds to cover the execution of the contract, in accordance with the AIA Document A101 - 2017 Exhibit A and Article 11 of the AIA Document A201 – 2017 General Conditions of the Contract for Construction.
8. Contractors may be required to furnish a statement of their business experience, record of accomplishments, and financial responsibility, at the discretion of the University System.
9. The base bid shall be based on the materials, methods, equipment and products, as specified.
10. Bidders shall submit the bid on the Bid Form provided in the Specifications, Section 00 41 13.
11. Any materials, methods, equipment and products not herein specified, but worthy of consideration by any General or Subcontractor, may be introduced by a separate letter attached to the regular bid. The Bidder shall state the cost comparison with the specified materials, methods, equipment and products, and the reason for the suggested substitution. It shall be understood by all bidders that the attached letter proposing substitutions shall not be used to determine the low bidder and that all bids are based on specified products.
12. Telegraphic or facsimile proposals will not be considered, but modification of proposals already submitted will be considered if received prior to the hour set for receipt of proposals. If the telegram or facsimile discloses the amount of the proposal, the proposal will be declared invalid. The bidder bears full responsibility to assure that the correction is delivered to the proper location and within the time required.
13. Where a bidder wishes a product to be considered an "approved equal" for bidding purposes, the product, along with all supporting documentation, shall be submitted to the architect for review a minimum of 10 calendar days prior to the bid opening date or the file bid due date, if file bids are required on the project. Products which are determined to be an "approved equal" for bidding purposes shall be listed in an addendum issued so as to be received by bidders no less than 72 hours prior to the bid date or the file bid due date if file bids are required.
14. Where the Bid Form requires the tabulation of subcontractors other than "File Bidders," the Bidder shall list the name of the firm the bidder intends to use in the event the bidder receives the contract award.
15. Bidders may appeal the award decision by submitting a written protest to the University of Maine System

Chief Facilities and General Services Officer within five (5) business days of the date of the award notice (Notice of Award) with a copy of the protest to the successful bidder. The protest must contain a statement of the basis for the challenge.

END OF SECTION 00 21 13

SECTION 00 41 13
BID FORM – SHORT FORM

BIDDER: _____
Physical/Street Address _____
City, State ZIP _____

University of Maine
Office of Facilities Management
5765 Service Building
Orono ME 04469-5765

Having carefully examined the form of contract, general conditions and plans and specifications contained therein for UM Keyo Electrical Service Upgrade, as well as the premises and conditions affecting the work, we the undersigned propose to furnish all labor, equipment, and materials necessary for and reasonably incidental to the construction and completion of this contract for the Base Bid of _____ Dollars (\$ _____).

ALTERNATE PRICE AS FOLLOWS:

Alternate 1. Communication Cable Material and Pulling Deduct \$ _____

UNIT PRICE ITEMS: The undersigned agrees to perform additional work as directed at the following prices:

<u>Item (quantity)</u>	<u>Unit Price</u>
1. Removal of unsatisfactory soil and replacement with satisfactory soil material (15 cu yd)	\$ _____
2. Mass rock excavation and replacement with satisfactory soil material (10 cu yd)	\$ _____
3. Trench rock excavation and replacement with satisfactory soil material (5 cu yd)	\$ _____

This proposal includes the cost of 100% Performance Bond plus 100% Payment Bond.

The receipt of the following addenda to plans and specifications is hereby acknowledged:

ADDENDUM # _____ DATED _____ ADDENDUM # _____ DATED _____

ADDENDUM # _____ DATED _____ ADDENDUM # _____ DATED _____

Any material or materials not specified in the bidding document but worthy of consideration may be introduced by the bidder by a separate letter attached to this Bid. A cost comparison must be included giving the comparison with the Material specified and the reason for the suggested substitution. The basic bid shall be as specified.

The undersigned agrees, if this Bid is accepted to sign a contract and deliver it, along with the bonds and affidavits for all insurance specified within twelve (12) calendar days after the date of notification of such acceptance, except if the 12th day falls on a Saturday, Sunday or holiday, then the conditions will be fulfilled if the required documents are received before 12 o'clock noon on the day following the holiday, or the Monday following the Saturday or Sunday, and as a guarantee thereof, herewith submits a bid bond as required.

The undersigned agrees, if awarded the Contract, to substantially complete the work on or before October 1, 2026. The undersigned also agrees, if awarded the Contract, that no more than 80% of the contract amount will be sublet to other contractors.

Signed (by individual authorized to sign contract) _____

By (printed name & title) _____ Phone _____

PO Box (if applicable) _____ Email _____

NOTE: If bidder is a corporation, write State of Incorporation, and if a partnership, give full names of all partners.

END OF SECTION 00 41 13

SECTION 00 43 13

BID SECURITY FORM

KNOW ALL BY THESE PRESENTS, THAT WE, the undersigned, as PRINCIPAL _____
_____, and _____
_____ as SURETY, are hereby held and firmly bound unto the Treasurer
of the UNIVERSITY OF MAINE SYSTEM in the penal sum of _____
_____ for the payment of which, well and truly to
be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and
assigns, signed this _____ day of _____, 20 _____.

The condition of the above obligation is such that whereas the Principal has submitted to UNIVERSITY OF
MAINE SYSTEM, BY AND THROUGH THE UNIVERSITY OF MAINE, a certain proposal, attached hereto
and hereby made a part hereof, to enter into a contract in writing for the
UM KEYO ELECTRICAL SERVICE UPGRADE.

NOW THEREFORE,

- (a) If said proposal shall be rejected, or, in the alternate
- (b) If said proposal shall be accepted and the Principal shall execute and deliver a contract in the form of
contract attached hereto (properly completed in accordance with said proposal) and shall furnish a bond for
faithful performance of said contract, and for the payment of all persons performing labor or furnishing
materials in connection therewith, and shall in all other respects perform the agreement created by the
acceptance of said proposal, then this obligation shall be void, otherwise the same shall remain in force and
effect: It being expressly understood and agreed that the liability of the surety for any and all claims
hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligation of said Surety and its bond shall
be in no way impaired or affected by any extension of the time within which the principal may accept such
proposal: and said Surety does hereby waive notice of any such extension.

In the event suit is brought upon this bond by the Treasurer of the UNIVERSITY OF MAINE SYSTEM, Surety
shall pay reasonable attorneys' fees and costs incurred by the Treasurer of the UNIVERSITY OF MAINE
SYSTEM in such suit.

IN WITNESS WHEREOF, the Principal and Surety have hereunto set their hands and seals, and such of them
as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their
proper officers, the day and year first set above.

PRINCIPAL: _____

By: _____
L.S.

SURETY: _____

SURETY ADDRESS: _____

By: _____
L.S.

****DO NOT ALTER LANGUAGE****

END OF SECTION 00 43 13

SECTION 00 51 00

NOTICE OF AWARD

DATE

Vendor Name
Vendor Address.
Vendor Address

RE: ***NOTICE OF AWARD – UM KEYO ELECTRICAL SERVICE UPGRADE
UNIVERSITY OF MAINE***

Dear (vendor name),

You are hereby notified that the University of Maine System, by and through the University of Maine, accepts your Bid of **\$00.00** for the above named project, subject to final resolution of any bid protests and the parties' ability to establish and confirm final terms, as well as the execution of a written contract and your furnishing satisfactory bonds within twelve (12) calendar days as provided in the bidding documents.

This Notice of Award will permit you to proceed with the ordering of materials and scheduling the work so that the project can be completed on time. Should you fail to execute a contract or furnish satisfactory bonds within the stipulated time, the bid bond accompanying your proposal will be forfeited to the University of Maine System as liquidated damages.

Enclosed is your contract agreement for signature. Further, please have your surety provide one original each of the Performance Bond and the Payment Bond, as prescribed in Sections 00 61 13.13 and 00 61 13.16 of the bid document, and a properly executed "Power of Attorney." Please advise your surety agent that the bonds should carry the same date as this Notice of Award and the Contract Agreement. **All originals of the signed contract, bonds and insurance certificates should be forwarded directly to Sandra Binette, Capital Contracts Administrator, 5765 Service Building, Orono, ME 04469.** Once it is completely signed, a copy of the contract will be returned for your use.

Prior to the start of any work on the construction site, Capital Planning and Project Management must receive Certificates of Liability Insurance as specified in Article A.3 of the AIA Document A101 – 2017 Exhibit A, Insurance and Bonds. Please advise your surety that the certificate holder should be as follows: University of Maine System; Office of Risk Management; Robinson Hall, 46 University Drive, Augusta, ME 04330.

The day-to-day administrative and technical details of this project will be handled by the Architect/Engineer, insert name here. All correspondence relative to the day-to-day administration of the project should be directed to insert name, insert title, insert email; 207-000-0000.

A pre-construction conference on this project will be scheduled as soon as possible. This conference must be attended by your firm's authorized representative as well as your project superintendent.

Sincerely,

Jenny Boyden
Vice President of Finance
& Chief Business Officer

Enclosures

END OF SECTION 00 51 00

**UNIVERSITY OF MAINE SYSTEM
Construction Contract Agreement**

THIS AGREEMENT is made and entered into the _____ day of _____, 20____, by and between the Contractor, _____, and the University of Maine System acting by and through the University of Maine, 5765 Service Building, Orono, ME 04469, hereinafter called the Owner.

WITNESSETH: That the Owner and the Contractor for the considerations hereinafter named agree as follows:

ARTICLE 1. SCOPE OF THE WORK

The Contractor shall furnish all of the materials and perform all of the work described in the Contract Documents entitled [INSERT PROJECT NAME HERE], prepared by [Insert name of Architect/Engineer here], acting as and in these Contract Documents entitled the Architect and/or Engineer.

ARTICLE 2: START AND TIME OF COMPLETION

The date of the commencement of work shall be the date of this Agreement and shall be substantially completed on or before _____ subject to adjustments as provided in the Contract Documents.

The Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner the following stipulated liquidated damages for each calendar day of delay after the date established for Substantial Completion until the Work is substantially complete: _____ Dollars (\$____) per calendar day.

ARTICLE 3: THE CONTRACT SUM

The Owner shall pay the Contractor for the performance of the Contract as follows _____ Dollars, \$ (____), subject to adjustments as provided in the Contract Documents.

The Contract Sum is based upon the following Alternates and Unit Prices, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

Alternate (1)	_____	Alternate (2)	_____	Alternate (3)	_____
Unit Prices					
Item	_____	Price	_____		
Item	_____	Price	_____		

Final payment shall be made after completion and acceptance of the work as provided in the Contract Documents.

ARTICLE 4: THE CONTRACT DOCUMENTS

The Contract Documents for this project, except for modifications issued after execution of this agreement, consist of:

- .1 This agreement.
- .2 AIA Document A201-2017, General Conditions of the Contract for Construction, as modified by the Owner.
- .3 AIA A101 – 2017, Exhibit A, Insurance and Bonds, as modified by the Owner.

- .4 The Specifications as outlined in the Project Manual: [Insert Name of Project Here], dated _____.
- .5 The Drawings as listed in the Project Manual.
- .6 The Addenda: Addendum 01 dated _____.
- .7 Exhibit B, Contractor's Proposal dated _____.

ARTICLE 5: OWNER'S REPRESENTATIVES

The Owner's Representative on this project will be _____, who is authorized to sign contracts and other legal documents related to this project on behalf of the Owner.

The Owner's Project Manager on this project will be _____.

The Owner and the Contractor hereby agree to the full performance of the covenants herein.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day and year first above written.

UNIVERSITY OF MAINE SYSTEM
by and through
University of Maine

Company

Company

By: _____
[Insert Signatory Name]
[Insert Signatory Title]
University of Maine

By: _____

END OF SECTION 00 52 13

SECTION 00 61 13.13

PERFORMANCE BOND FORM

Bond No. _____

KNOW ALL BY THESE PRESENTS THAT (1) _____
(2) _____
of _____ and State of _____, as PRINCIPAL,
and (3) _____
a corporation duly organized under the laws of the State of _____ and
having a usual place of business in _____, as SURETY, are held
and firmly bound unto the University of Maine System in the sum of _____ Dollars
(\$ _____), to be paid said Treasurer of the University of Maine System, or successor
in office, for which payment well and truly to be made, Principal and Surety bind themselves, their heirs,
executors and administrators, successors and assigns, jointly and severally by these presents.

The condition of this obligation is such that if the Principal shall promptly and faithfully perform the Contract
entered into on the (4) _____ day of _____, A.D., 20____ for the
construction of (5) _____

then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

The Surety hereby waives notice of any alteration or extension of time made by the University of Maine
System.

Signed and sealed this (4) _____ day of _____, 20_____.

WITNESSES:

SIGNATURES:

_____ LS
_____ LS
_____ LS

Bonding Company Agent:

Company: _____

Street: _____

City, State, Zip: _____

Telephone: _____

- (1) Correct name of Contractor.
- (2) A corporation, a partnership, or an individual, as the case may be.
- (3) Correct name of Surety.
- (4) Same date as that of contract.
- (5) Name of Project as designated in contract.

If Contractor is a partnership, all partners should execute bond. A Power of Attorney document, together with a
statement that it still is in effect shall be provided by the person executing this bond. Bond must be
countersigned by a Resident Maine Agent.

****DO NOT ALTER LANGUAGE****

END OF SECTION 00 61 13.13

SECTION 00 61 13.16
PAYMENT BOND FORM

Bond No. _____

KNOW ALL BY THESE PRESENTS THAT (1) _____
_____ (2) _____
of _____ and State of _____, as PRINCIPAL,
and (3) _____,
a corporation duly organized under the laws of the State of _____ and
having a usual place of business in _____, as SURETY, are held
and firmly bound unto the University of Maine System in the sum of _____ Dollars
(\$ _____), for the use and benefit of claimants* as herein below defined, for the
payment whereof Principal and Surety bind themselves, their heirs, executors and administrators, successors
and assigns, jointly and severally by these presents.

The condition of this obligation is such that if the Principal shall promptly satisfy all claims and demands
incurred for all labor and materials used or required by the Principal in connection with the work contemplated
in the Contract entered into on the (4) _____ day of _____, A.D., 20 _____ for the
construction of (5) _____

_____,
and shall fully reimburse the obligee for all outlay and expense which said obligee may incur in making good
any default of said principal, then this obligation shall be null and void; otherwise, it shall remain in full force
and effect.

*A Claimant is defined as one having a direct contract with the Principal or with a subcontractor of the
Principal for labor, material, or both, used or reasonably required for use in the performance of the contract.

Signed and sealed this (6) _____ day of _____, 20 _____.

WITNESSES:

SIGNATURES:

_____ LS
_____ LS
_____ LS

Bonding Company Agent:

Company: _____

Street: _____

City, State, Zip: _____

Telephone: _____

- (1) Correct name of Contractor.
- (2) A corporation, a partnership, or an individual, as the case may be.
- (3) Correct name of Surety.
- (4) Same date as that of contract.
- (5) Name of Project as designated in contract.
- (6) Same date as that of Contract.

If contractor is a partnership, all partners should execute bond. A Power of Attorney document, together with a
statement that it still is in effect shall be provided by the person executing this bond. Bond must be
countersigned by a Resident Maine Agent.

****DO NOT ALTER LANGUAGE****

END OF SECTION 00 61 13.16



AIA® Document G715™ – 2017

Supplemental Attachment for ACORD Certificate of Insurance 25

PROJECT: <i>(name and address)</i> Samples	CONTRACT INFORMATION: Contract For: Date:	CERTIFICATE INFORMATION: Producer: Insured: Date:
OWNER: <i>(name and address)</i> University of Maine System by and through University of Maine 5765 Service Building Orono, ME 04469	ARCHITECT: <i>(name and address)</i>	CONTRACTOR: <i>(name and address)</i>

A. General Liability	Yes	No	N/A
1. Does this policy include coverage for:			
a Damages because of bodily injury, sickness, or disease, including occupational sickness or disease, and death of any person?	☐	☐	☐
b Personal injury and advertising injury?	☐	☐	☐
c Damages because of physical damage to or destruction of tangible property, including the loss of use of such property?	☐	☐	☐
d Bodily injury or property damage arising out of completed operations?	☐	☐	☐
e The Contractor's indemnity obligations included in the Contract Documents?	☐	☐	☐
2. Does this policy contain an exclusion or restriction of coverage for:			
a Claims by one insured against another insured, where the exclusion or restrictions is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim?	☐	☐	☐
b Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor?	☐	☐	☐
c Claims for bodily injury other than to employees of the insured?	☐	☐	☐
d Claims for the Contractor's indemnity obligations included in the Contract Documents arising out of injury to employees of the insured?	☐	☐	☐
e Claims for loss excluded under a prior work endorsement or other similar exclusionary language?	☐	☐	☐
f Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language?	☐	☐	☐
g Claims related to residential, multi-family, or other habitational projects?	☐	☐	☐
h Claims related to roofing?	☐	☐	☐
i Claims related to exterior insulation finish systems, synthetic stucco, or similar exterior coatings or surfaces?	☐	☐	☐
j Claims related to earth subsistence or movement?	☐	☐	☐
k Claims related to explosion, collapse, and underground hazards?	☐	☐	☐
 B. Other Insurance Coverage	 Yes	 No	 N/A
1. Indicate whether the Contractor has the following insurance coverages and, if so, indicate the coverage limits for each.			
a Professional liability insurance	☐	☐	☐
Coverage limits:			
b Pollution liability insurance	☐	☐	☐

- Coverage limits:
- c** Insurance for maritime liability risks associated with the operation of a vessel ☐ ☐ ☐
- Coverage limits:
- d** Insurance for the use or operation of manned or unmanned aircraft ☐ ☐ ☐
- Coverage limits:
- e** Property insurance ☐ ☐ ☐
- Coverage limits:
- f** Railroad protective liability insurance ☐ ☐ ☐
- Coverage limits:
- g** Asbestos abatement liability insurance ☐ ☐ ☐
- Coverage limits:
- h** Insurance for physical damage to property while it is in storage and in transit to the construction site ☐ ☐ ☐
- Coverage limits:
- i** Other: ☐ ☐ ☐

(Authorized Representative)

(Date of Issue)

ACORDTM CERTIFICATE OF LIABILITY INSURANCE		DATE (MM/DD/YY)
PRODUCER	THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.	
	INSURERS AFFORDING COVERAGE	
INSURED	INSURER A: INSURER B: INSURER C: INSURER D: INSURER E:	

COVERAGES

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS								
	GENERAL LIABILITY ☐ COMMERCIAL GENERAL LIABILITY ☐ CLAIMS MADE ☐ OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: ☐ POLICY ☐ PRO-JECT ☐ LOC				EACH OCCURRENCE \$ FIRE DAMAGE (Any one fire) \$ MED EXP (Any one person) \$ PERSONAL & ADV INJURY \$ GENERAL AGGREGATE \$ PRODUCTS - COMP/OP AGG \$								
	AUTOMOBILE LIABILITY ☐ ANY AUTO ☐ ALL OWNED AUTOS ☐ SCHEDULED AUTOS ☐ HIRED AUTOS ☐ NON-OWNED AUTOS				COMBINED SINGLE LIMIT (Ea accident) \$ BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$								
	GARAGE LIABILITY ☐ ANY AUTO				AUTO ONLY - EA ACCIDENT \$ OTHER THAN EA ACC \$ AUTO ONLY: AGG \$								
	EXCESS LIABILITY ☐ OCCUR ☐ CLAIMS MADE ☐ DEDUCTIBLE ☐ RETENTION \$				EACH OCCURRENCE \$ AGGREGATE \$ \$ \$ \$								
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY				<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 60%;">WC STATU-TORY LIMITS</td> <td style="width: 40%;">OTH-ER</td> </tr> <tr> <td>E.L. EACH ACCIDENT</td> <td>\$</td> </tr> <tr> <td>E.L. DISEASE - EA EMPLOYEE</td> <td>\$</td> </tr> <tr> <td>E.L. DISEASE - POLICY LIMIT</td> <td>\$</td> </tr> </table>	WC STATU-TORY LIMITS	OTH-ER	E.L. EACH ACCIDENT	\$	E.L. DISEASE - EA EMPLOYEE	\$	E.L. DISEASE - POLICY LIMIT	\$
WC STATU-TORY LIMITS	OTH-ER												
E.L. EACH ACCIDENT	\$												
E.L. DISEASE - EA EMPLOYEE	\$												
E.L. DISEASE - POLICY LIMIT	\$												
	OTHER												

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS

University of Maine System is named an additional insured under General Liability.
 Project:

CERTIFICATE HOLDER

ADDITIONAL INSURED; INSURER LETTER: _____

CANCELLATION

University of Maine System
 Office of Risk Management
 Robinson Hall
 46 University Drive
 Augusta, ME 04330

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL _____ DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE

IMPORTANT

If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

DISCLAIMER

The Certificate of Insurance on the reverse side of this form does not constitute a contract between the issuing insurer(s), authorized representative or producer, and the certificate holder, nor does it affirmatively or negatively amend, extend or alter the coverage afforded by the policies listed thereon.

Sample

COMMERCIAL GENERAL LIABILITY COVERAGE FORM

Various provisions in this policy restrict coverage. Read the entire policy carefully to determine rights, duties and what is and is not covered.

Throughout this policy the words "you" and "your" refer to the Named Insured shown in the Declarations, and any other person or organization qualifying as a Named Insured under this policy. The words "we", "us" and "our" refer to the company providing this insurance.

The word "insured" means any person or organization qualifying as such under Section II – Who Is An Insured.

Other words and phrases that appear in quotation marks have special meaning. Refer to Section V – Definitions.

SECTION I – COVERAGES

COVERAGE A BODILY INJURY AND PROPERTY DAMAGE LIABILITY

1. Insuring Agreement

- a. We will pay those sums that the insured becomes legally obligated to pay as damages because of "bodily injury" or "property damage" to which this insurance applies. We will have the right and duty to defend the insured against any "suit" seeking those damages. However, we will have no duty to defend the insured against any "suit" seeking damages for "bodily injury" or "property damage" to which this insurance does not apply. We may, at our discretion, investigate any "occurrence" and settle any claim or "suit" that may result. But:
 - (1) The amount we will pay for damages is limited as described in Section III – Limits Of Insurance; and
 - (2) Our right and duty to defend ends when we have used up the applicable limit of insurance in the payment of judgments or settlements under Coverages A or B or medical expenses under Coverage C.

No other obligation or liability to pay sums or perform acts or services is covered unless explicitly provided for under Supplementary Payments – Coverages A and B.
- b. This insurance applies to "bodily injury" and "property damage" only if:
 - (1) The "bodily injury" or "property damage" is caused by an "occurrence" that takes place in the "coverage territory";
 - (2) The "bodily injury" or "property damage" occurs during the policy period; and
 - (3) Prior to the policy period, no insured listed under Paragraph 1. of Section II – Who Is An Insured and no "employee" authorized by you to give or receive notice of an "occurrence" or claim, knew that the "bodily injury" or "property damage" had occurred, in whole or in part. If such a listed insured or authorized "employee" knew, prior to the policy period, that the "bodily injury" or "property damage" occurred, then any continuation, change or resumption of such "bodily injury" or "property damage" during or after the policy period will be deemed to have been known prior to the policy period.
- c. "Bodily injury" or "property damage" which occurs during the policy period and was not, prior to the policy period, known to have occurred by any insured listed under Paragraph 1. of Section II – Who Is An Insured or any "employee" authorized by you to give or receive notice of an "occurrence" or claim, includes any continuation, change or resumption of that "bodily injury" or "property damage" after the end of the policy period.
- d. "Bodily injury" or "property damage" will be deemed to have been known to have occurred at the earliest time when any insured listed under Paragraph 1. of Section II – Who Is An Insured or any "employee" authorized by you to give or receive notice of an "occurrence" or claim:
 - (1) Reports all, or any part, of the "bodily injury" or "property damage" to us or any other insurer;
 - (2) Receives a written or verbal demand or claim for damages because of the "bodily injury" or "property damage"; or
 - (3) Becomes aware by any other means that "bodily injury" or "property damage" has occurred or has begun to occur.

- e. Damages because of "bodily injury" include damages claimed by any person or organization for care, loss of services or death resulting at any time from the "bodily injury".

2. Exclusions

This insurance does not apply to:

a. Expected Or Intended Injury

"Bodily injury" or "property damage" expected or intended from the standpoint of the insured. This exclusion does not apply to "bodily injury" resulting from the use of reasonable force to protect persons or property.

b. Contractual Liability

"Bodily injury" or "property damage" for which the insured is obligated to pay damages by reason of the assumption of liability in a contract or agreement. This exclusion does not apply to liability for damages:

- (1) That the insured would have in the absence of the contract or agreement; or
- (2) Assumed in a contract or agreement that is an "insured contract", provided the "bodily injury" or "property damage" occurs subsequent to the execution of the contract or agreement. Solely for the purposes of liability assumed in an "insured contract", reasonable attorney fees and necessary litigation expenses incurred by or for a party other than an insured are deemed to be damages because of "bodily injury" or "property damage", provided:
 - (a) Liability to such party for, or for the cost of, that party's defense has also been assumed in the same "insured contract"; and
 - (b) Such attorney fees and litigation expenses are for defense of that party against a civil or alternative dispute resolution proceeding in which damages to which this insurance applies are alleged.

c. Liquor Liability

"Bodily injury" or "property damage" for which any insured may be held liable by reason of:

- (1) Causing or contributing to the intoxication of any person;
- (2) The furnishing of alcoholic beverages to a person under the legal drinking age or under the influence of alcohol; or
- (3) Any statute, ordinance or regulation relating to the sale, gift, distribution or use of alcoholic beverages.

This exclusion applies only if you are in the business of manufacturing, distributing, selling, serving or furnishing alcoholic beverages.

d. Workers' Compensation And Similar Laws

Any obligation of the insured under a workers' compensation, disability benefits or unemployment compensation law or any similar law.

e. Employer's Liability

"Bodily injury" to:

- (1) An "employee" of the insured arising out of and in the course of:
 - (a) Employment by the insured; or
 - (b) Performing duties related to the conduct of the insured's business; or
- (2) The spouse, child, parent, brother or sister of that "employee" as a consequence of Paragraph (1) above.

This exclusion applies:

- (1) Whether the insured may be liable as an employer or in any other capacity; and
- (2) To any obligation to share damages with or repay someone else who must pay damages because of the injury.

This exclusion does not apply to liability assumed by the insured under an "insured contract".

f. Pollution

- (1) "Bodily injury" or "property damage" arising out of the actual, alleged or threatened discharge, dispersal, seepage, migration, release or escape of "pollutants":
- (a) At or from any premises, site or location which is or was at any time owned or occupied by, or rented or loaned to, any insured. However, this subparagraph does not apply to:
 - (i) "Bodily injury" if sustained within a building and caused by smoke, fumes, vapor or soot produced by or originating from equipment that is used to heat, cool or dehumidify the building, or equipment that is used to heat water for personal use, by the building's occupants or their guests;
 - (ii) "Bodily injury" or "property damage" for which you may be held liable, if you are a contractor and the owner or lessee of such premises, site or location has been added to your policy as an additional insured with respect to your ongoing operations performed for that additional insured at that premises, site or location and such premises, site or location is not and never was owned or occupied by, or rented or loaned to, any insured, other than that additional insured; or
 - (iii) "Bodily injury" or "property damage" arising out of heat, smoke or fumes from a "hostile fire";
 - (b) At or from any premises, site or location which is or was at any time used by or for any insured or others for the handling, storage, disposal, processing or treatment of waste;
 - (c) Which are or were at any time transported, handled, stored, treated, disposed of, or processed as waste by or for:
 - (i) Any insured; or
 - (ii) Any person or organization for whom you may be legally responsible; or
 - (d) At or from any premises, site or location on which any insured or any contractors or subcontractors working directly or indirectly on any insured's behalf are performing operations if the "pollutants" are brought on or to the premises, site or location in connection with such operations by such insured, contractor or subcontractor. However, this subparagraph does not apply to:
 - (i) "Bodily injury" or "property damage" arising out of the escape of fuels, lubricants or other operating fluids which are needed to perform the normal electrical, hydraulic or mechanical functions necessary for the operation of "mobile equipment" or its parts, if such fuels, lubricants or other operating fluids escape from a vehicle part designed to hold, store or receive them. This exception does not apply if the "bodily injury" or "property damage" arises out of the intentional discharge, dispersal or release of the fuels, lubricants or other operating fluids, or if such fuels, lubricants or other operating fluids are brought on or to the premises, site or location with the intent that they be discharged, dispersed or released as part of the operations being performed by such insured, contractor or subcontractor;
 - (ii) "Bodily injury" or "property damage" sustained within a building and caused by the release of gases, fumes or vapors from materials brought into that building in connection with operations being performed by you or on your behalf by a contractor or subcontractor; or
 - (iii) "Bodily injury" or "property damage" arising out of heat, smoke or fumes from a "hostile fire".
 - (e) At or from any premises, site or location on which any insured or any contractors or subcontractors working directly or indirectly on any insured's behalf are performing operations if the operations are to test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of, "pollutants".

(2) Any loss, cost or expense arising out of any:

- (a) Request, demand, order or statutory or regulatory requirement that any insured or others test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of, "pollutants"; or
- (b) Claim or "suit" by or on behalf of a governmental authority for damages because of testing for, monitoring, cleaning up, removing, containing, treating, detoxifying or neutralizing, or in any way responding to, or assessing the effects of, "pollutants".

However, this paragraph does not apply to liability for damages because of "property damage" that the insured would have in the absence of such request, demand, order or statutory or regulatory requirement, or such claim or "suit" by or on behalf of a governmental authority.

g. Aircraft, Auto Or Watercraft

"Bodily injury" or "property damage" arising out of the ownership, maintenance, use or entrustment to others of any aircraft, "auto" or watercraft owned or operated by or rented or loaned to any insured. Use includes operation and "loading or unloading".

This exclusion applies even if the claims against any insured allege negligence or other wrongdoing in the supervision, hiring, employment, training or monitoring of others by that insured, if the "occurrence" which caused the "bodily injury" or "property damage" involved the ownership, maintenance, use or entrustment to others of any aircraft, "auto" or watercraft that is owned or operated by or rented or loaned to any insured.

This exclusion does not apply to:

- (1) A watercraft while ashore on premises you own or rent;
- (2) A watercraft you do not own that is:
 - (a) Less than 26 feet long; and
 - (b) Not being used to carry persons or property for a charge;
- (3) Parking an "auto" on, or on the ways next to, premises you own or rent, provided the "auto" is not owned by or rented or loaned to you or the insured;
- (4) Liability assumed under any "insured contract" for the ownership, maintenance or use of aircraft or watercraft; or

(5) "Bodily injury" or "property damage" arising out of:

- (a) The operation of machinery or equipment that is attached to, or part of, a land vehicle that would qualify under the definition of "mobile equipment" if it were not subject to a compulsory or financial responsibility law or other motor vehicle insurance law in the state where it is licensed or principally garaged; or
- (b) the operation of any of the machinery or equipment listed in Paragraph **f.(2)** or **f.(3)** of the definition of "mobile equipment".

h. Mobile Equipment

"Bodily injury" or "property damage" arising out of:

- (1) The transportation of "mobile equipment" by an "auto" owned or operated by or rented or loaned to any insured; or
- (2) The use of "mobile equipment" in, or while in practice for, or while being prepared for, any prearranged racing, speed, demolition, or stunting activity.

i. War

"Bodily injury" or "property damage", however caused, arising, directly or indirectly, out of:

- (1) War, including undeclared or civil war;
- (2) Warlike action by a military force, including action in hindering or defending against an actual or expected attack, by any government, sovereign or other authority using military personnel or other agents; or
- (3) Insurrection, rebellion, revolution, usurped power, or action taken by governmental authority in hindering or defending against any of these.

j. Damage To Property

"Property damage" to:

- (1) Property you own, rent, or occupy, including any costs or expenses incurred by you, or any other person, organization or entity, for repair, replacement, enhancement, restoration or maintenance of such property for any reason, including prevention of injury to a person or damage to another's property;
- (2) Premises you sell, give away or abandon, if the "property damage" arises out of any part of those premises;
- (3) Property loaned to you;
- (4) Personal property in the care, custody or control of the insured;

(5) That particular part of real property on which you or any contractors or subcontractors working directly or indirectly on your behalf are performing operations, if the "property damage" arises out of those operations; or

(6) That particular part of any property that must be restored, repaired or replaced because "your work" was incorrectly performed on it.

Paragraphs (1), (3) and (4) of this exclusion do not apply to "property damage" (other than damage by fire) to premises, including the contents of such premises, rented to you for a period of 7 or fewer consecutive days. A separate limit of insurance applies to Damage To Premises Rented To You as described in Section III – Limits Of Insurance.

Paragraph (2) of this exclusion does not apply if the premises are "your work" and were never occupied, rented or held for rental by you.

Paragraphs (3), (4), (5) and (6) of this exclusion do not apply to liability assumed under a side-track agreement.

Paragraph (6) of this exclusion does not apply to "property damage" included in the "products-completed operations hazard".

k. Damage To Your Product

"Property damage" to "your product" arising out of it or any part of it.

l. Damage To Your Work

"Property damage" to "your work" arising out of it or any part of it and included in the "products-completed operations hazard".

This exclusion does not apply if the damaged work or the work out of which the damage arises was performed on your behalf by a subcontractor.

m. Damage To Impaired Property Or Property Not Physically Injured

"Property damage" to "impaired property" or property that has not been physically injured, arising out of:

- (1) A defect, deficiency, inadequacy or dangerous condition in "your product" or "your work"; or
- (2) A delay or failure by you or anyone acting on your behalf to perform a contract or agreement in accordance with its terms.

This exclusion does not apply to the loss of use of other property arising out of sudden and accidental physical injury to "your product" or "your work" after it has been put to its intended use.

n. Recall Of Products, Work Or Impaired Property

Damages claimed for any loss, cost or expense incurred by you or others for the loss of use, withdrawal, recall, inspection, repair, replacement, adjustment, removal or disposal of:

- (1) "Your product";
- (2) "Your work"; or
- (3) "Impaired property";

if such product, work, or property is withdrawn or recalled from the market or from use by any person or organization because of a known or suspected defect, deficiency, inadequacy or dangerous condition in it.

o. Personal And Advertising Injury

"Bodily injury" arising out of "personal and advertising injury".

p. Electronic Data

Damages arising out of the loss of, loss of use of, damage to, corruption of, inability to access, or inability to manipulate electronic data.

As used in this exclusion, electronic data means information, facts or programs stored as or on, created or used on, or transmitted to or from computer software, including systems and applications software, hard or floppy disks, CD-ROMS, tapes, drives, cells, data processing devices or any other media which are used with electronically controlled equipment.

Exclusions c. through n. do not apply to damage by fire to premises while rented to you or temporarily occupied by you with permission of the owner. A separate limit of insurance applies to this coverage as described in Section III – Limits Of Insurance.

COVERAGE B PERSONAL AND ADVERTISING INJURY LIABILITY

1. Insuring Agreement

a. We will pay those sums that the insured becomes legally obligated to pay as damages because of "personal and advertising injury" to which this insurance applies. We will have the right and duty to defend the insured against any "suit" seeking those damages. However, we will have no duty to defend the insured against any "suit" seeking damages for "personal and advertising injury" to which this insurance does not apply. We may, at our discretion, investigate any offense and settle any claim or "suit" that may result. But:

- (1) The amount we will pay for damages is limited as described in Section III – Limits Of Insurance; and

- (2) Our right and duty to defend end when we have used up the applicable limit of insurance in the payment of judgments or settlements under Coverages **A** or **B** or medical expenses under Coverage **C**.

No other obligation or liability to pay sums or perform acts or services is covered unless explicitly provided for under Supplementary Payments – Coverages **A** and **B**.

- b. This insurance applies to "personal and advertising injury" caused by an offense arising out of your business but only if the offense was committed in the "coverage territory" during the policy period.

2. Exclusions

This insurance does not apply to:

a. Knowing Violation Of Rights Of Another

"Personal and advertising injury" caused by or at the direction of the insured with the knowledge that the act would violate the rights of another and would inflict "personal and advertising injury".

b. Material Published With Knowledge Of Falsity

"Personal and advertising injury" arising out of oral or written publication of material, if done by or at the direction of the insured with knowledge of its falsity.

c. Material Published Prior To Policy Period

"Personal and advertising injury" arising out of oral or written publication of material whose first publication took place before the beginning of the policy period.

d. Criminal Acts

"Personal and advertising injury" arising out of a criminal act committed by or at the direction of the insured.

e. Contractual Liability

"Personal and advertising injury" for which the insured has assumed liability in a contract or agreement. This exclusion does not apply to liability for damages that the insured would have in the absence of the contract or agreement.

f. Breach Of Contract

"Personal and advertising injury" arising out of a breach of contract, except an implied contract to use another's advertising idea in your "advertisement".

g. Quality Or Performance Of Goods – Failure To Conform To Statements

"Personal and advertising injury" arising out of the failure of goods, products or services to conform with any statement of quality or performance made in your "advertisement".

h. Wrong Description Of Prices

"Personal and advertising injury" arising out of the wrong description of the price of goods, products or services stated in your "advertisement".

i. Infringement Of Copyright, Patent, Trademark Or Trade Secret

"Personal and advertising injury" arising out of the infringement of copyright, patent, trademark, trade secret or other intellectual property rights.

However, this exclusion does not apply to infringement, in your "advertisement", of copyright, trade dress or slogan.

j. Insureds In Media And Internet Type Businesses

"Personal and advertising injury" committed by an insured whose business is:

- (1) Advertising, broadcasting, publishing or telecasting;
- (2) Designing or determining content of websites for others; or
- (3) An Internet search, access, content or service provider.

However, this exclusion does not apply to Paragraphs **14.a.**, **b.** and **c.** of "personal and advertising injury" under the Definitions Section.

For the purposes of this exclusion, the placing of frames, borders or links, or advertising, for you or others anywhere on the Internet, is not by itself, considered the business of advertising, broadcasting, publishing or telecasting.

k. Electronic Chatrooms Or Bulletin Boards

"Personal and advertising injury" arising out of an electronic chatroom or bulletin board the insured hosts, owns, or over which the insured exercises control.

l. Unauthorized Use Of Another's Name Or Product

"Personal and advertising injury" arising out of the unauthorized use of another's name or product in your e-mail address, domain name or metatag, or any other similar tactics to mislead another's potential customers.

m. Pollution

"Personal and advertising injury" arising out of the actual, alleged or threatened discharge, dispersal, seepage, migration, release or escape of "pollutants" at any time.

n. Pollution-Related

Any loss, cost or expense arising out of any:

- (1) Request, demand, order or statutory or regulatory requirement that any insured or others test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of, "pollutants"; or
- (2) Claim or suit by or on behalf of a governmental authority for damages because of testing for, monitoring, cleaning up, removing, containing, treating, detoxifying or neutralizing, or in any way responding to, or assessing the effects of, "pollutants".

o. War

"Personal and advertising injury", however caused, arising, directly or indirectly, out of:

- (1) War, including undeclared or civil war;
- (2) Warlike action by a military force, including action in hindering or defending against an actual or expected attack, by any government, sovereign or other authority using military personnel or other agents; or
- (3) Insurrection, rebellion, revolution, usurped power, or action taken by governmental authority in hindering or defending against any of these.

COVERAGE C MEDICAL PAYMENTS

1. Insuring Agreement

- a. We will pay medical expenses as described below for "bodily injury" caused by an accident:

- (1) On premises you own or rent;
- (2) On ways next to premises you own or rent; or
- (3) Because of your operations; provided that:
 - (1) The accident takes place in the "coverage territory" and during the policy period;
 - (2) The expenses are incurred and reported to us within one year of the date of the accident; and
 - (3) The injured person submits to examination, at our expense, by physicians of our choice as often as we reasonably require.

- b. We will make these payments regardless of fault. These payments will not exceed the applicable limit of insurance. We will pay reasonable expenses for:

- (1) First aid administered at the time of an accident;
- (2) Necessary medical, surgical, x-ray and dental services, including prosthetic devices; and
- (3) Necessary ambulance, hospital, professional nursing and funeral services.

2. Exclusions

We will not pay expenses for "bodily injury":

a. Any Insured

To any insured, except "volunteer workers".

b. Hired Person

To a person hired to do work for or on behalf of any insured or a tenant of any insured.

c. Injury On Normally Occupied Premises

To a person injured on that part of premises you own or rent that the person normally occupies.

d. Workers Compensation And Similar Laws

To a person, whether or not an "employee" of any insured, if benefits for the "bodily injury" are payable or must be provided under a workers' compensation or disability benefits law or a similar law.

e. Athletics Activities

To a person injured while practicing, instructing or participating in any physical exercises or games, sports, or athletic contests.

f. Products-Completed Operations Hazard

Included within the "products-completed operations hazard".

g. Coverage A Exclusions

Excluded under Coverage A.

SUPPLEMENTARY PAYMENTS – COVERAGES A AND B

1. We will pay, with respect to any claim we investigate or settle, or any "suit" against an insured we defend:

- a. All expenses we incur.
- b. Up to \$250 for cost of bail bonds required because of accidents or traffic law violations arising out of the use of any vehicle to which the Bodily Injury Liability Coverage applies. We do not have to furnish these bonds.

- c. The cost of bonds to release attachments, but only for bond amounts within the applicable limit of insurance. We do not have to furnish these bonds.
- d. All reasonable expenses incurred by the insured at our request to assist us in the investigation or defense of the claim or "suit", including actual loss of earnings up to \$250 a day because of time off from work.
- e. All costs taxed against the insured in the "suit".
- f. Prejudgment interest awarded against the insured on that part of the judgment we pay. If we make an offer to pay the applicable limit of insurance, we will not pay any prejudgment interest based on that period of time after the offer.
- g. All interest on the full amount of any judgment that accrues after entry of the judgment and before we have paid, offered to pay, or deposited in court the part of the judgment that is within the applicable limit of insurance.

These payments will not reduce the limits of insurance.

- 2. If we defend an insured against a "suit" and an indemnitee of the insured is also named as a party to the "suit", we will defend that indemnitee if all of the following conditions are met:
 - a. The "suit" against the indemnitee seeks damages for which the insured has assumed the liability of the indemnitee in a contract or agreement that is an "insured contract";
 - b. This insurance applies to such liability assumed by the insured;
 - c. The obligation to defend, or the cost of the defense of, that indemnitee, has also been assumed by the insured in the same "insured contract";
 - d. The allegations in the "suit" and the information we know about the "occurrence" are such that no conflict appears to exist between the interests of the insured and the interests of the indemnitee;
 - e. The indemnitee and the insured ask us to conduct and control the defense of that indemnitee against such "suit" and agree that we can assign the same counsel to defend the insured and the indemnitee; and
 - f. The indemnitee:
 - (1) Agrees in writing to:
 - (a) Cooperate with us in the investigation, settlement or defense of the "suit";

- (b) Immediately send us copies of any demands, notices, summonses or legal papers received in connection with the "suit";
 - (c) Notify any other insurer whose coverage is available to the indemnitee; and
 - (d) Cooperate with us with respect to coordinating other applicable insurance available to the indemnitee; and
- (2) Provides us with written authorization to:
 - (a) Obtain records and other information related to the "suit"; and
 - (b) Conduct and control the defense of the indemnitee in such "suit".

So long as the above conditions are met, attorneys' fees incurred by us in the defense of that indemnitee, necessary litigation expenses incurred by us and necessary litigation expenses incurred by the indemnitee at our request will be paid as Supplementary Payments. Notwithstanding the provisions of Paragraph **2.b.(2)** of Section **I – Coverage A – Bodily Injury And Property Damage Liability**, such payments will not be deemed to be damages for "bodily injury" and "property damage" and will not reduce the limits of insurance.

Our obligation to defend an insured's indemnitee and to pay for attorneys' fees and necessary litigation expenses as Supplementary Payments ends when:

- a. We have used up the applicable limit of insurance in the payment of judgments or settlements; or
- b. The conditions set forth above, or the terms of the agreement described in Paragraph **f.** above, are no longer met.

SECTION II – WHO IS AN INSURED

- 1. If you are designated in the Declarations as:
 - a. An individual, you and your spouse are insureds, but only with respect to the conduct of a business of which you are the sole owner.
 - b. A partnership or joint venture, you are an insured. Your members, your partners, and their spouses are also insureds, but only with respect to the conduct of your business.
 - c. A limited liability company, you are an insured. Your members are also insureds, but only with respect to the conduct of your business. Your managers are insureds, but only with respect to their duties as your managers.

- d. An organization other than a partnership, joint venture or limited liability company, you are an insured. Your "executive officers" and directors are insureds, but only with respect to their duties as your officers or directors. Your stockholders are also insureds, but only with respect to their liability as stockholders.
 - e. A trust, you are an insured. Your trustees are also insureds, but only with respect to their duties as trustees.
2. Each of the following is also an insured:
- a. Your "volunteer workers" only while performing duties related to the conduct of your business, or your "employees", other than either your "executive officers" (if you are an organization other than a partnership, joint venture or limited liability company) or your managers (if you are a limited liability company), but only for acts within the scope of their employment by you or while performing duties related to the conduct of your business. However, none of these "employees" or "volunteer workers" are insureds for:
 - (1) "Bodily injury" or "personal and advertising injury":
 - (a) To you, to your partners or members (if you are a partnership or joint venture), to your members (if you are a limited liability company), to a co-"employee" while in the course of his or her employment or performing duties related to the conduct of your business, or to your other "volunteer workers" while performing duties related to the conduct of your business;
 - (b) To the spouse, child, parent, brother or sister of that co-"employee" or "volunteer worker" as a consequence of Paragraph (1)(a) above;
 - (c) For which there is any obligation to share damages with or repay someone else who must pay damages because of the injury described in Paragraphs (1)(a) or (b) above; or
 - (d) Arising out of his or her providing or failing to provide professional health care services.
 - (2) "Property damage" to property:
 - (a) Owned, occupied or used by,
 - (b) Rented to, in the care, custody or control of, or over which physical control is being exercised for any purpose by you, any of your "employees", "volunteer workers", any partner or member (if you are a partnership or joint venture), or any member (if you are a limited liability company).
 - b. Any person (other than your "employee" or "volunteer worker"), or any organization while acting as your real estate manager.
 - c. Any person or organization having proper temporary custody of your property if you die, but only:
 - (1) With respect to liability arising out of the maintenance or use of that property; and
 - (2) Until your legal representative has been appointed.
 - d. Your legal representative if you die, but only with respect to duties as such. That representative will have all your rights and duties under this Coverage Part.
3. Any organization you newly acquire or form, other than a partnership, joint venture or limited liability company, and over which you maintain ownership or majority interest, will qualify as a Named Insured if there is no other similar insurance available to that organization. However:
- a. Coverage under this provision is afforded only until the 90th day after you acquire or form the organization or the end of the policy period, whichever is earlier;
 - b. Coverage A does not apply to "bodily injury" or "property damage" that occurred before you acquired or formed the organization; and
 - c. Coverage B does not apply to "personal and advertising injury" arising out of an offense committed before you acquired or formed the organization.
- No person or organization is an insured with respect to the conduct of any current or past partnership, joint venture or limited liability company that is not shown as a Named Insured in the Declarations.

SECTION III – LIMITS OF INSURANCE

- 1. The Limits of Insurance shown in the Declarations and the rules below fix the most we will pay regardless of the number of:
 - a. Insureds;
 - b. Claims made or "suits" brought; or
 - c. Persons or organizations making claims or bringing "suits".

2. The General Aggregate Limit is the most we will pay for the sum of:
 - a. Medical expenses under Coverage C;
 - b. Damages under Coverage A, except damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard"; and
 - c. Damages under Coverage B.
3. The Products-Completed Operations Aggregate Limit is the most we will pay under Coverage A for damages because of "bodily injury" and "property damage" included in the "products-completed operations hazard".
4. Subject to 2. above, the Personal and Advertising Injury Limit is the most we will pay under Coverage B for the sum of all damages because of all "personal and advertising injury" sustained by any one person or organization.
5. Subject to 2. or 3. above, whichever applies, the Each Occurrence Limit is the most we will pay for the sum of:
 - a. Damages under Coverage A; and
 - b. Medical expenses under Coverage C because of all "bodily injury" and "property damage" arising out of any one "occurrence".
6. Subject to 5. above, the Damage To Premises Rented To You Limit is the most we will pay under Coverage A for damages because of "property damage" to any one premises, while rented to you, or in the case of damage by fire, while rented to you or temporarily occupied by you with permission of the owner.
7. Subject to 5. above, the Medical Expense Limit is the most we will pay under Coverage C for all medical expenses because of "bodily injury" sustained by any one person.

The Limits of Insurance of this Coverage Part apply separately to each consecutive annual period and to any remaining period of less than 12 months, starting with the beginning of the policy period shown in the Declarations, unless the policy period is extended after issuance for an additional period of less than 12 months. In that case, the additional period will be deemed part of the last preceding period for purposes of determining the Limits of Insurance.

SECTION IV – COMMERCIAL GENERAL LIABILITY CONDITIONS

1. Bankruptcy

Bankruptcy or insolvency of the insured or of the insured's estate will not relieve us of our obligations under this Coverage Part.

2. Duties In The Event Of Occurrence, Offense, Claim Or Suit

- a. You must see to it that we are notified as soon as practicable of an "occurrence" or an offense which may result in a claim. To the extent possible, notice should include:
 - (1) How, when and where the "occurrence" or offense took place;
 - (2) The names and addresses of any injured persons and witnesses; and
 - (3) The nature and location of any injury or damage arising out of the "occurrence" or offense.
- b. If a claim is made or "suit" is brought against any insured, you must:
 - (1) Immediately record the specifics of the claim or "suit" and the date received; and
 - (2) Notify us as soon as practicable.

You must see to it that we receive written notice of the claim or "suit" as soon as practicable.
- c. You and any other involved insured must:
 - (1) Immediately send us copies of any demands, notices, summonses or legal papers received in connection with the claim or "suit";
 - (2) Authorize us to obtain records and other information;
 - (3) Cooperate with us in the investigation or settlement of the claim or defense against the "suit"; and
 - (4) Assist us, upon our request, in the enforcement of any right against any person or organization which may be liable to the insured because of injury or damage to which this insurance may also apply.
- d. No insured will, except at that insured's own cost, voluntarily make a payment, assume any obligation, or incur any expense, other than for first aid, without our consent.

3. Legal Action Against Us

No person or organization has a right under this Coverage Part:

- a. To join us as a party or otherwise bring us into a "suit" asking for damages from an insured; or

- b.** To sue us on this Coverage Part unless all of its terms have been fully complied with.

A person or organization may sue us to recover on an agreed settlement or on a final judgment against an insured; but we will not be liable for damages that are not payable under the terms of this Coverage Part or that are in excess of the applicable limit of insurance. An agreed settlement means a settlement and release of liability signed by us, the insured and the claimant or the claimant's legal representative.

4. Other Insurance

If other valid and collectible insurance is available to the insured for a loss we cover under Coverages **A** or **B** of this Coverage Part, our obligations are limited as follows:

a. Primary Insurance

This insurance is primary except when **b.** below applies. If this insurance is primary, our obligations are not affected unless any of the other insurance is also primary. Then, we will share with all that other insurance by the method described in **c.** below.

b. Excess Insurance

This insurance is excess over:

- (1)** Any of the other insurance, whether primary, excess, contingent or on any other basis:
 - (a)** That is Fire, Extended Coverage, Builder's Risk, Installation Risk or similar coverage for "your work";
 - (b)** That is Fire insurance for premises rented to you or temporarily occupied by you with permission of the owner;
 - (c)** That is insurance purchased by you to cover your liability as a tenant for "property damage" to premises rented to you or temporarily occupied by you with permission of the owner; or
 - (d)** If the loss arises out of the maintenance or use of aircraft, "autos" or watercraft to the extent not subject to Exclusion **g.** of Section **I** – Coverage **A** – Bodily Injury And Property Damage Liability.
- (2)** Any other primary insurance available to you covering liability for damages arising out of the premises or operations, or the products and completed operations, for which you have been added as an additional insured by attachment of an endorsement.

When this insurance is excess, we will have no duty under Coverages **A** or **B** to defend the insured against any "suit" if any other insurer has a duty to defend the insured against that "suit". If no other insurer defends, we will undertake to do so, but we will be entitled to the insured's rights against all those other insurers.

When this insurance is excess over other insurance, we will pay only our share of the amount of the loss, if any, that exceeds the sum of:

- (1)** The total amount that all such other insurance would pay for the loss in the absence of this insurance; and
- (2)** The total of all deductible and self-insured amounts under all that other insurance.

We will share the remaining loss, if any, with any other insurance that is not described in this Excess Insurance provision and was not bought specifically to apply in excess of the Limits of Insurance shown in the Declarations of this Coverage Part.

c. Method Of Sharing

If all of the other insurance permits contribution by equal shares, we will follow this method also. Under this approach each insurer contributes equal amounts until it has paid its applicable limit of insurance or none of the loss remains, whichever comes first.

If any of the other insurance does not permit contribution by equal shares, we will contribute by limits. Under this method, each insurer's share is based on the ratio of its applicable limit of insurance to the total applicable limits of insurance of all insurers.

5. Premium Audit

- a.** We will compute all premiums for this Coverage Part in accordance with our rules and rates.
- b.** Premium shown in this Coverage Part as advance premium is a deposit premium only. At the close of each audit period we will compute the earned premium for that period and send notice to the first Named Insured. The due date for audit and retrospective premiums is the date shown as the due date on the bill. If the sum of the advance and audit premiums paid for the policy period is greater than the earned premium, we will return the excess to the first Named Insured.
- c.** The first Named Insured must keep records of the information we need for premium computation, and send us copies at such times as we may request.

6. Representations

By accepting this policy, you agree:

- a. The statements in the Declarations are accurate and complete;
- b. Those statements are based upon representations you made to us; and
- c. We have issued this policy in reliance upon your representations.

7. Separation Of Insureds

Except with respect to the Limits of Insurance, and any rights or duties specifically assigned in this Coverage Part to the first Named Insured, this insurance applies:

- a. As if each Named Insured were the only Named Insured; and
- b. Separately to each insured against whom claim is made or "suit" is brought.

8. Transfer Of Rights Of Recovery Against Others To Us

If the insured has rights to recover all or part of any payment we have made under this Coverage Part, those rights are transferred to us. The insured must do nothing after loss to impair them. At our request, the insured will bring "suit" or transfer those rights to us and help us enforce them.

9. When We Do Not Renew

If we decide not to renew this Coverage Part, we will mail or deliver to the first Named Insured shown in the Declarations written notice of the non-renewal not less than 30 days before the expiration date.

If notice is mailed, proof of mailing will be sufficient proof of notice.

SECTION V – DEFINITIONS

1. "Advertisement" means a notice that is broadcast or published to the general public or specific market segments about your goods, products or services for the purpose of attracting customers or supporters. For the purposes of this definition:
 - a. Notices that are published include material placed on the Internet or on similar electronic means of communication; and
 - b. Regarding web-sites, only that part of a web-site that is about your goods, products or services for the purposes of attracting customers or supporters is considered an advertisement.
2. "Auto" means:
 - a. A land motor vehicle, trailer or semitrailer designed for travel on public roads, including any attached machinery or equipment; or

- b. Any other land vehicle that is subject to a compulsory or financial responsibility law or other motor vehicle insurance law in the state where it is licensed or principally garaged.

However, "auto" does not include "mobile equipment".

3. "Bodily injury" means bodily injury, sickness or disease sustained by a person, including death resulting from any of these at any time.

4. "Coverage territory" means:

- a. The United States of America (including its territories and possessions), Puerto Rico and Canada;
- b. International waters or airspace, but only if the injury or damage occurs in the course of travel or transportation between any places included in a. above; or
- c. All other parts of the world if the injury or damage arises out of:
 - (1) Goods or products made or sold by you in the territory described in a. above;
 - (2) The activities of a person whose home is in the territory described in a. above, but is away for a short time on your business; or
 - (3) "Personal and advertising injury" offenses that take place through the Internet or similar electronic means of communication

provided the insured's responsibility to pay damages is determined in a "suit" on the merits, in the territory described in a. above or in a settlement we agree to.

5. "Employee" includes a "leased worker". "Employee" does not include a "temporary worker".
6. "Executive officer" means a person holding any of the officer positions created by your charter, constitution, by-laws or any other similar governing document.
7. "Hostile fire" means one which becomes uncontrollable or breaks out from where it was intended to be.
8. "Impaired property" means tangible property, other than "your product" or "your work", that cannot be used or is less useful because:
 - a. It incorporates "your product" or "your work" that is known or thought to be defective, deficient, inadequate or dangerous; or
 - b. You have failed to fulfill the terms of a contract or agreement;if such property can be restored to use by:
 - a. The repair, replacement, adjustment or removal of "your product" or "your work"; or

- b. Your fulfilling the terms of the contract or agreement.

9. "Insured contract" means:

- a. A contract for a lease of premises. However, that portion of the contract for a lease of premises that indemnifies any person or organization for damage by fire to premises while rented to you or temporarily occupied by you with permission of the owner is not an "insured contract";
- b. A sidetrack agreement;
- c. Any easement or license agreement, except in connection with construction or demolition operations on or within 50 feet of a railroad;
- d. An obligation, as required by ordinance, to indemnify a municipality, except in connection with work for a municipality;
- e. An elevator maintenance agreement;
- f. That part of any other contract or agreement pertaining to your business (including an indemnification of a municipality in connection with work performed for a municipality) under which you assume the tort liability of another party to pay for "bodily injury" or "property damage" to a third person or organization. Tort liability means a liability that would be imposed by law in the absence of any contract or agreement.

Paragraph f. does not include that part of any contract or agreement:

- (1) That indemnifies a railroad for "bodily injury" or "property damage" arising out of construction or demolition operations, within 50 feet of any railroad property and affecting any railroad bridge or trestle, tracks, roadbeds, tunnel, underpass or crossing;
- (2) That indemnifies an architect, engineer or surveyor for injury or damage arising out of:
 - (a) Preparing, approving, or failing to prepare or approve, maps, shop drawings, opinions, reports, surveys, field orders, change orders or drawings and specifications; or
 - (b) Giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage; or
- (3) Under which the insured, if an architect, engineer or surveyor, assumes liability for an injury or damage arising out of the insured's rendering or failure to render professional services, including those listed in (2) above and supervisory, inspection, architectural or engineering activities.

10. "Leased worker" means a person leased to you by a labor leasing firm under an agreement between you and the labor leasing firm, to perform duties related to the conduct of your business. "Leased worker" does not include a "temporary worker".

11. "Loading or unloading" means the handling of property:

- a. After it is moved from the place where it is accepted for movement into or onto an aircraft, watercraft or "auto";
- b. While it is in or on an aircraft, watercraft or "auto"; or
- c. While it is being moved from an aircraft, watercraft or "auto" to the place where it is finally delivered;

but "loading or unloading" does not include the movement of property by means of a mechanical device, other than a hand truck, that is not attached to the aircraft, watercraft or "auto".

12. "Mobile equipment" means any of the following types of land vehicles, including any attached machinery or equipment:

- a. Bulldozers, farm machinery, forklifts and other vehicles designed for use principally off public roads;
- b. Vehicles maintained for use solely on or next to premises you own or rent;
- c. Vehicles that travel on crawler treads;
- d. Vehicles, whether self-propelled or not, maintained primarily to provide mobility to permanently mounted:
 - (1) Power cranes, shovels, loaders, diggers or drills; or
 - (2) Road construction or resurfacing equipment such as graders, scrapers or rollers;
- e. Vehicles not described in a., b., c. or d. above that are not self-propelled and are maintained primarily to provide mobility to permanently attached equipment of the following types:
 - (1) Air compressors, pumps and generators, including spraying, welding, building cleaning, geophysical exploration, lighting and well servicing equipment; or
 - (2) Cherry pickers and similar devices used to raise or lower workers;
- f. Vehicles not described in a., b., c. or d. above maintained primarily for purposes other than the transportation of persons or cargo.

However, self-propelled vehicles with the following types of permanently attached equipment are not "mobile equipment" but will be considered "autos":

- (1) Equipment designed primarily for:
 - (a) Snow removal;
 - (b) Road maintenance, but not construction or resurfacing; or
 - (c) Street cleaning;
- (2) Cherry pickers and similar devices mounted on automobile or truck chassis and used to raise or lower workers; and
- (3) Air compressors, pumps and generators, including spraying, welding, building cleaning, geophysical exploration, lighting and well servicing equipment.

However, "mobile equipment" does not include any land vehicles that are subject to a compulsory or financial responsibility law or other motor vehicle insurance law in the state where it is licensed or principally garaged. Land vehicles subject to a compulsory or financial responsibility law or other motor vehicle insurance law are considered "autos".

13. "Occurrence" means an accident, including continuous or repeated exposure to substantially the same general harmful conditions.
14. "Personal and advertising injury" means injury, including consequential "bodily injury", arising out of one or more of the following offenses:
 - a. False arrest, detention or imprisonment;
 - b. Malicious prosecution;
 - c. The wrongful eviction from, wrongful entry into, or invasion of the right of private occupancy of a room, dwelling or premises that a person occupies, committed by or on behalf of its owner, landlord or lessor;
 - d. Oral or written publication, in any manner, of material that slanders or libels a person or organization or disparages a person's or organization's goods, products or services;
 - e. Oral or written publication, in any manner, of material that violates a person's right of privacy;
 - f. The use of another's advertising idea in your "advertisement"; or
 - g. Infringing upon another's copyright, trade dress or slogan in your "advertisement".

15. "Pollutants" mean any solid, liquid, gaseous or thermal irritant or contaminant, including smoke, vapor, soot, fumes, acids, alkalis, chemicals and waste. Waste includes materials to be recycled, reconditioned or reclaimed.

16. "Products-completed operations hazard":

- a. Includes all "bodily injury" and "property damage" occurring away from premises you own or rent and arising out of "your product" or "your work" except:

- (1) Products that are still in your physical possession; or
- (2) Work that has not yet been completed or abandoned. However, "your work" will be deemed completed at the earliest of the following times:

- (a) When all of the work called for in your contract has been completed.
- (b) When all of the work to be done at the job site has been completed if your contract calls for work at more than one job site.
- (c) When that part of the work done at a job site has been put to its intended use by any person or organization other than another contractor or subcontractor working on the same project.

Work that may need service, maintenance, correction, repair or replacement, but which is otherwise complete, will be treated as completed.

- b. Does not include "bodily injury" or "property damage" arising out of:

- (1) The transportation of property, unless the injury or damage arises out of a condition in or on a vehicle not owned or operated by you, and that condition was created by the "loading or unloading" of that vehicle by any insured;
- (2) The existence of tools, uninstalled equipment or abandoned or unused materials; or
- (3) Products or operations for which the classification, listed in the Declarations or in a policy schedule, states that products-completed operations are subject to the General Aggregate Limit.

17. "Property damage" means:

- a. Physical injury to tangible property, including all resulting loss of use of that property. All such loss of use shall be deemed to occur at the time of the physical injury that caused it; or

- b.** Loss of use of tangible property that is not physically injured. All such loss of use shall be deemed to occur at the time of the "occurrence" that caused it.

For the purposes of this insurance, electronic data is not tangible property.

As used in this definition, electronic data means information, facts or programs stored as or on, created or used on, or transmitted to or from computer software, including systems and applications software, hard or floppy disks, CD-ROMS, tapes, drives, cells, data processing devices or any other media which are used with electronically controlled equipment.

18. "Suit" means a civil proceeding in which damages because of "bodily injury", "property damage" or "personal and advertising injury" to which this insurance applies are alleged. "Suit" includes:

- a.** An arbitration proceeding in which such damages are claimed and to which the insured must submit or does submit with our consent; or
- b.** Any other alternative dispute resolution proceeding in which such damages are claimed and to which the insured submits with our consent.

19. "Temporary worker" means a person who is furnished to you to substitute for a permanent "employee" on leave or to meet seasonal or short-term workload conditions.

20. "Volunteer worker" means a person who is not your "employee", and who donates his or her work and acts at the direction of and within the scope of duties determined by you, and is not paid a fee, salary or other compensation by you or anyone else for their work performed for you.

21. "Your product":

a. Means:

- (1)** Any goods or products, other than real property, manufactured, sold, handled, distributed or disposed of by:
 - (a)** You;
 - (b)** Others trading under your name; or
 - (c)** A person or organization whose business or assets you have acquired; and
- (2)** Containers (other than vehicles), materials, parts or equipment furnished in connection with such goods or products.

b. Includes

- (1)** Warranties or representations made at any time with respect to the fitness, quality, durability, performance or use of "your product"; and
- (2)** The providing of or failure to provide warnings or instructions.

c. Does not include vending machines or other property rented to or located for the use of others but not sold.

22. "Your work":

a. Means:

- (1)** Work or operations performed by you or on your behalf; and
- (2)** Materials, parts or equipment furnished in connection with such work or operations.

b. Includes

- (1)** Warranties or representations made at any time with respect to the fitness, quality, durability, performance or use of "your work", and
- (2)** The providing of or failure to provide warnings or instructions.

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 20 10 07 04

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

**ADDITIONAL INSURED – OWNERS, LESSEES OR
CONTRACTORS – SCHEDULED PERSON OR
ORGANIZATION**

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Name Of Additional Insured Person(s) Or Organization(s):	Location(s) Of Covered Operations
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.	

A. Section II – Who Is An Insured is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury", "property damage" or "personal and advertising injury" caused, in whole or in part, by:

1. Your acts or omissions; or
2. The acts or omissions of those acting on your behalf;

in the performance of your ongoing operations for the additional insured(s) at the location(s) designated above.

B. With respect to the insurance afforded to these additional insureds, the following additional exclusions apply:

This insurance does not apply to "bodily injury" or "property damage" occurring after:

1. All work, including materials, parts or equipment furnished in connection with such work, on the project (other than service, maintenance or repairs) to be performed by or on behalf of the additional insured(s) at the location of the covered operations has been completed; or
2. That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as a part of the same project.

END OF SECTION 00 62 16.12

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 20 37 07 04**THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.****ADDITIONAL INSURED – OWNERS, LESSEES OR
CONTRACTORS – COMPLETED OPERATIONS**

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Name Of Additional Insured Person(s) Or Organization(s):	Location And Description Of Completed Operations
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.	

Section II – Who Is An Insured is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury" or "property damage" caused, in whole or in part, by "your work" at the location designated and described in the schedule of this endorsement performed for that additional insured and included in the "products-completed operations hazard".

END OF SECTION 00 62 16.13

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 25 04 03 97**THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.****DESIGNATED LOCATION(S)
GENERAL AGGREGATE LIMIT**

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE**Designated Location(s):**

(If no entry appears above, information required to complete this endorsement will be shown in the Declarations as applicable to this endorsement.)

- A.** For all sums which the insured becomes legally obligated to pay as damages caused by "occurrences" under **COVERAGE A (SECTION I)**, and for all medical expenses caused by accidents under **COVERAGE C (SECTION I)**, which can be attributed only to operations at a single designated "location" shown in the Schedule above:
- 1.** A separate Designated Location General Aggregate Limit applies to each designated "location", and that limit is equal to the amount of the General Aggregate Limit shown in the Declarations.
 - 2.** The Designated Location General Aggregate Limit is the most we will pay for the sum of all damages under **COVERAGE A**, except damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard", and for medical expenses under **COVERAGE C** regardless of the number of:
 - a.** Insureds;
 - b.** Claims made or "suits" brought; or
 - c.** Persons or organizations making claims or bringing "suits".
 - 3.** Any payments made under **COVERAGE A** for damages or under **COVERAGE C** for medical expenses shall reduce the Designated Location General Aggregate Limit for that designated "location". Such payments shall not reduce the General Aggregate Limit shown in the Declarations nor shall they reduce any other Designated Location General Aggregate Limit for any other designated "location" shown in the Schedule above.
 - 4.** The limits shown in the Declarations for Each Occurrence, Fire Damage and Medical Expense continue to apply. However, instead of being subject to the General Aggregate Limit shown in the Declarations, such limits will be subject to the applicable Designated Location General Aggregate Limit.

B. For all sums which the insured becomes legally obligated to pay as damages caused by "occurrences" under **COVERAGE A (SECTION I)**, and for all medical expenses caused by accidents under **COVERAGE C (SECTION I)**, which cannot be attributed only to operations at a single designated "location" shown in the Schedule above:

- 1.** Any payments made under **COVERAGE A** for damages or under **COVERAGE C** for medical expenses shall reduce the amount available under the General Aggregate Limit or the Products-Completed Operations Aggregate Limit, whichever is applicable; and
- 2.** Such payments shall not reduce any Designated Location General Aggregate Limit.

C. When coverage for liability arising out of the "products-completed operations hazard" is provided, any payments for damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard" will reduce the Products-Completed Operations Aggregate Limit, and not reduce the General Aggregate Limit nor the Designated Location General Aggregate Limit.

D. For the purposes of this endorsement, the **Definitions** Section is amended by the addition of the following definition:

"Location" means premises involving the same or connecting lots, or premises whose connection is interrupted only by a street, roadway, waterway or right-of-way of a railroad.

E. The provisions of Limits Of Insurance (**SECTION III**) not otherwise modified by this endorsement shall continue to apply as stipulated.

Sample

END OF SECTION 00 62 16.14



AIA Document G702®, Application and Certificate for Payment, or G732™, Application and Certificate for Payment, Construction Manager as Adviser Edition, containing Contractor's signed certification is attached.

Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:	001
APPLICATION DATE:	
PERIOD TO:	
ARCHITECT'S PROJECT NO:	



Application and Certificate for Payment

TO OWNER: University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

PROJECT:

FROM CONTRACTOR:

VIA ARCHITECT:

APPLICATION NO:
PERIOD TO:

CONTRACT FOR:
CONTRACT DATE:
PROJECT NOS: / /

Distribution to:
OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER: ☐

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
AIA Document G703®, Continuation Sheet, is attached.

1. ORIGINAL CONTRACT SUM 0.00

2. NET CHANGE BY CHANGE ORDERS 0.00

3. CONTRACT SUM TO DATE (Line 1 ± 2) 0.00

4. TOTAL COMPLETED & STORED TO DATE (Column G on G703) 0.00

5. RETAINAGE:

a. 0 % of Completed Work
(Column D + E on G703) 0.00

b. 0 % of Stored Material
(Column F on G703) 0.00

Total Retainage (Lines 5a + 5b or Total in Column I of G703) 0.00

6. TOTAL EARNED LESS RETAINAGE 0.00
(Line 4 Less Line 5 Total)

7. LESS PREVIOUS CERTIFICATES FOR PAYMENT 0.00
(Line 6 from prior Certificate)

8. CURRENT PAYMENT DUE 0.00

9. BALANCE TO FINISH, INCLUDING RETAINAGE 0.00
(Line 3 less Line 6)

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	0.00	0.00
Total approved this Month	0.00	0.00
TOTALS	0.00	0.00
NET CHANGES by Change Order		0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of: _____

County of: _____

Subscribed and sworn to before
me this _____ day of _____

Notary Public: _____

My Commission expires: _____

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED 0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

SECTION 00 62 76.13

SAMPLE

SALES TAX FORM

DATE: _____

VENDOR: _____

Vendor Name

Vendor Address

Vendor City, State Zip

I hereby certify under penalties of perjury, that:

I am engaged in the performance of a construction contract on a project for the University of Maine System which is a Sales Tax exempt organization under the Maine Sales and Use Tax Law, Section 1760, subsection 2 and 16:

This project is titled: UM Keyo Electrical Service Upgrade
Project Title

The project is located at: UNIVERSITY OF MAINE
Campus Name or Town

This certificate is issued to cover purchases of materials that will be permanently incorporated into the real property belonging to the exempt organization or government agency indicated above.

Signed: _____
Authorized Signature

Name & Title: _____

Firm Name: _____

Firm Address: _____

Firm City, State Zip _____

END OF SECTION 00 62 76.13



AIA® Document G707A™ – 1994

Consent of Surety to Reduction in or Partial Release of Retainage

PROJECT: *(Name and address)*
Samples

ARCHITECT'S PROJECT NUMBER:

OWNER: ☐

CONTRACT FOR:

ARCHITECT: ☐

TO OWNER: *(Name and address)*
University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

CONTRACT DATED:

CONTRACTOR: ☐

SURETY: ☐

OTHER: ☐

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

on bond of
(Insert name and address of Contractor)

, SURETY,

hereby approves the reduction in or partial release of retainage to the Contractor as follows:

, CONTRACTOR,

The Surety agrees that such reduction in or partial release of retainage to the Contractor shall not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

as set forth in said Surety's bond.

, OWNER,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

Attest:
(Seal):

(Printed name and title)

00 62 79
SAMPLE
STORED MATERIALS

University of Maine System
by and through
University of Maine
5765 Service Building
Orono ME 04469

Project Title: _____
Location: University of Maine
Contractor: _____

Materials and/or equipment (hereinafter "Materials") that have not yet been incorporated into the work may be delivered and suitably stored, at the site or some other location agreed upon by the Owner. The Materials listed below have been estimated at 100% of the cost and will be stored at _____. The Owner will reimburse the Contractor based upon the prices included on the Schedule of Values Form, 00 62 73(AIA G703), less the cost of installation. The Contractor must complete sufficient copies of this Stored Materials Form, 00 62 79, to accompany the Application for Payment. The Contractor shall secure the signature of its bonding company on all forms and shall also provide a Power of Attorney from the bonding company.

SCHEDULE

Qty	Material/Equipment	Item in AIA G703		Unit Wholesale Price	Extended Wholesale Price
		Item No	Unit Price		
Total					

Surety _____
Power of Attorney Must be Attached

By: _____
Attorney-in-Fact

Date: _____

BILL OF SALE

The Contractor, _____, (will store/has stored) certain Materials (at the site of this project/at an approved warehouse/at bonded warehouse) and will be paid in accordance with the provisions of the General Conditions of the Contract for Construction. In consideration of the sum of \$_____ paid to the contractor by the Owner, and, in compliance with the provisions of the Contract, and, with the intention to be legally bound, the Contractor does hereby grant, bargain, sell and deliver unto the Owner, its successors and assigns, all and singular, the Materials described in the schedule above. The Contractor agrees that:

1. Contractor has good title to the Materials, free and clear of all liens and encumbrances, and title is granted to the Owner;
2. The Materials will be used only in the construction of the above referenced project, under the provisions of the Contract, and will not be diverted elsewhere without the prior written consent of the Owner;
3. The Materials have been delivered to and are at the places approved for storage, and they are clearly marked and identified as the property of the Owner and are stored in a safe and secure manner to protect from damage or loss;

4. The Contractor will pay all expenses in connection with the sale, delivery, storage, protection and insurance of Materials granted to the Owner.
5. The Contractor will remain responsible for the Materials, which will remain under its custody and control for all losses, and will fully indemnify the Owner for the cost of the Materials should the Materials be lost or damaged or stolen, regardless of exclusions in insurance policies required under this document. The contractor has insured the Materials against loss or damage by fire (with extended coverage), theft and burglary, with loss payable to the Owner;
6. The Contractor agrees that the quantities of Materials set forth in the Schedule of Values Form represents the maximum quantities for which it may be entitled to payment under the provisions of the contract;
7. The following information is included with this form:

- (1) An Application for Payment;
- (2) An invoice or copy of an invoice for Materials stored;
- (3) Evidence of payment, or when payment has not been made, a letter on the Contractor's letterhead authorizing payment to be made jointly to the Contractor and the Supplier;
- (4) Photographs showing the stored Materials and its location;
- (5) a fire and theft insurance policy rider for the stored Materials.
- (6) a warehouseman's receipt acknowledging that the Materials being stored at the warehouse are being held for the benefit of the Contractor or/or University.

Witness:

By: _____ (SEAL)
Principal/Contractor-Individual

Witness:

Principal/Contractor-Individual

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

Attest:

Secretary

Principal/Contractor-Corporation

By: _____

President

END OF SECTION 00 62 79



AIA[®] Document G716[™] – 2004

Request for Information (“RFI”)

TO:

FROM:

PROJECT:

Samples

ISSUE DATE:

RFI No.

PROJECT NUMBERS:

/

REQUESTED REPLY DATE:

COPIES TO:

RFI DESCRIPTION: *(Fully describe the question or type of information requested.)*

REFERENCES/ATTACHMENTS: *(List specific documents researched when seeking the information requested.)*

SPECIFICATIONS:

DRAWINGS:

OTHER:

SENDER'S RECOMMENDATION: *(If RFI concerns a site or construction condition, the sender may provide a recommended solution, including cost and/or schedule considerations.)*

RECEIVER'S REPLY: *(Provide answer to RFI, including cost and/or schedule considerations.)*

BY

DATE

COPIES TO

Note: This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.



AIA[®] Document G710[™] – 2017

Architect's Supplemental Instructions

PROJECT: *(name and address)*

Samples

CONTRACT INFORMATION:

Contract For:

Date:

ASI INFORMATION:

ASI Number:

Date:

OWNER: *(name and address)*

University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

ARCHITECT: *(name and address)***CONTRACTOR:** *(name and address)*

The Contractor shall carry out the Work in accordance with the following supplemental instructions without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.

(Insert a detailed description of the Architect's supplemental instructions and, if applicable, attach or reference specific exhibits.)

ISSUED BY THE ARCHITECT:

ARCHITECT *(Firm name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE



AIA[®] Document G714[™] – 2017

Construction Change Directive

PROJECT: *(name and address)*
Samples

CONTRACT INFORMATION:
Contract For:
Date:

CCD INFORMATION:
Directive Number:
Date:

OWNER: *(name and address)*
University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

ARCHITECT: *(name and address)*

CONTRACTOR: *(name and address)*

The Contractor is hereby directed to make the following change(s) in this Contract:
(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits.)

PROPOSED ADJUSTMENTS

- The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:
 - ☐ Lump Sum decrease of \$0.00
 - ☐ Unit Price of \$ per
 - ☐ Cost, as defined below, plus the following fee:
(Insert a definition of, or method for determining, cost)
 - ☐ As follows:

- The Contract Time is proposed to . The proposed adjustment, if any, is .

NOTE: The Owner, Architect and Contractor should execute a Change Order to supersede this Construction Change Directive to the extent they agree upon adjustments to the Contract Sum, Contract Time, or Guaranteed Maximum price for the change(s) described herein.

When signed by the Owner and Architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

Contractor signature indicates agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this CCD.

ARCHITECT *(Firm name)*

OWNER *(Firm name)*

CONTRACTOR *(Firm name)*

SIGNATURE

SIGNATURE

SIGNATURE

PRINTED NAME AND TITLE

PRINTED NAME AND TITLE

PRINTED NAME AND TITLE

DATE

DATE

DATE



AIA[®] Document G709[™] – 2018

Proposal Request

PROJECT: *(name and address)*
Samples

CONTRACT INFORMATION:
Contract For:
Date:

Architect's Project Number:
Proposal Request Number:
Proposal Request Date:

OWNER: *(name and address)*
University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

ARCHITECT: *(name and address)*

CONTRACTOR: *(name and address)*

The Owner requests an itemized proposal for changes to the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. The Contractor shall submit this proposal within Zero (0) days or notify the Architect in writing of the anticipated date of submission.

(Insert a detailed description of the proposed modifications to the Contract Documents and, if applicable, attach or reference specific exhibits.)

THIS IS NOT A CHANGE ORDER, A CONSTRUCTION CHANGE DIRECTIVE, OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.

REQUESTED BY THE ARCHITECT:

PRINTED NAME AND TITLE



AIA[®] Document G701™ – 2017

Change Order

PROJECT: *(Name and address)*
Samples

CONTRACT INFORMATION:
Contract For:
Date:

CHANGE ORDER INFORMATION:
Change Order Number:
Date:

OWNER: *(Name and address)*
University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

ARCHITECT: *(Name and address)*

CONTRACTOR: *(Name and address)*

THE CONTRACT IS CHANGED AS FOLLOWS:

(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits. Also include agreed upon adjustments attributable to executed Construction Change Directives.)

The original Contract Sum was	\$	0.00
The net change by previously authorized Change Orders	\$	0.00
The Contract Sum prior to this Change Order was	\$	0.00
The Contract Sum will be increased by this Change Order in the amount of	\$	0.00
The new Contract Sum including this Change Order will be	\$	0.00

The Contract Time will be increased by Zero (0) days.

The new date of Substantial Completion will be

NOTE: This Change Order does not include adjustments to the Contract Sum or Guaranteed Maximum Price, or the Contract Time, that have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

ARCHITECT *(Firm name)*

CONTRACTOR *(Firm name)*

OWNER *(Firm name)*

SIGNATURE

SIGNATURE

SIGNATURE

PRINTED NAME AND TITLE

PRINTED NAME AND TITLE

PRINTED NAME AND TITLE

DATE

DATE

DATE



AIA® Document G704™ – 2017

Certificate of Substantial Completion

PROJECT: *(name and address)*

Samples

CONTRACT INFORMATION:

Contract For:

Date:

CERTIFICATE INFORMATION:

Certificate Number:

Date:

OWNER: *(name and address)*

University of Maine System

by and through

University of Maine

5765 Service Building

Orono, ME 04469

ARCHITECT: *(name and address)*
CONTRACTOR: *(name and address)*

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.

(Identify the Work, or portion thereof, that is substantially complete.)

ARCHITECT *(Firm Name)*
SIGNATURE
PRINTED NAME AND TITLE
DATE OF SUBSTANTIAL COMPLETION
WARRANTIES

The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED

A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:

(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within () days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: \$

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:

(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR *(Firm Name)*

Name)

SIGNATURE
PRINTED NAME AND TITLE
DATE
OWNER *(Firm Name)*
SIGNATURE
PRINTED NAME AND TITLE
DATE

SECTION 00 65 19
CERTIFICATE OF COMPLETION FORM
(Final)

DATE:

PROJECT NAME: UM Keyo Electrical Upgrade

SUBSTANTIAL COMPLETION DATE:

FINAL COMPLETION is defined, in accordance with Article 9 of the A201 General Conditions of the Contract for Construction, as the date certified by the Architect when all the Work of the Project is fully complete, the Close-Out requirements of Paragraph 9.10 of the General Conditions have been completed, including the Close-Out Meeting and approval of Close-Out by the Architect, in accordance with Subparagraph 9.10.2, and the Contract fully performed in accordance with the Contract Documents, and the Contractor entitled to final payment.

The CONTRACTOR certifies that the Work is fully completed and was completed on or before February 28, 2025, and submits herewith:

Application for Final Payment (AIA G702)
Affidavit of Payments (AIA G706)
Consent of Surety (AIA G707)
Releases of Liens (AIA G706A)
Waiver of Lien

CONTRACTOR:

By: _____ Date: _____
Name:

The ARCHITECT has inspected the Work and has determined that the Date of Final Completion was _____.

ARCHITECT:

By: _____ Date: _____
Name:

The OWNER hereby accepts the Work as fully complete and will make final payment.

OWNER:

By: _____ Date: _____
Ryan Ward
University of Maine System

END OF SECTION 00 65 19



AIA[®] Document G706[™] – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)*
Samples

ARCHITECT'S PROJECT NUMBER:

OWNER: ☐

ARCHITECT: ☐

CONTRACTOR: ☐

SURETY: ☐

OTHER: ☐

TO OWNER: *(Name and address)*
University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

CONTRACT FOR:
CONTRACT DATED:

STATE OF: *(State of Signature)*

COUNTY OF: *(County of Signature)*

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment ☐ Yes ☐ No

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

The following supporting documents should be attached hereto if required by the Owner:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:



AIA[®] Document G706A[™] – 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)*

Samples

ARCHITECT'S PROJECT NUMBER:

OWNER: ☐

CONTRACT FOR:

ARCHITECT: ☐

CONTRACT DATED:

CONTRACTOR: ☐

TO OWNER: *(Name and address)*

University of Maine System

by and through

University of Maine

5765 Service Building

Orono, ME 04469

SURETY: ☐

OTHER: ☐

STATE OF: *(State of Signature)*

COUNTY OF: *(County of Signature)*

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

SAMPLE

SECTION 00 65 19.17
WAIVER OF LIEN

DATE: _____

State of: _____

State of Signature

County of: _____

County of Signature

TO: University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

SUBJECT:

Project Name: UM Keyo Electrical Service Upgrade

Project Location: UNIVERSITY OF MAINE

Upon receipt of the sum of _____ (being the balance due us under the existing contract or subcontract agreement for work on the Subject Project) the undersigned agrees that it will waive and release the University of Maine System from any and all lien or claim or right to lien on the Subject Project under the Statutes of the state of Maine relating to liens for labor, materials and/or subcontracts furnished for the Subject Project on premises belonging to the University of Maine System.

Signed: _____

Title: _____

Firm Name: _____

NOTARY

Subscribed and sworn to before me this _____ day of _____, 20____.

Signature Notary Public

END OF SECTION 00 65 19.17

SUBCONTRACTOR/SUPPLIER CONDITIONAL
RELEASE AND WAIVER OF LIEN

DATE: _____

State of: _____
State of Signature

County of: _____
County of Signature

SUBJECT:

Project Name: _____

Project Location: _____

_____ (hereinafter called the Subcontractor) in consideration of the sum of \$ _____ to be paid to Subcontractor by _____ upon receipt of said payment does hereby release and forever discharge _____ and the **University of Maine System** from any and all workman's, materialman's, mechanic's, building or other liens, claims, causes of action, liabilities and other obligations with respect to the value of any and all work, services and materials furnished, performed, or supplied by the subcontractor to or in connection with the construction project known as the Insert Project Name Here located in Insert Location Here (hereinafter called the "Premises") through the date of _____. Subcontractor shall take all reasonable action to discharge any lien currently filed or pending against _____ and the **University of Maine System**, including without limitation the recording of instruments discharging said lien with the appropriate Registry of Deeds.

Subcontractor acknowledges that its receipt of said payment will constitute full and final payment for all work performed by Subcontractor through the date set forth above except for retainage if applicable, in the amount of (\$) _____.

Subcontractor further covenants and represents that all of the subcontract suppliers, mechanics, materialmen, and laborers listed below engaged by Subcontractor have been paid in full (less proper retainage if any) or shall be immediately paid in full from the proceeds of this current payment for all work done and or materials furnished to the Premises through the date set forth in the first paragraph above. The Subcontractor hereby agrees to indemnify, defend, and hold _____ and The **University of Maine System** harmless from any and all claims, including but not limited to attorney fees, claims for payment, and liens of any kind or nature filed or made by any person or entity based upon work done or materials furnished in connection with the Premises by the Subcontractor or any sub-subcontractor, suppliers, mechanics, materialmen, and laborers employed by Subcontractor through the date set forth in the first paragraph above. Subcontractor shall request any sub-subcontractor, suppliers, mechanics, materialmen, and laborers employed by Subcontractor through the date set forth in the first paragraph above to, and shall itself, take all reasonable action to discharge any lien in connection with payments owed by Subcontractor currently filed or pending against _____ and the **University of Maine System**, including without limitation the recording of instruments discharging said lien with the appropriate Registry of Deeds.

Major sub-subcontractors and suppliers whose contract or purchase order meets or exceeds \$5,000 working for said Subcontractor for the period stated above:

SECTION 00 65 19.18

The undersigned represents that he is authorized by all corporate or other action necessary to execute and deliver this release.

Signed: _____

Title: _____

Firm Name: _____

NOTARY

Subscribed and sworn to before me this _____ day of _____, 20_____.

Signature Notary Public

END OF SECTION 00 65 19.18



AIA[®] Document G707[™] – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)*
Samples

ARCHITECT'S PROJECT NUMBER:

OWNER: ☐

CONTRACT FOR:

ARCHITECT: ☐

CONTRACT DATED:

CONTRACTOR: ☐

SURETY: ☐

OTHER: ☐

TO OWNER: *(Name and address)*
University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

on bond of
(Insert name and address of Contractor)

, SURETY,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall
not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, CONTRACTOR,

as set forth in said Surety's bond.

, OWNER,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

(Printed name and title)

Attest:
(Seal):



AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

THE OWNER:

(Name, legal status and address)

University of Maine System
by and through

THE ARCHITECT:

(Name, legal status and address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

TABLE OF ARTICLES

1	GENERAL PROVISIONS
2	OWNER
3	CONTRACTOR
4	ARCHITECT
5	SUBCONTRACTORS
6	CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
7	CHANGES IN THE WORK
8	TIME
9	PAYMENTS AND COMPLETION
10	PROTECTION OF PERSONS AND PROPERTY
11	INSURANCE AND BONDS
12	UNCOVERING AND CORRECTION OF WORK
13	MISCELLANEOUS PROVISIONS

Init.

14	TERMINATION OR SUSPENSION OF THE CONTRACT
15	CLAIMS AND DISPUTES



Init.
/

INDEX

(Topics and numbers in bold are Section headings.)

Acceptance of Nonconforming Work

9.6.6, 9.9.3, **12.3**

Acceptance of Work

9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3

Access to Work

3.16, 6.2.1, 12.1

Accident Prevention

10

Acts and Omissions

3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5,

10.2.8, 13.3.2, 14.1, 15.1.2, 15.2

Addenda

1.1.1

Additional Costs, Claims for

3.7.4, 3.7.5, 10.3.2, 15.1.5

Additional Inspections and Testing

9.4.2, 9.8.3, 12.2.1, **13.4**

Additional Time, Claims for

3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, **15.1.6**

Administration of the Contract

3.1.3, **4.2**, 9.4, 9.5

Advertisement or Invitation to Bid

1.1.1

Aesthetic Effect

4.2.13

Allowances

3.8

Applications for Payment

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5.1, 9.5.4, 9.6.3, 9.7, 9.10

Approvals

2.1.1, 2.3.1, 2.5, 3.1.3, 3.10.2, 3.12.8, 3.12.9,

3.12.10.1, 4.2.7, 9.3.2, 13.4.1

Arbitration

8.3.1, 15.3.2, **15.4**

ARCHITECT

4

Architect, Definition of

4.1.1

Architect, Extent of Authority

2.5, 3.12.7, 4.1.2, 4.2, 5.2, 6.3, 7.1.2, 7.3.4, 7.4, 9.2,
9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1,
13.4.1, 13.4.2, 14.2.2, 14.2.4, 15.1.4, 15.2.1

Architect, Limitations of Authority and Responsibility

2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2, 4.2.3,
4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4, 9.4.2,
9.5.4, 9.6.4, 15.1.4, 15.2

Architect's Additional Services and Expenses

2.5, 12.2.1, 13.4.2, 13.4.3, 14.2.4

Architect's Administration of the Contract

3.1.3, 3.7.4, 15.2, 9.4.1, 9.5

Architect's Approvals

2.5, 3.1.3, 3.5, 3.10.2, 4.2.7

Architect's Authority to Reject Work

3.5, 4.2.6, 12.1.2, 12.2.1

Architect's Copyright

1.1.7, 1.5

Architect's Decisions

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3,
7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1,
13.4.2, 15.2

Architect's Inspections

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.4

Architect's Instructions

3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.4.2

Architect's Interpretations

4.2.11, 4.2.12

Architect's Project Representative

4.2.10

Architect's Relationship with Contractor

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2,
3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16,
3.18, 4.1.2, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5,
9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.3.2, 13.4, 15.2

Architect's Relationship with Subcontractors

1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3

Architect's Representations

9.4.2, 9.5.1, 9.10.1

Architect's Site Visits

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

Asbestos

10.3.1

Attorneys' Fees

3.18.1, 9.6.8, 9.10.2, 10.3.3

Award of Separate Contracts

6.1.1, 6.1.2

Award of Subcontracts and Other Contracts for Portions of the Work

5.2

Basic Definitions

1.1

Bidding Requirements

1.1.1

Binding Dispute Resolution

8.3.1, 9.7, 11.5, 13.1, 15.1.2, 15.1.3, 15.2.1, 15.2.5,
15.2.6.1, 15.3.1, 15.3.2, 15.3.3, 15.4.1

Bonds, Lien

7.3.4.4, 9.6.8, 9.10.2, 9.10.3

Bonds, Performance, and Payment

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**, 11.1.3, **11.5**

Building Information Models Use and Reliance

1.8

Building Permit

3.7.1

Capitalization

1.3

Certificate of Substantial Completion

9.8.3, 9.8.4, 9.8.5

Certificates for Payment

4.2.1, 4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7,
9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.4

Certificates of Inspection, Testing or Approval
13.4.4

Certificates of Insurance
9.10.2

Change Orders

1.1.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11, 3.12.8, 4.2.8, 5.2.3,
7.1.2, 7.1.3, **7.2**, 7.3.2, 7.3.7, 7.3.9, 7.3.10, 8.3.1,
9.3.1.1, 9.10.3, 10.3.2, 11.2, 11.5, 12.1.2

Change Orders, Definition of

7.2.1

CHANGES IN THE WORK

2.2.2, 3.11, 4.2.8, **7**, 7.2.1, 7.3.1, 7.4, 8.3.1, 9.3.1.1,
11.5

Claims, Definition of

15.1.1

Claims, Notice of
1.6.2, 15.1.3

CLAIMS AND DISPUTES

3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, **15**, 15.4
Claims and Timely Assertion of Claims
15.4.1

Claims for Additional Cost

3.2.4, 3.3.1, 3.7.4, 7.3.9, 9.5.2, 10.2.5, 10.3.2, **15.1.5**

Claims for Additional Time

3.2.4, 3.3.1, 3.7.4, 6.1.1, 8.3.2, 9.5.2, 10.3.2, **15.1.6**

Concealed or Unknown Conditions, Claims for

3.7.4

Claims for Damages
3.2.4, 3.18, 8.3.3, 9.5.1, 9.6.7, 10.2.5, 10.3.3, 11.3,
11.3.2, 14.2.4, 15.1.7

Claims Subject to Arbitration
15.4.1

Cleaning Up

3.15, 6.3

Commencement of the Work, Conditions Relating to
2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3,
6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.2, **15.1.5**

Commencement of the Work, Definition of

8.1.2

Communications

3.9.1, **4.2.4**
Completion, Conditions Relating to
3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1,
9.10, 12.2, 14.1.2, 15.1.2

COMPLETION, PAYMENTS AND

9

Completion, Substantial
3.10.1, 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1,
9.10.3, 12.2, 15.1.2
Compliance with Laws
2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 10.2.2, 13.1,
13.3, 13.4.1, 13.4.2, 13.5, 14.1.1, 14.2.1.3, 15.2.8,
15.4.2, 15.4.3

Concealed or Unknown Conditions

3.7.4, 4.2.8, 8.3.1, 10.3

Conditions of the Contract

1.1.1, 6.1.1, 6.1.4

Consent, Written

3.4.2, 3.14.2, 4.1.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 13.2,
15.4.4.2

Consolidation or Joinder

15.4.4

CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

1.1.4, **6**

Construction Change Directive, Definition of
7.3.1

Construction Change Directives

1.1.1, 3.4.2, 3.11, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3, **7.3**,
9.3.1.1

Construction Schedules, Contractor's

3.10, 3.11, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

Contingent Assignment of Subcontracts

5.4, 14.2.2.2

Continuing Contract Performance

15.1.4

Contract, Definition of

1.1.2

CONTRACT, TERMINATION OR SUSPENSION OF THE

5.4.1.1, 5.4.2, 11.5, **14**

Contract Administration

3.1.3, 4, 9.4, 9.5

Contract Award and Execution, Conditions Relating
to

3.7.1, 3.10, 5.2, 6.1

Contract Documents, Copies Furnished and Use of
1.5.2, 2.3.6, 5.3

Contract Documents, Definition of

1.1.1

Contract Sum

2.2.2, 2.2.4, 3.7.4, 3.7.5, 3.8, 3.10.2, 5.2.3, 7.3, 7.4,
9.1, 9.2, 9.4.2, 9.5.1.4, 9.6.7, 9.7, 10.3.2, 11.5, 12.1.2,
12.3, 14.2.4, 14.3.2, 15.1.4.2, **15.1.5**, **15.2.5**

Contract Sum, Definition of

9.1

Contract Time

1.1.4, 2.2.1, 2.2.2, 3.7.4, 3.7.5, 3.10.2, 5.2.3, 6.1.5,
7.2.1.3, 7.3.1, 7.3.5, 7.3.6, 7, 7, 7.3.10, 7.4, 8.1.1,
8.2.1, 8.2.3, 8.3.1, 9.5.1, 9.7, 10.3.2, 12.1.1, 12.1.2,
14.3.2, 15.1.4.2, 15.1.6.1, 15.2.5

Contract Time, Definition of

8.1.1

CONTRACTOR

3

Contractor, Definition of

3.1, **6.1.2**

Contractor's Construction and Submittal Schedules

3.10, 3.12.1, 3.12.2, 4.2.3, 6.1.3, 15.1.6.2

Init.

/

Contractor's Employees
2.2.4, 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2,
10.3, 11.3, 14.1, 14.2.1.1

Contractor's Liability Insurance
11.1
Contractor's Relationship with Separate Contractors
and Owner's Forces
3.12.5, 3.14.2, 4.2.4, 6, 11.3, 12.2.4
Contractor's Relationship with Subcontractors
1.2.2, 2.2.4, 3.3.2, 3.18.1, 3.18.2, 4.2.4, 5, 9.6.2, 9.6.7,
9.10.2, 11.2, 11.3, 11.4
Contractor's Relationship with the Architect
1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2,
3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.2, 5.2, 6.2.2,
7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3,
11.3, 12, 13.4, 15.1.3, 15.2.1
Contractor's Representations
3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2
Contractor's Responsibility for Those Performing the
Work
3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8
Contractor's Review of Contract Documents
3.2
Contractor's Right to Stop the Work
2.2.2, 9.7
Contractor's Right to Terminate the Contract
14.1
Contractor's Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2,
9.8.3, 9.9.1, 9.10.2, 9.10.3
Contractor's Superintendent
3.9, 10.2.6
Contractor's Supervision and Construction
Procedures
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3,
7.3.4, 7.3.6, 8.2, 10, 12, 14, 15.1.4
Coordination and Correlation
1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1
Copies Furnished of Drawings and Specifications
1.5, 2.3.6, 3.11
Copyrights
1.5, **3.17**
Correction of Work
2.5, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, **12.2**, 12.3,
15.1.3.1, 15.1.3.2, 15.2.1

Correlation and Intent of the Contract Documents
1.2
Cost, Definition of
7.3.4
Costs
2.5, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3,
7.3.3.3, 7.3.4, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.2,
12.1.2, 12.2.1, 12.2.4, 13.4, 14

Cutting and Patching
3.14, 6.2.5

Damage to Construction of Owner or Separate
Contractors
3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 12.2.4
Damage to the Work
3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 12.2.4
Damages, Claims for
3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.3.2,
11.3, 14.2.4, 15.1.7
Damages for Delay
6.2.3, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 14.3.2

Date of Commencement of the Work, Definition of
8.1.2
Date of Substantial Completion, Definition of
8.1.3
Day, Definition of
8.1.4
Decisions of the Architect
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 6.3, 7.3.4,
7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.4.2,
14.2.2, 14.2.4, 15.1, 15.2

Decisions to Withhold Certification
9.4.1, **9.5**, 9.7, 14.1.1.3
Defective or Nonconforming Work, Acceptance,
Rejection and Correction of
2.5, 3.5, 4.2.6, 6.2.3, 9.5.1, 9.5.3, 9.6.6, 9.8.2, 9.9.3,
9.10.4, 12.2.1
Definitions
1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 5.1,
6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1

Delays and Extensions of Time
3.2, **3.7.4**, 5.2.3, 7.2.1, 7.3.1, **7.4**, **8.3**, 9.5.1, **9.7**,
10.3.2, **10.4**, 14.3.2, **15.1.6**, 15.2.5

Digital Data Use and Transmission
1.7
Disputes
6.3, 7.3.9, 15.1, 15.2

Documents and Samples at the Site
3.11
Drawings, Definition of
1.1.5
Drawings and Specifications, Use and Ownership of
3.11
Effective Date of Insurance
8.2.2

Emergencies
10.4, 14.1.1.2, **15.1.5**
Employees, Contractor's
3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2,
10.3.3, 11.3, 14.1, 14.2.1.1
Equipment, Labor, or Materials
1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,
4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3,
9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2
Execution and Progress of the Work
1.1.3, 1.2.1, 1.2.2, 2.3.4, 2.3.6, 3.1, 3.3.1, 3.4.1, 3.7.1,
3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.6, 8.2, 9.5.1,
9.9.1, 10.2, 10.3, 12.1, 12.2, 14.2, 14.3.1, 15.1.4

Extensions of Time
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2,
10.4, 14.3, 15.1.6, **15.2.5**
Failure of Payment
9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2
Faulty Work
(See Defective or Nonconforming Work)
Final Completion and Final Payment
4.2.1, 4.2.9, 9.8.2, **9.10**, 12.3, 14.2.4, 14.4.3
Financial Arrangements, Owner's
2.2.1, 13.2.2, 14.1.1.4
GENERAL PROVISIONS
1
Governing Law
13.1
Guarantees (See Warranty)
Hazardous Materials and Substances
10.2.4, **10.3**
Identification of Subcontractors and Suppliers
5.2.1
Indemnification
3.17, **3.18**, 9.6.8, 9.10.2, 10.3.3, 11.3
Information and Services Required of the Owner
2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10.1, 6.1.3, 6.1.4, 6.2.5,
9.6.1, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2,
14.1.1.4, 14.1.4, 15.1.4
Initial Decision
15.2
Initial Decision Maker, Definition of
1.1.8
Initial Decision Maker, Decisions
14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5
Initial Decision Maker, Extent of Authority
14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5
Injury or Damage to Person or Property
10.2.8, 10.4
Inspections
3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,
9.9.2, 9.10.1, 12.2.1, 13.4
Instructions to Bidders
1.1.1
Instructions to the Contractor
3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.4.2
Instruments of Service, Definition of
1.1.7
Insurance
6.1.1, 7.3.4, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5, **11**
Insurance, Notice of Cancellation or Expiration
11.1.4, 11.2.3
Insurance, Contractor's Liability
11.1
Insurance, Effective Date of
8.2.2, 14.4.2
Insurance, Owner's Liability
11.2
Insurance, Property
10.2.5, 11.2, 11.4, 11.5

Insurance, Stored Materials
9.3.2
INSURANCE AND BONDS
11
Insurance Companies, Consent to Partial Occupancy
9.9.1
Insured loss, Adjustment and Settlement of
11.5
Intent of the Contract Documents
1.2.1, 4.2.7, 4.2.12, 4.2.13
Interest
13.5
Interpretation
1.1.8, 1.2.3, **1.4**, 4.1.1, 5.1, 6.1.2, 15.1.1
Interpretations, Written
4.2.11, 4.2.12
Judgment on Final Award
15.4.2
Labor and Materials, Equipment
1.1.3, 1.1.6, **3.4**, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,
5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1,
10.2.4, 14.2.1.1, 14.2.1.2
Labor Disputes
8.3.1
Laws and Regulations
1.5, 2.3.2, 3.2.3, 3.2.4, 3.6, 3.7, 3.12.10, 3.13, 9.6.4,
9.9.1, 10.2.2, 13.1, 13.3.1, 13.4.2, 13.5, 14, 15.2.8,
15.4
Liens
2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8
Limitations, Statutes of
12.2.5, 15.1.2, 15.4.1.1
Limitations of Liability
3.2.2, 3.5, 3.12.10, 3.12.10.1, 3.17, 3.18.1, 4.2.6,
4.2.7, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 9.6.8, 10.2.5, 10.3.3,
11.3, 12.2.5, 13.3.1
Limitations of Time
2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7,
5.2, 5.3, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3,
9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15,
15.1.2, 15.1.3, 15.1.5
Materials, Hazardous
10.2.4, **10.3**
Materials, Labor, Equipment and
1.1.3, 1.1.6, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,
5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2,
10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2
Means, Methods, Techniques, Sequences and
Procedures of Construction
3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2
Mechanic's Lien
2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8
Mediation
8.3.1, 15.1.3.2, 15.2.1, 15.2.5, 15.2.6, **15.3**, 15.4.1,
15.4.1.1
Minor Changes in the Work
1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1, **7.4**

Init.

/

MISCELLANEOUS PROVISIONS

13

Modifications, Definition of

1.1.1

Modifications to the Contract

1.1.1, 1.1.2, 2.5, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7, 10.3.2

Mutual Responsibility

6.2

Nonconforming Work, Acceptance of

9.6.6, 9.9.3, **12.3**

Nonconforming Work, Rejection and Correction of
2.4, 2.5, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4, 12.2

Notice

1.6, 1.6.1, 1.6.2, 2.1.2, 2.2.2., 2.2.3, 2.2.4, 2.5, 3.2.4, 3.3.1, 3.7.4, 3.7.5, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 7.4, 8.2.2, 9.6.8, 9.7, 9.10.1, 10.2.8, 10.3.2, 11.5, 12.2.2.1, 13.4.1, 13.4.2, 14.1, 14.2.2, 14.4.2, 15.1.3, 15.1.5, 15.1.6, 15.4.1

Notice of Cancellation or Expiration of Insurance

11.1.4, 11.2.3

Notice of Claims

1.6.2, 2.1.2, 3.7.4, 9.6.8, 10.2.8, **15.1.3**, 15.1.5, 15.1.6, 15.2.8, 15.3.2, 15.4.1

Notice of Testing and Inspections

13.4.1, 13.4.2

Observations, Contractor's

3.2, 3.7.4

Occupancy

2.3.1, 9.6.6, 9.8

Orders, Written

1.1.1, 2.4, 3.9.2, 7, 8.2.2, 11.5, 12.1, 12.2.2.1, 13.4.2, 14.3.1

OWNER

2

Owner, Definition of

2.1.1

Owner, Evidence of Financial Arrangements

2.2, 13.2.2, 14.1.1.4

Owner, Information and Services Required of the

2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5, 9.3.2, 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4

Owner's Authority

1.5, 2.1.1, 2.3.32.4, 2.5, 3.4.2, 3.8.1, 3.12.10, 3.14.2, 4.1.2, 4.2.4, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3, 7.2.1, 7.3.1, 8.2.2, 8.3.1, 9.3.2, 9.5.1, 9.6.4, 9.9.1, 9.10.2, 10.3.2, 11.4, 11.5, 12.2.2, 12.3, 13.2.2, 14.3, 14.4, 15.2.7

Owner's Insurance

11.2

Owner's Relationship with Subcontractors

1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2

Owner's Right to Carry Out the Work

2.5, 14.2.2

Owner's Right to Clean Up

6.3

Owner's Right to Perform Construction and to Award Separate Contracts

6.1

Owner's Right to Stop the Work

2.4

Owner's Right to Suspend the Work

14.3

Owner's Right to Terminate the Contract

14.2, 14.4

Ownership and Use of Drawings, Specifications and Other Instruments of Service

1.1.1, 1.1.6, 1.1.7, **1.5**, 2.3.6, 3.2.2, 3.11, 3.17, 4.2.12, 5.3

Partial Occupancy or Use

9.6.6, **9.9**

Patching, Cutting and

3.14, 6.2.5

Patents

3.17

Payment, Applications for

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5, 9.6.3, 9.7, 9.8.5, 9.10.1, 14.2.3, 14.2.4, 14.4.3

Payment, Certificates for

4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4

Payment, Failure of

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Payment, Final

4.2.1, 4.2.9, **9.10**, 12.3, 14.2.4, 14.4.3

Payment Bond, Performance Bond and

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Payments, Progress

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

PAYMENTS AND COMPLETION

9

Payments to Subcontractors

5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7, 14.2.1.2
PCB

10.3.1

Performance Bond and Payment Bond

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Permits, Fees, Notices and Compliance with Laws

2.3.1, **3.7**, 3.13, 7.3.4.4, 10.2.2

PERSONS AND PROPERTY, PROTECTION OF

10

Polychlorinated Biphenyl

10.3.1

Product Data, Definition of

3.12.2

Product Data and Samples, Shop Drawings

3.11, **3.12**, 4.2.7

Progress and Completion

4.2.2, **8.2**, 9.8, 9.9.1, 14.1.4, 15.1.4

Progress Payments

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

Init.

/

Project, Definition of

1.1.4

Project Representatives

4.2.10

Property Insurance

10.2.5, **11.2**

Proposal Requirements

1.1.1

PROTECTION OF PERSONS AND PROPERTY

10

Regulations and Laws

1.5, 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1,
10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14, 15.2.8, 15.4

Rejection of Work

4.2.6, 12.2.1

Releases and Waivers of Liens

9.3.1, 9.10.2

Representations

3.2.1, 3.5, 3.12.6, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.10.1

Representatives

2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.10, 13.2.1

Responsibility for Those Performing the Work

3.3.2, 3.18, 4.2.2, 4.2.3, 5.3, 6.1.3, 6.2, 6.3, 9.5.1, 10
Retainage

9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3

Review of Contract Documents and Field

Conditions by Contractor

3.2, 3.12.7, 6.1.3

Review of Contractor's Submittals by Owner and
Architect

3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2

Review of Shop Drawings, Product Data and Samples
by Contractor

3.12

Rights and Remedies

1.1.2, 2.4, 2.5, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1,
6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.1, 12.2.2,
12.2.4, **13.3**, 14, 15.4

Royalties, Patents and Copyrights

3.17

Rules and Notices for Arbitration

15.4.1

Safety of Persons and Property

10.2, 10.4

Safety Precautions and Programs

3.3.1, 4.2.2, 4.2.7, 5.3, **10.1**, 10.2, 10.4

Samples, Definition of

3.12.3

Samples, Shop Drawings, Product Data and

3.11, **3.12**, 4.2.7

Samples at the Site, Documents and

3.11

Schedule of Values

9.2, 9.3.1

Schedules, Construction

3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

Separate Contracts and Contractors

1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2

Separate Contractors, Definition of

6.1.1

Shop Drawings, Definition of

3.12.1

Shop Drawings, Product Data and Samples

3.11, **3.12**, 4.2.7

Site, Use of

3.13, 6.1.1, 6.2.1

Site Inspections

3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.9.2, 9.4.2, 9.10.1, 13.4

Site Visits, Architect's

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

Special Inspections and Testing

4.2.6, 12.2.1, 13.4

Specifications, Definition of

1.1.6

Specifications

1.1.1, **1.1.6**, 1.2.2, 1.5, 3.12.10, 3.17, 4.2.14

Statute of Limitations

15.1.2, 15.4.1.1

Stopping the Work

2.2.2, 2.4, 9.7, 10.3, 14.1

Stored Materials

6.2.1, 9.3.2, 10.2.1.2, 10.2.4

Subcontractor, Definition of

5.1.1

SUBCONTRACTORS

5

Subcontractors, Work by

1.2.2, 3.3.2, 3.12.1, 3.18, 4.2.3, 5.2.3, 5.3, 5.4, 9.3.1.2,
9.6.7

Subcontractual Relations

5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1

Submittals

3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.4, 9.2, 9.3, 9.8,
9.9.1, 9.10.2, 9.10.3

Submittal Schedule

3.10.2, 3.12.5, 4.2.7

Subrogation, Waivers of

6.1.1, **11.3**

Substances, Hazardous

10.3

Substantial Completion

4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, **9.8**, 9.9.1, 9.10.3, 12.2,
15.1.2

Substantial Completion, Definition of

9.8.1

Substitution of Subcontractors

5.2.3, 5.2.4

Substitution of Architect

2.3.3

Substitutions of Materials

3.4.2, 3.5, 7.3.8

Sub-subcontractor, Definition of

5.1.2

Init.

/

Subsurface Conditions

3.7.4

Successors and Assigns

13.2

Superintendent

3.9, 10.2.6

Supervision and Construction Procedures

1.2.2, **3.3**, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3,
7.3.4, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.4

Suppliers

1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.5.4, 9.6,
9.10.5, 14.2.1

Surety

5.4.1.2, 9.6.8, 9.8.5, 9.10.2, 9.10.3, 11.1.2, 14.2.2,
15.2.7

Surety, Consent of

9.8.5, 9.10.2, 9.10.3

Surveys

1.1.7, 2.3.4

Suspension by the Owner for Convenience

14.3

Suspension of the Work

3.7.5, 5.4.2, 14.3

Suspension or Termination of the Contract

5.4.1.1, 14

Taxes

3.6, 3.8.2.1, 7.3.4.4

Termination by the Contractor

14.1, 15.1.7

Termination by the Owner for Cause

5.4.1.1, **14.2**, 15.1.7

Termination by the Owner for Convenience

14.4

Termination of the Architect

2.3.3

Termination of the Contractor Employment

14.2.2

**TERMINATION OR SUSPENSION OF THE
CONTRACT**

14

Tests and Inspections

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,
9.9.2, 9.10.1, 10.3.2, 12.2.1, **13.4**

TIME

8

Time, Delays and Extensions of

3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, **8.3**, 9.5.1, 9.7,
10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5

Time Limits

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2,
5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1,
9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15.1.2,
15.1.3, 15.4

Time Limits on Claims

3.7.4, 10.2.8, 15.1.2, 15.1.3

Title to Work

9.3.2, 9.3.3

**UNCOVERING AND CORRECTION OF WORK
12**

Uncovering of Work

12.1

Unforeseen Conditions, Concealed or Unknown

3.7.4, 8.3.1, 10.3

Unit Prices

7.3.3.2, 9.1.2

Use of Documents

1.1.1, 1.5, 2.3.6, 3.12.6, 5.3

Use of Site

3.13, 6.1.1, 6.2.1

Values, Schedule of

9.2, 9.3.1

Waiver of Claims by the Architect

13.3.2

Waiver of Claims by the Contractor

9.10.5, 13.3.2, **15.1.7**

Waiver of Claims by the Owner

9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.3.2, 14.2.4, **15.1.7**

Waiver of Consequential Damages

14.2.4, 15.1.7

Waiver of Liens

9.3, 9.10.2, 9.10.4

Waivers of Subrogation

6.1.1, **11.3**

Warranty

3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.2, 9.10.4, 12.2.2,
15.1.2

Weather Delays

8.3, 15.1.6.2

Work, Definition of

1.1.3

Written Consent

1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.10.3,
13.2, 13.3.2, 15.4.4.2

Written Interpretations

4.2.11, 4.2.12

Written Orders

1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith. The Architect is the Initial Decision Maker for this Agreement.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Where the Procurement Requirements include provisions that portions of the Work be File Bid in accordance with the requirements of the Maine Bid Depository System, the subcontracts for these portions of the work will cover the same scope of work as defined by the Procurement Requirements and the File Bid and shall have the same contract amount as listed in the successful bid.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights. The provisions of this section shall not be deemed to modify the contract between the University of Maine System (the Owner) and the Architect under B102-2017 and B201-2017.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants. The provisions of this section shall not be deemed to modify the contract between the University of Maine System (the Owner) and the Architect under B102-2017 and B201-2017.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties ~~will use AIA Document~~ may use AIA Document G201-2013 Project Digital Data Protocol Form and E203™-2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™-2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

.1 For the purpose of this Contract, the Owner is defined as: University of Maine System, acting through its duly authorized agent.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

~~§ 2.2.1 Prior to Following~~ commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. ~~The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.~~

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

Init.

After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor. Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. Architect is a person or entity lawfully licensed to practice in the State of Maine. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number. Whenever the prime professional designer for the Work is an Engineer, the term Architect, wherever used in these documents shall have the term Engineer substituted for the term Architect. The Engineer shall be lawfully licensed to practice engineering in the State of Maine or an entity lawfully practicing engineering identified as such in the Agreement.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work at all times conduct safe performance of the Work, including but not limited to appropriate precautions.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner

to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors,

Init.

/

inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best industry standard or better skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.2.1 After the Contract has been executed, the Owner and Architect may consider a formal request for substitution of products in place of those specified. The Owner shall deduct from the next payment made from the Contract Sum amounts paid to the Architect to evaluate the Contractor's proposed substitutions and to make agreed-upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of the substitutions. By making requests for substitutions, the Contractor

- .1 Represents that the Contractor has personally investigated the proposed substitute product and determined it is equal or superior in all respects to that specified;
- .2 Represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
- .3 Certifies that the cost data presented is complete and includes all related costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and,
- .4 Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be completed in all respects.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.4.4 If a wage scale prepared by the State of Maine Department of Labor, Bureau of Labor Standards, is included in the Contract Documents, such wage scale represents the minimum wages that must be paid in each category of labor employed on the project.

Init.

The provisions of Title 26 MRSA Chapter 15 Preference to Maine Workers and Contractors, apply to this project, including but not limited to:

§ 1310. Wage and benefits rates to be kept posted

A clearly legible statement of all fair minimum wage and benefits rates to be paid the several classes of laborers, workers and mechanics employed on the construction on the public work must be kept posted in a prominent and easily accessible place at the site by each contractor and subcontractor subject to sections 1304 to 1313.

§ 1311. Wage and benefit record of contractor

The contractor and each subcontractor in charge of the construction of a public work shall keep an accurate record showing the names and occupation of all laborers, workers and mechanics employed by them and all independent contractors working under contract with them in connection with the construction on the public works. The record must also show for all laborers, workers, mechanics and independent contractors the hours worked, the title of the job, the hourly rate or other method of remuneration and the actual wages or other compensation paid to each of the laborers, workers, mechanics and independent contractors. A copy of such a record must be kept at the job site and must be open at all reasonable hours to the inspection of the Bureau of Labor Standards and the public authority that let the contract and its officers and agents. It is not necessary to preserve those records for a period longer than 3 years after the termination of the contract. A copy of each such record must also be filed monthly with the public authority that let the contract. The filed record is a public record pursuant to Title 1, chapter 13, except that the public authority letting a contract shall adopt rules to protect the privacy of personal information contained in the records filed with the public authority under this section, such as Social Security numbers and taxpayer identification numbers. The rules may not prevent the disclosure of information regarding the classification of workers or independent contractors and the remuneration they receive. Such rules are routine technical rules as defined by Title 5, chapter 375, subchapter 2-A.

§ 3.4.5 If a wage scale prepared by the U.S. Department of Labor pursuant to the provision of the Davis-Bacon Act is included in the Contract Documents, such wage scale represents the minimum wages that must be paid in each category of labor on the project. The requirements and responsibilities within the Davis-Bacon Act apply to this project if a Davis-Bacon wage scale is included.

§ 3.4.6 EQUAL EMPLOYMENT OPPORTUNITY

During the performance of this contract, the contractor agrees as follows:

- .1 The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, including transgender status, gender, gender identity or gender expression, ethnicity, national origin or citizenship status, familial status, ancestry, age, disability physical or mental, genetic information, veteran or military status status. Such action shall include, but not be limited to, the following: employment, upgrading, demotions, transfers, recruitment or recruitment advertising; layoffs or terminations; rates of pay or other forms of compensation; and selection for training, including apprenticeship.
- .2 The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, including transgender status, gender, gender identity or gender expression, ethnicity, national origin or citizenship status, familial status, ancestry, age, disability physical or mental, genetic information, veteran or military status.
- .3 The contractor will send to each labor union or representative of the workers with which there is a collective or bargaining agreement in place, or other contract or understanding, whereby labor is being furnished for the performances of his contract, a notice, as set forth by the Maine Human Rights Commission, found on their website (https://www1.maine.gov/mhrc/guidance/mhra_guarantees.htm), to be provided by the contracting department or agency, advising the said labor union or workers' representative of the contractor's commitment under the provisions of the contract, and shall post copies of the notice in conspicuous places available to employees and to applicants for employment.
- .4 The contractor will cause the foregoing provisions to be inserted in all contracts for any work covered by this agreement so that such provisions will be binding upon each subcontractor.

.5 Contractors and subcontractors with contracts in excess of \$50,000 will also pursue in good faith affirmative action programs.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.6.1 The University of Maine System is exempt from payment of taxes under the Maine Sales and Use Tax Law Title 36 Section 1760 for taxes on materials that are permanently incorporated into the real property belonging to the University of Maine System. The University of Maine System is also exempt from the payment of Federal Excise Taxes on articles not for resale and from the Federal Transportation Tax on all shipments; exemption certificates for these taxes will be furnished when required. All quotations shall be less these taxes. The contractor shall pay all other taxes that have been or are legally enacted.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions disturbed. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately

suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

- .1 The Contractor shall provide an updated Construction Schedule with each Application for Payment reflecting actual construction progress and activities.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.12.11 The Architect's review of the Contractor's submittals will be limited to examination of an initial submission and two (2) resubmittals. The Architects review of additional submittals will be made only with the consent of the Owner after notification by the Architect. The Owner shall deduct from the next payment made from the Contract Sum amounts paid to the Architect for evaluation of such additional submittals.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.15.3 Waste Management. The University is committed to a resource management strategy which reduces to a minimum the production of waste material while reusing, recycling or composting as much as possible of the remaining materials. Contractor will submit a construction waste management plan for the project that identifies opportunities to reduce, reuse, or recycle waste from renovations or new construction.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the final payment is due, and from time to time during the period for correction of Work described in § 12.2, and until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, endeavor to guard the Owner against defects and deficiencies in the Work, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the

Init.

construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

- .1 The Contractor shall reimburse the Owner for compensation paid to the Architect for additional site visits made necessary by the fault, neglect as determined solely by the Owner, or request of the Contractor. The reimbursement shall be deducted from the next payment made from the Contract Sum following the Owner's payment to the Architect.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably-informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

- 1 The Contractor shall provide Owner a list of all subcontractors and independent contractors on the job site and a record of the entity to whom that subcontractor or independent contractor is directly contracted and by whom that subcontractor or independent contractor is insured for workers' compensation purposes. The list shall be presented at the preconstruction meeting and, when changes occur, at each requisition meeting as necessary.
- 2 Where the use of the Maine Bid Depository is required by the Procurement Requirements, Subcontractors included in the Contractor's Proposal shall be the Subcontractors for the defined Work unless a change has been approved by the Owner.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or

Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction

Init.

/

schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.1.4 The combined overhead and profit included in the total cost to the Owner of a Change in the Work shall be based on a previously agreed upon unit pricing or on the following schedule allowing for appropriate allowances for contract duration:

.1 For the Contractor, for Work performed by the Contractor's own forces, 20% of the cost.

Init.

/

- .2 For the Contractor, for Work performed by the Contractor's Subcontractors, 10% of the amount due the Subcontractors.
- .3 For each Subcontractor involved, for Work performed by the Subcontractor's own forces, 20% of the cost.
- .4 For each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractors, 10% of the amount due the Sub-subcontractor.
- .5 Costs to which overhead and profit is to be applied shall be limited to the following:
 - .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
 - .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
 - .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others; and,
 - .4 Costs of premiums for all bonds, insurance, permit fees, and sales, use or similar taxes related to the Work.

§ 7.1.5 When there is only an extension of Contract Time, any Claim for delay made pursuant to Article 15 is limited to additional costs related to supervision and field office personnel, which may be included in the overhead and profit calculation.

§ 7.1.6 In order to facilitate checking of quotations, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they are to be itemized also. In no case will a change be approved without such itemization.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1** The change in the Work;
- .2** The amount of the adjustment, if any, in the Contract Sum; and
- .3** The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4** As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may

prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

Init.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 The provisions of Title 5 M.R.S.A § 1746, as amended, pertain to this project. The Owner shall retain five percent (5%) of each payment due the Contractor as part of the security for the fulfillment of the Contract Agreement by the Contractor; the Contractor shall not withhold a greater percentage from subcontractors. The Owner may, if deemed expedient by the Owner, cause the Contractor to be paid temporarily or permanently from time to time during the progress of the work, such portion of the amount retained as the Owner deems prudent or desirable.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect ~~may~~ shall withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to

Init.

make such representations to the Owner. The Architect ~~may~~ shall also withhold a Certificate for Payment or, because of subsequently discovered evidence, ~~may~~ shall nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work, i.e. Work that does not conform to the requirements of the Contract, shall include, but not be limited to, non-conforming Work, disputed Work, incomplete Work, and unacceptable Work, which is not remedied;
 - .1 The Architect shall deduct and withhold from any certification for payment an amount equal to one hundred and fifty percent (150%) the value of any defective Work.
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.6.9 All Progress Payments and Final Payment are subject to the requirements of the "Maine Prompt Pay Act" Title 10 M.R.S.A. ch. 201-A, as amended. Payments shall be made on a timely basis in accord with the requirements of this Statute; however, the Contractor waives interest on any late payment.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

- .1 Except with the consent of the Owner, the Architect will perform no more than three (3) site reviews to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional site reviews.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to

certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

§ 9.11 The Contractor and the Contractor's Surety, if any, shall be liable for and shall pay the Owner the sums stipulated as liquidated damages in the Contract Documents for each calendar day of delay after the date established for Substantial Completion in the Contract Documents until the Work is substantially complete.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.
- .4 If this Contract involves renovation, repair, or preparation of surfaces for painting in pre-1978 apartments, houses, or spaces used by child care facilities, Contractor shall use certified workers who follow the lead-safe work practices as required by the US Environmental Protection Agency's Renovation, Repair and Remodeling rule described in 40 CFR § 745.85. Notification of the tenants or users under this rule will be the responsibility of the Owner.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to

Init.

the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. ~~Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection.~~ When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. ~~By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.~~

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, ~~including but not limited to exclusive of attorneys' fees,~~ arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity. This indemnification obligation shall not apply to any claim for which Owner would not be liable under the Maine Tort Claims Act (14 M.R.S.A. '8101, et seq.) if such claim were made directly against Owner and Owner shall continue to enjoy all rights, claims, immunities and defenses available to it under law.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the

Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby ~~incurred~~incurred, exclusive of attorneys' fees.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. ~~If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.~~

Init.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards ~~however caused~~caused, with the exception of intentional acts or grossly negligent consultants, contractors or sub-contractors.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have ~~14~~30 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising

out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

Init.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

Init.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

~~Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.~~

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 ~~The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.~~

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 ~~repeatedly~~ disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

Init.

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the ~~Agreement~~Agreement; but not including overhead and profit on Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law,

Init.

but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision

shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of

60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 ~~If the~~ The parties have selected arbitration as the method for binding dispute resolution in the Agreement, any ~~Claim~~ this Agreement, any claim, dispute or other matter in question arising out of or related to this Agreement subject to, but not resolved by, mediation shall be subject to ~~arbitration which, arbitration, which~~ unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association conducted in the place where the Project is located, unless another place is mutually agreed upon, and in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. ~~The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon, this Agreement, except that the parties shall select only one Arbitrator, and there shall be no discovery. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, this Agreement, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded, defended.~~

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

SECTION 00 73 00.11

SAMPLE

SCHEDULE OF LIQUIDATED DAMAGES

Liquidated damages (a fixed amount set forth in the Contract) agreed to by the Owner and the Contractor are intended to compensate the Owner for unexcused delay in the performance of the Contract. The parties agree that the purpose of the liquidated damages schedule below is to establish, in advance, a reasonable estimate of the damages that would be incurred by the Owner if there is an unexcused delay, or a breach of Contract, which causes the work to be extended beyond the contractual substantial completion date. This agreement of liquidated damages by the parties is made to establish the reasonableness of them to the actual damages an Owner may have incurred due to unexcused delays by the Contractor, even though the actual damages may be an uncertain amount and unprovable.

The specific per diem rates of Liquidated Damages are (____/[enter amt if can reasonably determine-provide method of determination; otherwise] set forth below). By executing the Contract, the Contractor acknowledges that such an amount is not a penalty and that the daily amount set forth in the Contract is a reasonable per diem forecast of damages incurred by the Owner due to the Contractor's failure to complete the Work within the Contract Time.

Original Contract Amount		Per Diem Amount of Liquidated Damages
From More Than	To and Including	
0	\$100,000	\$500
\$100,000	\$300,000	\$675
\$300,000	\$500,000	\$750
\$500,000	\$1,000,000	\$825
\$1,000,000	\$2,000,000	\$1,000
\$2,000,000	\$4,000,000	\$1,250
\$4,000,000	and more	\$1,500

END OF SECTION 00 73 00.11



AIA® Document A101® – 2017 Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the N/A day of _____ in the year Sample
(In words, indicate day, month and year.)

for the following **PROJECT**:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

THE CONTRACTOR:
(Name, legal status and address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Document A201®–2017, General Conditions of the Contract for Construction. Article 11 of A201®–2017 contains additional insurance provisions.

TABLE OF ARTICLES

- A.1 GENERAL**
- A.2 OWNER'S INSURANCE**
- A.3 CONTRACTOR'S INSURANCE AND BONDS**
- A.4 SPECIAL TERMS AND CONDITIONS**

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

§ A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 **Causes of Loss.** The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:

(Indicate below the cause of loss and any applicable sub-limit.)

§ A.2.3.1 For this project, Property Insurance coverage, up to the total amount of the Project, will be provided by the University by either adding the Project to the University's existing master property insurance or purchasing a stand-alone builder's risk policy. Coverage shall be included for the Contractor and all Subcontractors, as their interests may appear, while involved in the Project and until the work is completed or the contractor is otherwise advised in writing. This insurance is limited to the "all risk" type coverage provided under the University's master property insurance for direct physical loss or damage to the building or building materials related to the project, subject to standard policy limitations and exclusions. The contractor is responsible for a \$10,000 per claim deductible. Any other insurance desired by the Contractor beyond that covered by the University's insurance, or to cover the \$10,000 deductible, is the responsibility of the Contractor. This contract stands as verification of the University's property insurance coverage on the project and no further verification will be provided.

Causes of Loss

Sub-Limit

§ A.2.3.1.2 **Specific Required Coverages.** The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:

(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage

Sub-Limit

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 **Deductibles and Self-Insured Retentions.** If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 **Occupancy or Use Prior to Substantial Completion.** The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of

Init.

coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ A.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

- ☐ **§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.
- ☐ **§ A.2.4.2 Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.
- ☐ **§ A.2.4.3 Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.
- ☐ **§ A.2.4.4 Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.
- ☐ **§ A.2.4.5 Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.
- ☐ **§ A.2.4.6 Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.
- ☐ **§ A.2.4.7 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects,

Init.

AIA Document A101® – 2017 Exhibit A. Copyright © 2017 by The American Institute of Architects. All rights reserved. The "American Institute of Architects," "AIA," the AIA Logo, "A101," and "AIA Contract Documents" are registered trademarks and may not be used without permission. This document was produced by AIA software at 12:51:42 ET on 06/17/2021 under Order No.2908190133 which expires on 07/02/2021, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail copyright@aia.org.

User Notes:

(1467185228)

engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

☐ **§ A.2.5.1 Cyber Security Insurance** for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information. *(Indicate applicable limits of coverage or other conditions in the fill point below.)*

☐ **§ A.2.5.2 Other Insurance**
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage

Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.1.1 Certificates of Insurance filed with the University of Maine System shall indicate the Certificate Holder as:

University of Maine System
Office of Risk Management
Robinson Hall
46 University Drive
Augusta, ME 04330

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04. All required insurance shall be provided by companies that have a current A.M. Best insurance rating of A- or better and that are licensed or approved to do business in the State of Maine.

Init.

AIA Document A101® – 2017 Exhibit A. Copyright © 2017 by The American Institute of Architects. All rights reserved. The "American Institute of Architects," "AIA," the AIA Logo, "A101," and "AIA Contract Documents" are registered trademarks and may not be used without permission. This document was produced by AIA software at 12:51:42 ET on 06/17/2021 under Order No.2908190133 which expires on 07/02/2021, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail copyright@aia.org.

User Notes:

(1467185228)

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than two million dollars (\$ 2,000,000) each occurrence, two million dollars (\$ 2,000,000) general aggregate, and two million dollars (\$ 2,000,000) aggregate for products-completed operations hazard, providing coverage for claims including

- .1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
- .2 personal injury and advertising injury;
- .3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
- .4 bodily injury or property damage arising out of completed operations; and
- .5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

- .1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
- .2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.
- .3 Claims for bodily injury other than to employees of the insured.
- .4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
- .5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
- .6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
- .7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
- .8 Claims related to roofing, if the Work involves roofing.
- .9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
- .10 Claims related to earth subsidence or movement, where the Work involves such hazards.
- .11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than one million dollars (\$ 1,000,000) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

Init.

AIA Document A101® – 2017 Exhibit A. Copyright © 2017 by The American Institute of Architects. All rights reserved. The "American Institute of Architects," "AIA," the AIA Logo, "A101," and "AIA Contract Documents" are registered trademarks and may not be used without permission. This document was produced by AIA software at 12:51:42 ET on 06/17/2021 under Order No.2908190133 which expires on 07/02/2021, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail copyright@aia.org.

User Notes:

(1467185228)

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than five hundred thousand dollars (\$ 500,000.) each accident, five hundred thousand dollars (\$ 500,000.) each employee, and five hundred thousand dollars (\$ 500,000.) policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and ~~docks~~ docks. Policy limits for such coverage shall not be less than five hundred thousand dollars (\$500,000) each accident, five hundred thousand dollars (\$500,000) each employee, and five hundred thousand dollars (\$500,000) policy limit. Contractor is required to provide proof of such coverage, if applicable to the Work, by submitting a copy of the endorsement or by submitting the USLH form WC 00 01 06 A (current edition).

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than one million dollars (\$ 1,000,000.) per claim and one million dollars (\$ 1,000,000.) in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than one million dollars (\$ 1,000,000.) per claim and two million dollars (\$ 2,000,000.) in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than one million dollars (\$ 1,000,000.) per claim and two million dollars (\$ 2,000,000.) in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than two million dollars (\$ 2,000,000.) per claim and two million dollars (\$ 2,000,000.) in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than one million dollars (\$ 1,000,000.) per claim and one million dollars (\$ 1,000,000.) in the aggregate. Authorization from Administration of the University of Maine System must be obtained thirty (30) days prior to the utilization of the equipment.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

N/A

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[] **§ A.3.3.2.1** Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such ~~insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3-insurance.~~ The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any

deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:

(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

- [] **§ A.3.3.2.2 Railroad Protective Liability Insurance**, with policy limits of not less than (\$) per claim and (\$) in the aggregate, for Work within fifty (50) feet of railroad property.
- [] **§ A.3.3.2.3 Asbestos Abatement Liability Insurance**, with policy limits of not less than one million dollars (\$ 1,000,000) per claim and two million dollars (\$ 2,000,000) in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.
- [] **§ A.3.3.2.4 Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.**
- [] **§ A.3.3.2.5 Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.**
- [] **§ A.3.3.2.6 Other Insurance**
(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows: and the Contractor shall furnish a Performance Bond and a Payment Bond covering the faithful performance of the Contract and payment of obligations arising thereof. Bonds may be obtained through the Contractor's usual source and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to 100% of the Contract Sum. Should the Contract Sum change during the contract and warranty periods, the amount of the Bonds will be changed to reflect the Contract Sum.

- .1 The Contractor shall deliver the required bonds to the Owner at the same time as the signed Contract Agreement is delivered to the Owner. Prior to the commencement of the Work, the Contractor shall submit satisfactory evidence that such bonds will be furnished.

(Specify type and penal sum of bonds.)

- .2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

Type	Penal Sum (\$0.00)

Payment Bond

Performance Bond

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.**3**

The Contract Bonds shall continue in effect for one year after final acceptance of each contract to protect the Owner's interest in connection with the one year guarantee of workmanship and materials

Init.

and to assure settlement of claims, for the payment of all bills for labor, materials, and equipment by the Contractor.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

N/A



00 73 46
State of Maine
Department of Labor
Bureau of Labor Standards
Augusta, Maine 04333-0045
Telephone (207) 623-7906

Wage Determination - In accordance with 26 MRS §1301 et. seq., this is a determination by the Bureau of Labor Standards, of the fair minimum wage rate to be paid to laborers and workers employed on the below titled project.

2026 Fair Minimum Wage Rates – Building 2 Penobscot County (other than 1 or 2 family homes)

Occupational Title	Minimum Wage	Minimum Benefit	Total
Brickmasons and Blockmasons	\$43.02	\$7.64	\$50.66
Bulldozer Operator	\$30.62	\$5.38	\$36.00
Carpenter	\$30.01	\$19.69	\$49.70
Cement Masons and Concrete Finisher	\$24.42	\$2.52	\$26.94
Construction and Maintenance Painters	\$23.96	\$1.59	\$25.55
Construction Laborer	\$21.90	\$19.72	\$41.62
Conveyor Operators and Tenders	\$30.17	\$13.77	\$43.94
Crane and Tower Operators	\$40.43	\$8.63	\$49.06
Crushing Grinding and Polishing Machine Operators	\$26.15	\$3.24	\$29.39
Earth Drillers - Except Oil and Gas	\$25.04	\$3.77	\$28.81
Electrical Power - Line Installer and Repairers	\$48.12	\$15.63	\$63.75
Electricians	\$38.74	\$21.14	\$59.88
Elevator Installers and Repairers	\$67.34	\$39.76	\$107.10
Excavator Operator	\$34.12	\$6.49	\$40.61
Fence Erectors	\$30.90	\$2.18	\$33.08
Flaggers	\$21.39	\$0.86	\$22.25
Floor Layers - Except Carpet/Wood/Hard Tiles	\$29.00	\$8.65	\$37.65
Glaziers	\$23.73	\$4.62	\$28.35
Hazardous Materials Removal Workers	\$24.12	\$1.60	\$25.72
Heating and Air Conditioning and Refrigeration Mechanics and Installers	\$32.88	\$4.41	\$37.29
Heavy and Tractor - Trailer Truck Drivers	\$24.44	\$2.50	\$26.94
Highway Maintenance Workers	\$23.30	\$1.14	\$24.44
Industrial Machinery Mechanics	\$29.97	\$6.74	\$36.71
Industrial Truck and Tractor Operators	\$24.61	\$4.21	\$28.82
Insulation Worker - Mechanical	\$27.35	\$6.05	\$33.40
Light Truck or Delivery Services Drivers	\$26.79	\$5.14	\$31.93
Loading Machine and Dragline Operators	\$29.71	\$4.79	\$34.50
Millwrights	\$35.99	\$10.52	\$46.51
Mobile Heavy Equipment Mechanics - Except Engines	\$30.67	\$5.10	\$35.77
Operating Engineers and Other Equipment Operators	\$39.74	\$3.67	\$43.41
Paving Surfacing and Tamping Equipment Operators	\$30.74	\$10.67	\$41.41
Pile-Driver Operators	\$37.15	\$3.12	\$40.27
Pipe/Steam/Sprinkler Fitter	\$43.76	\$25.44	\$69.20
Pipelayers	\$28.75	\$3.64	\$32.39
Plumbers	\$40.00	\$24.71	\$64.71
Radio Cellular and Tower Equipment Installers	\$34.72	\$5.63	\$40.35
Reinforcing Iron and Rebar Workers	\$33.35	\$27.55	\$60.90
Riggers	\$31.25	\$7.68	\$38.93
Roofers	\$24.71	\$4.70	\$29.41
Sheet Metal Workers	\$24.97	\$5.69	\$30.66
Structural Iron and Steel Workers	\$30.98	\$7.12	\$38.10
Tapers	\$29.16	\$5.64	\$34.80
Telecommunications Equipment Installers and Repairers - Except Line Installers	\$37.09	\$10.21	\$47.30
Telecommunications Line Installers and Repairers	\$28.49	\$5.29	\$33.78
Tile and Marble Setters	\$28.91	\$5.46	\$34.37

Welders are classified as the trade to which welding is incidental (e.g. welding structural steel is Structural Iron and Steel Worker)

Apprentices – The minimum wage rates for registered apprentices are the rates recognized in the sponsorship agreement for registered apprentices working in the pertinent classification.

For any other specific trade on this project not listed above, contact the Bureau of Labor Standards for further clarification.

Title 26 §1310 requires that a clearly legible statement of all fair minimum wage and benefits rates to be paid the several classes of laborers, workers and mechanics employed on the construction on the public work must be kept posted in a prominent and easily accessible place at the site by each contractor and subcontractor subject to sections 1304 to 1313.

Appeal – Any person affected by the determination of these rates may appeal to the Commissioner of Labor by filing a written notice with the Commissioner stating the specific grounds of the objection within ten (10) days from the filing of these rates.

A true copy

Attest: Scott R. Cotnoir
Scott R. Cotnoir
Wage & Hour Director
Bureau of Labor Standards

Supersedes 02-03-2025
Effective 01-10-2026

This Page Intentionally Blank

SECTION 01 10 00
SUMMARY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents.
 - 2. Type of the Contract.
 - 3. Permits.
 - 4. Work schedule.
 - 5. Work under other contracts.
 - 6. Specification formats and conventions.
 - 7. Miscellaneous Provisions.

1.03 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: UM Keyo Electrical Service Upgrade
 - 1. Project Location:
 - a. University of Maine
 - b. Keyo Building
 - c. 139 Rangeley Road
 - d. Orono, ME 04469
- B. The project consists of the removal and replacement of existing building electrical equipment and associated feeders to the Keyo Building. Definable Features of Work (DFOW) include, but are not limited to:
 - 1. Division 01 – General, Temporary Facilities and Controls, Commissioning
 - 2. Division 02 – Select Demolition
 - 3. Division 03 – Concrete
 - 4. Division 07 – Sealants
 - 5. Division 23 – HVAC, Controls
 - 6. Division 26 – Electrical
 - 7. Division 27 – Communications
 - 8. Division 31 – Site Clearing, Earthwork
- C. Owner: University of Maine System, CPPM
 - 1. Owner's Representative: Sarah Cline
- D. Architect: Harriman, 46 Harriman Drive, Auburn, Maine.

1.04 TYPE OF CONTRACT

- A. Project will be constructed under a Design Bid Build contract.

1.05 PERMITS

- A. The Architect will obtain building permits from the Maine Office of State Fire Marshal and the Town of Orono.
- B. The Contractor is responsible for obtaining all trade permits required by the Town or Orono.

1.06 WORK SCHEDULE

- A. Bid Advertised: Thursday, January 8, 2026
- B. Non-Mandatory Pre-Bid Meeting: Thursday, January 15, 2026, 10:00 am
- C. Questions Due: Monday, January 26, 2026, 2:00 pm
- D. Response to Questions by: Tuesday, February 3, 2026, 2:00 pm
- E. Bid Opening-Bids Received Until: Thursday, February 12, 2026, 2:00 pm
- F. Construction Start Date: Mobilization shall be on a date to be determined that is mutually agreeable between Contractor and Owner
- G. Substantial Completion Date: Thursday, October 1, 2026
- H. Final Completion Date: Friday, January 29, 2027
- I. Substantial Completion is the date that the Keyo Building has permanent power from the new pad-mounted medium-voltage transformer. The switchgear is not expected to be delivered until after permanent power is needed on October 1, 2026. Contractor shall install the pad-mounted transformer with temporary buses to facilitate permanent power connections to Keyo. Contractor shall return to install the switchgear and make final connections.
- J. Final Completion and payment will not occur until after Switchgear has been installed and energized.
- K. Time: The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

1.07 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts. References to concurrent work included throughout the contract documents is intended to identify areas of potential overlap and conflict but does not necessarily capture all work under separate contracts. The Contractor shall coordinate fully with the Architect, Owner, and separate contractors prior to the

commencement of work to identify all potential conflicts between separate contractors and to confirm scheduling requirements for a successful project completion.

- B. The Owner shall be responsible for the abatement of any hazardous materials within the existing facility. The Contractor shall be responsible for coordinating with the Owner and the Owner's Hazardous Materials Abatement Contractor to ensure the abatement work is completed within the requirements of the construction schedule. If Contractor encounters any suspected hazardous materials that have not been previously identified in the contract documents, then Contractor shall immediately stop work in the affected area and notify the Owner within 24-hours. Work is not to continue in the affected area until test results have been received, and a remediation plan (if required) has been determined.
- C. Contractor shall be responsible for procuring and coordinating with a qualified 3rd Party Special Inspector to perform any required special inspections specified throughout the contract documents. The Owner will not obtain any special inspectors for this project. Contractor shall provide a matrix of all testing and inspections that are expected to occur throughout the project.
- D. Contractor shall be responsible for procuring and coordinating with a qualified commissioning agent to perform the commissioning specified throughout the contract documents. The Owner will not obtain a commissioning agent for this project.
- E. Owner has procured the pad-mounted switch from Specification 26 05 00 and the pad-mounted medium-voltage transformer from Specification 26 12 19. Contractor shall be responsible for receiving, handling, and storage of equipment upon delivery.
 - 1. Scheduled Delivery of Medium-Voltage Transformer: June 2026
 - 2. Scheduled Delivery of Switchgear: December 2026

1.08 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "2004 Master Format" numbering system.
 - 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
 - 2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for

clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

- a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.09 MISCELLANEOUS PROVISIONS

- A. Contractor shall be responsible for familiarizing themselves with the contract documents, and shall be responsible for all supervision, labor, tools, materials, equipment, incidentals, insurance, and associated work required to provide a complete installation of the work in accordance with the contract documents.
- B. In reviewing the contract documents, Contractor has accounted for all material quantities shown on the drawings, and any and all appurtenances not shown on the drawings/specifications, but which are required for the complete installation of performance of the work.
- C. Contractor is responsible for obtaining and paying for any police, flagmen, and traffic/vehicular permits required for the execution of their work, including closing any streets or rights-of-way.
- D. It is understood that every single condition, connection, transition, etc. cannot be specifically detailed in the Contract Documents. Details are provided for typical conditions and minor adjustments to adapt these to the specific conditions throughout the project is a part of the project scope of work and does not constitute a change in the Contract.
- E. Material safety data sheets shall be made available in accordance with OSHA requirements.
- F. No asbestos containing materials shall be used in the work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 14 00
WORK RESTRICTIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Special Scheduling Requirements
 - 2. Owner's Occupancy Requirements
 - 3. Contractor's Access and Use of Premises
 - 4. Work Hours and Notifications
 - 5. Security

1.03 SPECIAL SCHEDULING REQUIREMENTS

- A. Owner will provide the temporary generator identified on Drawing E20-0 to be used for the power shutdown to Keyo Building. Generator use for temporary power to the Keyo Building may not exceed 30-calendar days. Contractor will be responsible for performing the power change-over within 30-calendar days. Contractor shall be responsible for all other temporary power requirements necessary to complete the work.
- B. Shutdown of the Keyo Building electrical service shall not occur until after temporary electrical service is in place and critical loads have been cut over.
- C. The project will be occurring concurrently with the Food Innovation Lab project (Project 5100701), which will be connected to the Keyo building. The Food Innovation Lab project requires permanent power to the Keyo Building to be established and connected no later than 01 October 2026. Contractor shall coordinate and communicate with the Food Innovation Lab Contractor to ensure there is no conflict in work and ensure that the project schedule is maintained.
- D. The switchgear is expected to be delivered after permanent power is needed at the Keyo Building. Contractor shall proceed with installing and connecting the transformer and any temporary measures needed to facilitate permanent power to the Keyo Building. Contractor shall have the applicable infrastructure installed and prepped for the switchgear to be installed and final connections to be made within 2-business days of the switchgear being delivered.

1.04 OWNER'S OCCUPANCY REQUIREMENTS

- A. Contractor will not, at any point during the installation of their work during the life of the project, impeded or disrupt the operation of the University's Campus.

- B. Maintain access to existing walkways, roadways, and other adjacent occupied or used facilities. Do not close or obstruct walkways, roadways, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
- C. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- D. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of Work, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.

1.05 CONTRACTOR ACCESS AND USE OF PREMISES

- A. General: Portions of the existing Keyo Building will be occupied during construction and the Contractor shall ensure that occupants and operations of the existing building are not disrupted during construction.
- B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Owner Occupancy: Allow for Owner occupancy of facilities adjacent to the work and use by the public.
 - 2. Driveways and Entrances: Keep driveways, parking, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.
- D. Parking: Contractor parking shall be in compliance with University Parking and Transportation Services policy, which can be found at the link below:

<https://umaine.edu/parking/>
- E. Tobacco Free Policy: All institutions falling under the University System are tobacco free, and compliance with the tobacco free campus policy is mandatory. Contractor shall be responsible for notifying its workers and subcontractors of the policy, and Contractor shall be responsible for enforcing the policy with its workers and subcontractors. Noncompliance will be managed as follows:
 - 1. First offense – notify Contractor to remind employee and/or subcontractor of policy
 - 2. Second offense – Contractor/subcontractor employee removed from campus for the remainder of the Work.

Additional information regarding the tobacco free campus policy is located at:

<http://umaine.edu/tobaccofree/>

1.06 WORK HOURS AND NOTIFICATIONS

- A. On-Site Work Hours: Normal Work Hours are 7:00 AM to 5:00 PM, Monday through Friday unless otherwise coordinated with Owner.
- B. Work Outside Regular Hours: Requests to work outside of normal working hours are to be submitted in writing to the Owner's Representative 72 hours prior to the proposed work commencing. Owner reserves the right to reject such requests.
- C. Noise Restrictions: Contractor shall limit high-noise activities to occur between 8:00 AM and 4:00 PM. Noise levels shall be kept in compliance with the Town of Orono Noise Ordinance provided the below link.

https://library.municode.com/me/orono/codes/code_of_ordinances?nodeId=PTIIR_CH13EN_ARTIINOCO

- D. Utility Interruptions
 - 1. All utility cutovers and interruptions are to be coordinated with the Owner's Representative and submitted in writing 72 hours in advance of the requested shutdown.
 - 2. Contractor shall coordinate fire alarm and sprinkler shutdowns with the Owner's Representative 72 hours in advance of the requested shutdown. As part of the requested shutdown, Contractor shall provide a complete copy of the Orono Fire Department Life Safety Division Notification of Fire Alarm System Deficiency. Owner shall provide a blank template to Contractor during preconstruction meeting. Contractor shall be responsible for providing their own fire watch for all Fire Alarm and Sprinkler shutdowns. For any sprinkler shutdown, Contractor shall identify the valve that will be operated to impair the system.

1.07 SECURITY

- A. Employee List: Contractor and their subcontractors shall submit a list of all employees anticipated to be on-site as part of the subject project.
- B. Drone Policy: The use of drones on campus is strictly prohibited without prior approval. Any request by the contractor to utilize drones must be coordinated through the Owner's Project Manager.
- C. Weapons and Ammunition are not permitted on the campus of the University of Maine System.
- D. Sexual Harassment is strictly prohibited and will not be tolerated on any campuses of the University of Maine System.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 14 00

This Page Left Intentionally Blank

SECTION 01 22 00
UNIT PRICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.03 DEFINITIONS

- A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.04 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the Part 3 "Schedule of Unit Prices" Article contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material.
 - 1. Description: Unsatisfactory soil excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312000 "Earth Moving."
 - 2. Unit of Measurement: 15 cubic yards of soil excavated, based on in-place surveys of volume before and after removal.
- B. Unit Price No. 2: Mass rock excavation and replacement with satisfactory soil material.
 - 1. Description: Classified mass rock excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312000 "Earth Moving."
 - 2. Unit of Measurement: 10 cubic yards of rock excavated, based on in-place surveys of volume before and after removal.
- C. Unit Price No. 3: Trench rock excavation and replacement with satisfactory soil material.
 - 1. Description: Classified trench rock excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312000 "Earth Moving."
 - 2. Unit of Measurement: 5 cubic yards of rock excavated, based on survey of in-place surveys volume of before and after removal.

END OF SECTION 01 22 00

SECTION 01 23 00
ALTERNATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.
- B. Alternates listed below are “DEDUCT” alternates. Therefore, the costs associated with this work shall be included in the proposed “Base Bid” price and identified separately as a “Deduct Alternate” price on the “Price Proposal” form.

1.03 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form (Price Proposal Form) for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
 - 2. Hold pricing for 60 days from date of bid to allow Owner time for project accounting. Alternates not accepted before contract signing may be added by Change Order later.

1.04 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 – Communication Cable Material and Pulling
 - 1. Base Bid: Contractor to provide communication cables and all pull of cables through new underground communications conduits from manhole EHH-3 to proposed medium voltage switch location.
 - 2. Alternate: Contractor to remove cable and pulling for new underground communications cables from scope.

END OF SECTION 012300

SECTION 01 26 00
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
 - 1. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.03 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.04 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 20 days after receipt of Proposal Request or earlier as specified in Proposal Request issued, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include quotes on supplier's and subcontractor's letterhead for the requested change.
 - e. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float time before requesting an extension of the Contract Time.

- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float time before requesting an extension of the Contract Time.
 6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
- C. Proposal Request Form: Use AIA Document G709 for Proposal Requests, or format as approved by the Owner.

1.05 ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
1. Include installation costs in purchase amount only where indicated as part of the allowance.
 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.
1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.06 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a University of Maine Change Order form for signatures of Owner and Contractor.

1.07 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

This Page Left Intentionally Blank

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. The forms for application for payment, duly notarized, shall be the current authorized edition of the AIA Document G702, Application for Payment, supported by a current authorized edition of AIA G703, Continuation Sheet. Samples of these, and other required AIA documents, are provided in the Contract Documents under Division 00 for informational purposes only.

1.03 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

- A. Construction Schedule
 - 1. Correlate line items in the Schedule of Values with the construction schedule requirement of Section 01 32 00 "Construction Progress Documentation"
 - 2. Submit the Schedule of Values to Architect prior to the pre-construction meeting
- B. Format and Content: Utilize the cost-loaded construction schedule in Section 01 32 00 "Construction Progress Documentation" to establish the Schedule of Values. Each line item in the Schedule of Values shall correlate to a cost-loaded schedule activity.
 - 1. Identification: Include the following Project identification the Schedule of Values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Contractor's name and address.
 - d. Date of submittal.
 - 2. Submit draft of AIA G702 Application for Payment form and AIA G703 Continuation Sheet (Schedule of Values) form.
 - 3. Documentation: Electronically submit proper documentation for the amounts being requisitioned from subcontractors and material suppliers with each Application for Payment.
 - 4. Stored Materials: If Contractor is requesting payment for stored materials as part of the Application for Payment, Contractor must complete Column F in the G703 Continuation Sheet (Schedule of Values) to record the stored materials amounts against line items that

pertain to those stored materials. Stored materials are materials or equipment purchased or fabricated and stored, but not yet installed or incorporated into the Work.

- a. Complete and an electronic copy of 00 62 79 Stored Materials form with all required documentation. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
 - b. Only major long lead delivery items may be considered for off-site storage (example: long lead custom mechanical unit). Standard order and production materials and products shall be delivered to the site before including in Application for Payment of such items.
5. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when approved Change Orders or Construction Change Directives result in a change in the Contract Sum.
 6. Retainage: The required five percent (5%) retainage held per Application for Payment submission shall be accounted for on the G703 on a per line item basis. Each line item with a value in Column G "Total Completed and Stored To Date" shall have a corresponding five percent retainage value entered in Column I.
 - a. Final Release of Retainage: The final release of retainage shall be entered as a separate line item on the G703 as "Final Release of Retainage" with the full amount of the five percent retainage entered as a negative number in Column I. The final release of retainage request is submitted as a separate application.

1.05 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: A draft G702 Application for Payment shall be submitted to Architect and Owner on or before the last Wednesday of the month. Architect and Owner will review the draft Application for Payment and may return comments prior to scheduling a meeting to review. The period covered by each Application for Payment is one (1) month, ending on the last day of the month.
- C. Payment Application Forms: The Contractor is required under the Contract Documents to use official original AIA documents. Samples of the required documents are provided in Division 00 of the Specifications.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. Include amounts of approved Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal:
 1. Electronically submit signed and notarized originals of:
 - a. AIA G702 Application & Certificate of Payment.
 - b. AIA G703 Continuation Sheet.
 - c. AIA G706 Contractor's Affidavit of Payment of Debts & Claims.

- d. AIA G706A Contractor's Affidavit of Release of Liens
 - e. 00 65 19.17 Waiver of Lien
- 2. Transmit each Application for Payment with a transmittal form listing attachments and recording appropriate information about submission.

- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waiver of mechanic's lien from subcontractors, sub-subcontractors, major suppliers, and every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit final waivers.
 - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 5. Waiver Forms: Submit 00 65 19.17 Waiver of Lien forms, executed in a manner acceptable to Owner.

- G. Certified Payrolls: Wages paid to all workers performing work on the Project shall be in accordance with the Section 00 73 64 Wage Determination Schedule for the Project. Contractor shall submit one (1) copy of each weekly certified payroll for Contractor and all subcontractors, sub-subcontractors, sub-sub-subcontractors, etc. performing work on the Project during the time covered by the Application for Payment. Failure to provide accurate and timely reports may result in delayed payments. The certified payroll shall be completed in accordance with Section 3.4.4 of the A201 General Conditions and contain the following information:
 - 1. Contractor Name.
 - 2. Contractor Address.
 - 3. Period Number.
 - 4. Week ending date.
 - 5. Employee(s)'s name.
 - 6. Employee(s)'s job title.
 - 7. Employee hourly wage:
 - a. Straight time rate.
 - b. Overtime rate.
 - 8. Hours worked per day (broken down by straight time and overtime hours).
 - 9. Hours worked per week (broken down by straight time and overtime hours).
 - 10. Total earned for the week:
 - a. Straight time.
 - b. Overtime.
 - 11. Benefits that form a part of the wage rate.
 - 12. The signature and name of the authorized payroll person.

- H. Initial Application for Payment: Administrative actions and submittals that must precede submittal of first Application for Payment include the following:
 - 1. List of subcontractors.
 - 2. Schedule of Values.
 - 3. Contractor's Construction Schedule.
 - 4. Submittals Schedule.
 - 5. List of Contractor staff assignments.
 - 6. List of Contractor's principal consultants.

7. Copies of building permits and other required permits
 8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 9. Initial progress report.
 10. Report of preconstruction conference.
 11. Insurance verification through submission of insurance certificates, for all Subcontractors.
- I. Progress Applications for Payment: Administrative actions and submittals that must precede or coincide with submittal of progress Applications for Payment include the following:
1. Contractor's Construction Schedule update.
 2. Submittals for Work being requisitioned that are complete and approved.
 3. Submission of list of completed tests, checklists, commissioning, reports, and similar requirements for the work that are submitted and in compliance with the Contract Documents.
 4. Distribution of minutes of previous month's progress meeting.
 5. Current record drawings.
- J. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion, less retainage, for portion of the Work claimed as substantially complete. Application must:
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. Reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- K. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited to, the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that fees and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA G707 Consent of Surety to Final Payment.
 5. Evidence that claims have been settled.
 6. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assume responsibility for corresponding elements of the Work.
 7. Final, liquidated damages settlement statement, if a liquidated damage claim has been processed.
 8. As-built drawings.
 9. Operation and maintenance manuals.
 10. Final lien waivers.
 11. All training and equipment testing is complete.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

This Page Left Intentionally Blank

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Administrative and supervisory personnel.
 - 2. Project meetings.
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
 - 2. Division 01 Section "Closeout Procedures" for coordinating Contract closeout.

1.03 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
 - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components.
- B. Coordinate with contractors doing work for the Owner under separate contracts.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts

and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Project closeout activities.

- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.04 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings as determined by the Contractor and subcontractors, if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate required installation sequences.
 - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.05 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
1. Include special personnel required for coordination of operations with other contractors.

1.06 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for requests for interpretations (RFIs).
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of Record Documents.
 - l. Use of the premises.
 - m. Work restrictions.
 - n. Owner's occupancy requirements.
 - o. Responsibility for temporary facilities and controls.
 - p. Construction waste management and recycling.
 - q. Parking availability.
 - r. Office, work, and storage areas.
 - s. Equipment deliveries and priorities.
 - t. First aid.
 - u. Security.
 - v. Progress cleaning.
 - w. Working hours.
 - x. USM campus operational protocols and procedures.
 3. Minutes: Record and distribute meeting minutes.
 - a. Include action items and responsible party.
- C. Progress Meetings: Conduct progress meetings at intervals as required by the project schedule. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these

- meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Application for Payment: Contractor shall bring copy of Application for Payment to meeting. Review Application for Payment and required attachments, including record drawing and documents status, waivers of mechanic's liens, list of completed tests, checklists, commissioning, reports, and similar requirements for the work are submitted and in compliance with the Contract Documents.
 - c. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Requests for interpretations (RFIs).
 - 16) Status of proposal requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) Documentation of information for payment requests.
 3. Minutes: Record and distribute the meeting minutes.
 - a. Include action items and responsible party.
 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
1. Submittals Schedule.
 2. Baseline Construction Schedule.
 3. Monthly Construction Progress Schedule.
 4. Weekly Look Ahead.
 5. Field condition reports.
 6. Special reports.
- B. Related Sections include the following:
1. Section 01 29 00 "Payment Procedures" for submitting the Schedule of Values.
 2. Section 01 31 00 "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
 3. Section 01 33 00 "Submittal Procedures" for submitting schedules and reports.
 4. Section 01 40 00 "Quality Requirements" for submitting a schedule of tests and inspections.

1.03 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
 2. Predecessor Activity: An activity that precedes another activity in the network.
 3. Successor Activity: An activity that follows another activity in the network.
- B. Baseline Schedule: A schedule that is developed prior to commencement of work and serves as the original planned construction schedule. The baseline schedule is the original construction schedule that is used to evaluate construction progress, delays, and changes. It must be approved by the Architect and Owner prior to commencement of construction.
- C. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.

- D. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- E. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- F. Data Date: The last date that progress is recorded in the reporting period.
- G. Event: The starting or ending point of an activity.
- H. Final Completion: The point in time when all contract requirements are complete and verified with the Owner and Architect.
- I. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- J. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- K. Major Area: A story of construction, a separate building, or a similar significant construction element.
- L. Milestone: A key or critical point in time for reference or measurement.
- M. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
- N. Period of Performance: The contract duration starting from date of the Contract Agreement to the date of Final Completion.
- O. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.
- P. Substantial Completion: The point in time the Owner would consider the project ready for beneficial occupancy wherein by mutual agreement of the Owner, Architect, and Contractor, and a Certificate of Occupancy has been achieved, Owner use of the facility is allowed while construction access continues in order to complete remaining items (e.g., punchlist and other close out submittals)
- Q. Time Impact Analysis (TIA): Forensic schedule method used to evaluate how a specific delay impacts a project's critical path and overall completion date.

- R. Work Breakdown Structure (WBS): A hierarchical decomposition of a project's total scope into smaller, manageable deliverables and work components, acting as the project's outline to organize work phases before defining specific activities.

1.04 SUBMITTALS

- A. Submittals Schedule: Arrange the following information in a tabular format:
 - 1. Scheduled date for first submittal.
 - 2. Specification Section number and title.
 - 3. Submittal category (action or informational).
 - 4. Name of subcontractor.
 - 5. Description of the Work covered.
 - 6. Scheduled date for Architect's final release or approval.
- B. Construction Schedule: Contractor shall utilize professional construction scheduling computer software to develop a baseline schedule and maintain construction progress reporting throughout the duration of the project. Contractor shall prepare and submit the following schedules:
 - 1. Baseline Construction Schedule Package: Submit in 11x17 .pdf and native file format to the Owner and Architect prior to the preconstruction meeting
 - 2. Monthly Construction Progress Schedule Package: Submit in 11x17 .pdf and native file format concurrently with application for payment.
 - 3. Weekly Look Ahead: Submit in 11x17 .pdf format weekly on Friday
- C. Field Condition Reports: Submit at time of discovery of differing conditions.
- D. Special Reports: Submit at time of unusual event.

1.05 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from parties involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Submit prior to the preconstruction meeting. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. The Owner will review the schedule of submittals and identify the submittals that they want to receive a copy of at the same time that the Architect's copies are sent out.

2.02 BASELINE CONSTRUCTION SCHEDULE PACKAGE

- A. Deliverables:
 1. Provide the project's full, cost-loaded, baseline schedule in 11x17 .pdf and native file formats
 2. Utilizing the project's full baseline schedule, provide the project milestone schedule in 11x17 .pdf format
 3. Utilizing the project's full baseline schedule, provide the project's critical path schedule in 11x17 .pdf format
- B. Period of Performance: The Baseline Construction Schedule is to extend from date of Contract Award to date of Final Completion.
 1. Contract completion date shall not be changed by submission of a schedule that shows an early or delayed completion date, unless specifically authorized by Change Order.
 2. Changes to the Period of Performance may only be authorized by the Owner in a formal contract modification.
 3. Techniques used for the purpose of artificially adjusting activity durations to consume float and influence the critical path are prohibited.
- C. Cost Correlation and Cost Loading: The Baseline Construction Schedule is the basis of the schedule of values and it will subsequently determine the monthly contract earnings during each update period. Therefore, the schedule activities are to be accurately cost-loaded where the Owner, Architect, and Contractor can accurately track the volume of work planned throughout the project. Front-end loading will not be accepted.
 1. Contractor shall assign cost to construction activities on the baseline construction schedule and subsequent monthly construction progress updates. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Owner and Architect's approval, be assigned to fabrication and delivery activities.
 2. Each activity cost shall reflect an accurate value subject to approval by Owner and Architect.
 3. Total cost assigned to activities shall equal the total Contract Sum.
- D. Format: The Baseline schedule shall include the below columns as well as the Gantt Chart displaying the entire project's network diagram:
 1. Activity Number
 2. Activity Description/Name
 3. Total Float
 4. Duration
 5. Start
 6. Finish
 7. Predecessor
 8. Successor
 9. Percent Complete (Physical)

10. Cost

E. Activities:

1. Activity Identification and Organization:
 - a. Identify construction activities planned for the project and other activities that could impact project completion if delayed in the schedule.
 - b. Each activity must have a unique name
 - c. Identify administrative type activities, including all pre-construction submittal and permit requirements prior to mobilization.
 - d. Include durations for procurement, Contractor quality control, acceptance testing and training
 - e. Include the Owner/Architect approval time required for the submittals that require approval prior to the associated construction activities
2. Logic:
 - a. With the exception of the Contract Award and Final Completion milestone activities, activity must not be open-ended; each activity must have at least one predecessor and at least one successor.
 - b. Activities must not have open start or open finish logic.
 - c. Minimize redundant logic ties.
 - d. Activity type for all activities except for milestones must be set to “Task Dependent”.
 - e. Duration Type for all activities except for milestones must be set to “Fixed Duration & Units”.
 - f. Percent Complete type for all activities including milestones must be set to “Physical”.
3. Assigned Calendars:
 - a. All activities must be assigned calendars that reflect required and anticipated non-work days. Total work hours/day for all defined calendars are to be set to 8.
4. Activity Categories: Include the following activity categories, as applicable, in the baseline schedule to accurately reflect the project’s planned progress.
 - a. Management Activities:
 - 1) Include cost-loaded management activities that will track the Contractor’s General Conditions for payment progress throughout the duration of the project. Contractor may include a single General Conditions activity that will be progress billed monthly based on percent complete, or Contractor may include a General Conditions activity for each month of construction which will be billed monthly.
 - b. Pre-Construction Activities:
 - 1) Include pre-construction activities that are required to be completed prior to the Contractor mobilizing and commencing demolition and/or construction.
 - 2) At a minimum, the following activities must be included:
 - a) Bonds and Insurance
 - b) Permits
 - c) Preconstruction Submittals and Approvals
 - c. Procurement Activities:
 - 1) Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. At a minimum, separate procurement activities must be provided for critical items, long lead items, and material/equipment procurement for which payment will be requested in advance of installation.

- 2) Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Baseline Construction Schedule with Submittals Schedule.
 - 3) Show each delivery with relationship tie to the associated Construction Activity.
 - 4) At a minimum, the following activities must be included:
 - a) Materials/equipment submittals and approvals
 - b) Fabrication
 - c) Delivery
 - d. Owner Activities:
 - 1) Owner and other agency activities that could impact progress must be clearly identified.
 - 2) At a minimum, the following activities must be included:
 - a) Permits
 - b) Utility Outages
 - c) Delivery of Owner Furnished Material/Equipment
 - e. Construction Activities:
 - 1) Include construction work activities for each unique work activity. Examples include, but are not limited to: site grubbing and clearing, excavation, backfilling, concrete reinforcing, concrete formwork, concrete placement, trenching, conduit installation, terminations, etc.
 - 2) On-site construction activities that are the responsibility of the Contractor or Contractor's subcontractors must not have a duration in excess of 15 working days without prior approval of the Owner. Contractor activities must be driven by calendars that reflect Saturdays and Sundays as non-work days, unless otherwise defined in the contract.
 - 3) Within the work breakdown structure (WBS) on-site construction activities are to be organized and grouped primarily by phasing and secondarily by Specification Division.
 - f. Closeout Activities:
 - 1) Include activities or milestones that are applicable to the project. At a minimum, the following activities are to be included:
 - a) Contractor Testing, Startup, and Inspections
 - b) Commissioning
 - c) Owner Training
 - d) O&M Manuals
 - e) As-Built Drawings
 - f) Punchlist Inspection
 - g) Certificate of Occupancy Inspection
- F. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows showing how the sequence of the Work is affected.
1. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.

- i. Restriction of noise making operations during final exam weeks.

G. Milestones:

1. Include milestones indicated in the Contract Documents.
2. At a minimum, the following activities are to be included:
 - a. Contract Award
 - b. Preconstruction Submittals
 - c. Preconstruction Meeting
 - d. Mobilization
 - e. Commissioning
 - f. Substantial Completion
 - g. Demobilization
 - h. Final Completion
3. Include as the first activity in the schedule a start milestone titled, "Contract Award", which must have a Mandatory Start constraint equal to the Contract Award Date.
4. Include an unconstrained finish milestone titled, "Preconstruction Submittals", which is the date that all preconstruction submittals have been received and approved.
5. Include an unconstrained finish milestone titled, "Preconstruction Meeting".
6. Include an unconstrained finish milestone titled, "Mobilization".
7. Include an unconstrained finish milestone titled, "Substantial Completion". Indicate completion in advance of date established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion. Include a separate Substantial Completion Milestone for each phase if the contract required construction to be completed in phases.

- H. Computer Software: Prepare schedules using a professional program that has been developed specifically to manage construction schedules.

2.03 MONTHLY CONSTRUCTION PROGRESS SCHEDULE

A. Deliverables: To be submitted concurrently with Contractor's pay application.

1. Provide the project's full, cost-loaded, monthly schedule update in 11x17.pdf and native file formats. Utilize the same format as the Baseline Schedule.
2. Utilizing the project's monthly schedule update, provide an Earned Value Report in 8x11 .pdf format, identifying the activities for which the Contractor is billing.
3. Utilizing the project's full monthly schedule update, provide the project's updated critical path schedule in 11x17.pdf format
4. Provide a narrative summary report in 8x11 .pdf format that provides the following information:
 - a. Data Date
 - b. Contract Award Date
 - c. Original Project Duration
 - d. Current Project Duration
 - e. Identify if the schedule is delayed or not. If the schedule is delayed, then identify the reason for the delay and the associated activity in the Critical Path that is delaying the schedule
 - f. Table of activities that had logic changes. Include a column for the activity number, activity description, original predecessor, original successor, new predecessor, and new successor.

- g. Table of activities that had duration change. Include a column for the activity number, activity description, original duration, and new duration.
- h. Table of activities that had name changes and number changes. Include a column for the original activity number, original activity description, new activity number and new activity description.
- i. Table of activities that have been added
- j. Table of activities that have been deleted. Note that activities may not be deleted from the schedule. Any activities that are no longer applicable are to be moved to a separate WBS header titled, "Deleted Activities", where the duration is to be reduced to 0, but the logic remains.

B. Progress Reporting:

- 1. Update the project schedule based upon progress made in the current reporting period, indicating Actual Completion percentage for each activity. The reporting period extends from the 1st of the month to the last day of the month. The first monthly update is to utilize the baseline schedule as the basis for the update. Thereafter, updates are to be made to the previous month's schedule update, ensuring that the schedule is showing an accurate history of the project's progress.
- 2. Update activities with actual start and finish dates. If an activity has started and is still in progress, update the physical percent complete to provide a clear understanding of the activity's progress.
- 3. Change any logic necessary to account for revised work schedules, delays, etc.
- 4. Progress the schedule utilizing the accurate data date so that the Owner and Architect can easily identify the work completed on the Gantt Chart.
- 5. At the header of the schedule, provide a legend that identifies the cost correlation line, indicating planned and actual progress.

C. Earned Value Report: The Monthly Construction Progress Schedule is updated monthly from the Project Baseline Schedule and will therefore determine the monthly contract earnings during each update period utilizing an Earned Value Report.

- 1. On the task line, show dollar volume of the Work performed as of dates used for preparation of payment requests. The pay period shall extend from the 1st of the month to the last day of the month.
- 2. Include the below columns in the Earned Value Report. The Gantt Chart is not required to be included with the Earned Value Report
 - a. Activity Number
 - b. Activity Description
 - c. Duration
 - d. Start
 - e. Finish
 - f. Percent Complete
 - g. Cost Earned
 - h. Cost Remaining
- 3. Refer to Section 01 29 00 "Payment Procedures" for cost reporting and payment procedures.

D. Distribution: Distribute copies of the updated monthly schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

- 1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the
2. same locations. Delete parties from distribution when they have completed their assigned
2. portion of the Work and are no longer involved in performance of construction activities.

2.04 WEEKLY LOOK AHEAD

- A. Prepare and issue a Four-Week Look Ahead Schedule to provide a more detailed day-to-day plan of upcoming work identified in the current schedule. Requirements include:
 1. For each schedule activity, identify the parent Baseline Schedule activity number.
 2. Update schedule each week to show the planned work for the following four-week period. Submit the look ahead schedule 1-work day prior to the weekly Owner, Architect, Contractor (OAC) meeting each week.
 3. Include upcoming outages, closures, pre-installation meetings, testing and inspections, etc.
 4. Identify critical path activities on the Weekly Look Ahead Schedule
 5. Identify any offsite fabrication and production activities.

2.05 REPORTS

- A. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.06 SPECIAL REPORTS

- A. General: Submit special reports to Architect within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.01 CONTRACT MODIFICATIONS

- A. Time Impact Analysis (TIA):
 1. Submit a Time Impact Analysis with each cost and time proposal for a proposed change. TIA must illustrate the influence of each change or delay on the Final Completion Date. No time extensions will be granted unless a delay occurs which consumes all available Project Float, impacts the critical path, and extends the Final Completion Date. To demonstrate the delay, each TIA must include a narrative summary, a schedule fragnet that is used to define the scope of the change, the unimpacted schedule, the impacted schedule, and the impacted critical path.
 2. The narrative summary must:
 - a. Define the scope and conditions of the change

- b. Identify the party responsible for the delay. Multiple parties may be responsible if there are concurrent delays.
 - c. Identify any concurrent delays.
 - d. Describe how the impact originated
 - e. Provide start and finish dates on the impact to critical path
 - f. Identify the unimpacted schedule
 - g. Identify successor and predecessor activities to the impact period
 - 3. All TIAs must include any mitigation, and must determine the apportionment of the overall delay assignable to each individual delay. Apportionment must provide identification of delay type and classification of delay by compensable and non-compensable events. The associated narrative must clearly describe analysis methodology used, and the findings in a chronological listing beginning with the earliest delay event.
 - 4. Identify and classify types of delay as follows:
 - a. Force Majeure Delay (e.g. weather delay): Any delay event caused by something or someone other than the Owner, Architect, or the Contractor. Contractor must demonstrate that the identified Force Majeure Delay is in excess of 30-year historical averages and what would typically be considered normal precipitation for the given monthly period.
 - b. Contractor Delay: Any delay event caused by the Contractor.
 - c. Owner Delay: Any delay event caused by the Owner or Architect
- B. Executed Modifications:
- 1. When Owner approves a change proposal and executes a modification, Contractor shall immediately incorporate the modification TIA fragnet into the most recent Monthly Schedule update. The Modification TIA shall be incorporated under a separate WBS and is to be named so as to match the corresponding Modification number and description.

END OF SECTION 01 32 00

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. 01 31 00 "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
 - 3. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Section 01 40 00 "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
 - 5. Section 01 77 00 "Closeout Procedures" for submitting warranties.
 - 6. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 7. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 8. Section 01 79 00 "Demonstration and Training" for submitting documentation of demonstration of equipment and training of Owner's personnel.
 - 9. Division 01 to 33 Sections for specific requirements for submittals in those Sections.

1.03 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

- D. Portable Document Format (PDF): An open standard file format used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.04 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Electronic Document Files: Copies of the Contract Drawings in electronic format will be made available by the Architect to those requesting same in accordance with the "Agreement Between Harriman (Architect & Engineer of Record) and Owner or Contractor for Release of Electronic Documents" form attached to the end of this section. Agreement form shall be filled out and signed by each party requesting electronic documents before electronic media is released to them.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each specification section concurrently.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 - 5. No products shall be incorporated into the work unless they have been approved by the Contractor and Architect. No work will be paid for until required submittals for applicable work have been submitted and approved.
- C. Submittals Schedule: Comply with requirements in Section 01 32 00 "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 14 calendar days minimum for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 14 calendar days minimum for review of each resubmittal.
 - 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 calendar days minimum for initial review of each submittal.
- E. Electronic Submittals: **Architect is using Newforma software to process electronic submittals.** Submittals must be sent for review individually (one submittal per email). Identify and incorporate information in each electronic submittal file as follows:
 - 1. Assemble complete submittal package into single files incorporating submittal requirements of a single specification section and transmittal form.

- a. Provide a separate transmittal form for Product Data, a separate transmittal form for Shop Drawings, and a separate transmittal form for Informational Submittals required by each Specification Section.
 - b. Maximum File Size: A single file size, up to 18 MB can be received. Contact Architect for instructions if file exceeds 18 MB.
 - c. For each transmittal, attach one single PDF only. Where multiple PDFs are required for a transmittal, utilize a combine feature to merge the PDFs into a single PDF.
 - 1) Unacceptable Formats: In order to process the transmittals in Newforma, the single PDF file protocol must be followed. Transmittals zip files or grouped PDFs cannot be electronically processed and will be returned without action for correction and resubmittal.
 - 2) Submittals will be returned without action for correction and resubmittal if:
 - a) Submittal does not have an electronic Transmittal Form.
 - b) Multiple specification sections are contained within a single Transmittal form. Submittals must be separated into individual Specification Sections.
 - c) Submittal does not include the Contractors' signed reviewed stamp
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a dash and then a sequential number (e.g., LNHS-061000-01). Resubmittals shall include an alphabetic suffix after another dash (e.g., LNHS-061000-01-A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - h. Specification Section number and title.
 - i. Drawing number and detail references, as appropriate.
 - j. Location(s) where product is to be installed, as appropriate.
 - k. Related physical samples submitted directly.
 - l. Indication of full or partial submittal.
 - m. Other necessary identification.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with appropriate notation from Architect's action stamp.
 - 4. Repeated submission of inadequate and/or deficient submittals will be considered inexcusable delays and may result in rejected progress payments and/or a formal contract notification if the delay affects the schedule.
- I. Architect will return all processed submittals through the Newforma file transfer procedure. Contractor will be responsible for incorporating the processed submittals into their file management systems as appropriate.
- J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- K. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with appropriate notation from Architect's action stamp.

PART 2 - PRODUCTS

2.01 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Submit electronic submittals by either of the following methods:
 - a. Via email as PDF electronic file to constructadmin@harriman.com.
 - 1) Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - b. Post electronic submittals as PDF electronic files directly to Architect's FTP site specifically established for Project.
 - 1) Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.

- e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before or concurrent with Samples.
 - 6. Submit Product Data in the following format:
 - a. PDF electronic file.
 - 7. Do not submit Material Safety Data Sheets (MSDSs).
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
- 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Schedules.
 - d. Compliance with specified standards.
 - e. Notation of coordination requirements.
 - f. Notation of dimensions established by field measurement.
 - g. Relationship and attachment to adjoining construction clearly indicated.
 - h. Seal and signature of professional engineer if specified.
 - 2. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
- 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 - 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 - 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

- b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 - 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 - 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit two sets of Samples. Architect will retain one Sample sets; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 - 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 - 2. Manufacturer and product name, and model number if applicable.
 - 3. Number and name of room or space.
 - 4. Location within room or space.
 - 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."

- K. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- Y. Material Safety Data Sheets (MSDSs): Submit information directly to Owner at end of the project; do not submit to Architect. Maintain copy at the site for the duration of the construction.
 - 1. Architect will not review submittals that include MSDSs and will return them.

2.02 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Contractor to mark submittal with their approval stamp before submitting to Architect.
 - 1. The Contractor shall review submittals for completeness and compliance with the Contract Documents. If submittal contains substitutions, Contractor shall process substitutions in accordance with Section 01 63 00 "Substitutions and Product Options," and not part of specified Shop Drawings or Product Data submittals. Contractor is responsible for keeping Subcontractors on time with the submittal schedule. If the Contractor submits submittals that are repeatedly rejected, requiring the Architect to perform multiple reviews of the same submittal because of the failure to properly prepare and complete the submittals:
 - a. Owner will compensate Architect for such additional services.

- b. Owner will deduct the amount of such compensation from the final payment to the Contractor.
 - B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."
 - C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
- 3.02 ARCHITECT'S ACTION
- A. General: Architect will not review submittals that do not bear Contractor's submittal stamp and will return them without action.
 - B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an appropriate mark to indicate status.
 - 1. The Architect's marking of "Reviewed, Furnish as Corrected or similar verbiage means submittal has been reviewed for general conformance to the contract documents only and does not mean unqualified acceptance. The Contractor is fully responsible for compliance with the contract documents.
 - C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
 - D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
 - E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
 - F. Submittals not required by the Contract Documents will be returned by the Architect without action.

END OF SECTION 01 33 00

This Page Left Intentionally Blank

**AGREEMENT BETWEEN HARRIMAN (ARCHITECT & ENGINEER OF RECORD)
AND OWNER OR CONTRACTOR
FOR RELEASE OF ELECTRONIC DOCUMENTS**

RECIPIENT:

Name: _____ Phone Number: _____

Address: _____

Email Address: _____ Date: _____

Project Name: _____ HA Project No.: _____

- This request to for Harriman to provide the following Electronic Documents (AutoCad file or Revit model), dated _____, for the project use by the Recipient:

(List requested documents clearly) _____

-
- Electronic Documents will be provided in the current software version used by Harriman at the time of the request. Alternate versions may be available at Harriman's discretion. Current software versions are AutoCAD 2023 and Autodesk Revit 2023.

Alternate Version Requested: _____

- Transfer method shall be by Electronic File Transfer to the email address provided above.
- A fee may be assessed for processing and distributing requested document. Recipient will be notified on any fees prior after receipt of this request document. Fees are payable prior to receiving requested documents.

TERMS AND CONDITIONS:

1. For the purpose of this document, both 2d CAD files and 3d Revit models shall be collectively defined as "Electronic Documents".
2. It is understood and agreed that all drawings, specifications, or other documents of any kind prepared by Harriman or its subconsultants, whether in hard copy or in electronic format including Electronic Documents (collectively "Harriman's Documents"), are instruments of their services prepared solely for use in connection with the single project for which they were prepared and that Harriman and its subconsultants retain all common law, statutory and other reserved rights, including the copyright. This agreement is not intended in any way to alter the respective interests of the parties in the Instruments of Service as set forth in the Owner/Architect Agreement, notwithstanding Harriman's agreement to release the Electronic Documents to Recipient.
3. The Electronic Documents are provided as a convenience to the Recipient for informational purposes only in connection with the Recipient's performance of its responsibilities and obligations relating to the Project. The Electronic Documents do not replace or supplement the paper copies of the Drawings and Specifications, which are, and remain, the Contract Documents for the Project. In all instances, it is the responsibility of the Recipient to ensure that the Electronic Documents are

consistent with the Contract Documents.

4. The parties agree that the Electronic Documents are not, nor shall they be construed to be, a product. It is expressly agreed by the Recipient that there are no warranties of any kind in such Electronic Documents or in the media in which they are contained, either expressed or implied.
5. Harriman makes no representation as to the compatibility of the Electronic Documents with any hardware or software.
6. Since the information set forth on the Electronic Documents can be modified unintentionally or otherwise, Harriman reserves the right to remove all indicia of its ownership and/or involvement from each electronic display.
7. If any differences exist between printed Instruments of Service and Electronic Documents, the information contained in the printed documents shall be presumed to be correct and take precedence over the Electronic Documents.
8. Recipient agrees not to add to, modify or alter in any way, or to allow others to add to, modify or alter in any way, the Electronic Documents or any printed copies thereof.
9. Revit models are Design Models and will only contain elements and content that Harriman deems necessary and appropriate to share. Not all objects in the models are 3d objects and no specific Level of Detail is implied or expected. Consequently, the models cannot be used to extract precise material or object quantities. The Recipient agrees that no proprietary Revit families or Revit content shall be removed from the model and/or used for any other purpose but to support this specific project.
10. The Electronic Documents are supplied in a translatable format. Any conversion of the format is solely the responsibility of the Recipient. Recipient understands and agrees that the conversion of hard copies of Instruments of Service into electronic format or the conversion of Electronic Documents from formats used by Harriman to some other format may introduce errors or other inaccuracies. Recipient agrees to accept all responsibility for any errors or inaccuracies and to release Harriman, and its subconsultants from any liability or claims for recovery of damages or expenses arising as the result of such errors or inaccuracies.
11. Where the Recipient has received specific permission to use the Electronic Documents in connection with the Recipient's obligation to prepare certain documents for Project, Recipient shall, in addition to the other obligations set forth therein, be obligated to remove Harriman's or its Consultant's title block from the copy of the Electronic Documents used by Recipient. It is understood and agreed that, without the separate express written permission of Harriman to do so, the Electronic Documents are not to be used by any contractor or any of its subcontractors of any tier of material supplier or vendor as a shop drawing or any other type of submittal or as the basis for preparing such shop drawing or submittal. The sole exception to this prohibition shall be that the Recipient may use the Electronic Documents as a clearly distinguishable separate background upon which to prepare its shop drawings or other submittal.
12. Recipient further agrees that Harriman's Documents were prepared for use in connection with this project only and that the Electronic Documents are supplied to Recipient for the limited use stated above only. Recipient agrees not to use, or to allow others to use, the Electronic Documents, in whole or in part, for any purpose other than as stated above.

13. Harriman believes that no licensing or copyright fees are due to others on account of the transfer of the Electronic Documents, but to the extent any are, the Contractor will pay the appropriate fees and hold Harriman harmless from such claims.
14. Any purchase order number provided by the Contractor is for Contractor's accounting purposes only. Purchase order terms and conditions are void and are not a part of this agreement.
15. Harriman has prepared these Electronic Documents for the sole purpose of plotting and printing a hard copy of the design documents. Harriman believes only the hard copy print to be the accurate representation of all drawing information. Hard copy written dimensions override electronic measured dimensions. User must verify computer data against hard copy prints.
16. Electronic Documents are an inherently unstable medium subject to "bugs," deterioration, modifications, and viruses. Electronic Documents are subject to inadvertent changes in the process of moving from one computer to another or by compressing/decompressing the data; or by moving from one software revision to another; or any kind of manipulation of the data will lead to defects.
17. This agreement shall be governed by the laws of the principal place of business of Harriman. Only printed copies of the Instrument of Service shall be signed and sealed.
18. Recipient agrees to waive any and all claims and liability against Harriman and its subconsultants resulting in any way from any failure by Recipient to comply with the requirements of this Agreement for the Delivery of Documents in Electronic Format.
19. The Recipient agrees that no third-party beneficiary status or any other right of action is created in favor of any contractor, subcontractor, materialmen or other third party against Harriman by virtue of this Agreement or in connection with its delivery of Electronic Documents, and no third-party beneficiary status is intended.
20. Recipient further agrees to indemnify and save harmless Harriman and its subconsultants and each of their partners, officers, shareholders, and directors and employees from any and all claims, judgments, suits, liabilities, damages, costs or expenses (including reasonable defense and attorney's fees including claims asserted in breach of contract, breach of warranty, negligence, or any other tort) arising as a result of either: 1) Recipient's failure to comply with any of the requirements of Agreement for the Delivery of Documents in Electronic Format; or 2) a defect, error or omission in the Electronic Documents or the information contained therein, which defect, error or omission was not contained in the Contract Documents as defined in Paragraph 2 or where the use of such Contract Documents would have prevented the claim, judgment, suit, liability, damage, cost, or expense.
21. Harriman reserves the right to deny a request to translate files.

AUTHORIZED ACCEPTANCE

By Recipient

By Harriman (Architect/Engineer of Record)

Signature

Signature

Print Name and Title

Print Name and Title

Date

Date

This Page Intentionally Left Blank.

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. The Owner will hire an independent firm to do the testing and balancing of the air system and to do mechanical commissioning.
- C. Related Sections include the following:
 - 1. Section 01 32 00 "Construction Progress Documentation" for developing a schedule of required tests and inspections.
 - 2. Section 01 73 29 "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspection activities.
 - 3. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.03 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where

indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples.

- D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.
- E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.05 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Description of test and inspection.
 - 3. Identification of applicable standards.
 - 4. Identification of test and inspection methods.
 - 5. Number of tests and inspections required.
 - 6. Time schedule or time span for tests and inspections.
 - 7. Entity responsible for performing tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- C. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and re-inspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- E. Site-Specific Safety Plan: Prepare and submit a site-specific safety plan for approval prior to the preconstruction meeting. Include a section narrative that details how the Contractor will implement the below criteria (as applicable to the project). Include graphics and appendices as applicable.
 - 1. Safety Data Sheets (SDS)
 - 2. Lifting and Rigging
 - 3. Critical Lift Plans
 - 4. Scaffolding
 - 5. Fall Protection
 - 6. Confined Space
 - 7. Trenching
 - 8. Housekeeping
 - 9. Debris Disposal

10. Hot-Work Permits
11. Personal Protective Equipment (PPE)
12. Emergency Action Plan
13. Emergency Contact List
14. Safety Orientation

F. Site Logistics Plan: Prepare and submit a site-logistics plan for approval prior to the preconstruction meeting. Include a section narrative that details how the Contractor will implement the below criteria. Include graphics and appendices as applicable.

1. Site Fencing
2. Jobsite Trailer
3. Contractor Parking
4. Portable Toilets
5. Temporary Utility Connections
6. Dumpsters
7. Site Laydown
8. Staging
9. Construction Entrance
10. Concrete Washout
11. Dust Control and Tracking

G. Quality Control Plan: Prepare and submit a quality control plan for approval prior to the preconstruction meeting. Include a section narrative that details how the Contractor will implement the below criteria (as applicable to the project). Include graphics and appendices as applicable.

1. Designated Quality Control Manager (may be superintendent)
2. Submittal Process
3. RFI Process
4. Document Control
5. Utility Interruptions
6. Communication (including Shutdown/Closure Requests)
7. Test Plan
8. Inspections (Owner and 3rd Party)
9. Mockup Requirements
10. Manufacturer and Factory Representative Inspection Reports (per specification)

1.06 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Demolish and remove mockups when directed, unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 26.

1.07 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
 3. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

- D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.
 - 1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.08 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Contractor shall engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction, in compliance with applicable building code.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.02 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Comply with the Contract Document requirements for Section 01 73 29 "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00
REFERENCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.03 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.04 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists (The) www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	ACI International (American Concrete Institute) www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association	(972) 506-7216

www.concrete-pipe.org

AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association (Now part of CPA)	
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)	
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372

APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA EWS	APA - The Engineered Wood Association; Engineered Wood Systems (See APA - The Engineered Wood Association)	
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWCI	AWCI International (Association of the Wall and Ceiling Industry International) www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCSC)	
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636

AWPA	American Wood-Preservers' Association www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute	(301) 596-2583

www.chainlinkinfo.org

CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CPA	Composite Panel Association www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association www.cppa-info.org	(800) 510-2772 (202) 462-9607
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	Canadian Standards Association	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Cast Stone Institute www.caststone.org	(717) 272-3744
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org	(703) 295-5000
EJMA	Expansion Joint Manufacturers Association, Inc.	(914) 332-0040

www.ejma.org

ESD	ESD Association www.esda.org	(315) 339-6937
FIBA	Federation Internationale de Basketball (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM Approvals	FM Approvals www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FMRC	Factory Mutual Research (Now FM Global)	
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridarooft.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GRI	(Now GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700

HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (Now CSA International)	
IBF	International Badminton Federation www.internationalbadminton.org	(6-03) 9283-7155
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020

ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (702) 567-8150
ITS	Intertek Testing Service NA www.intertek.com	(972) 238-5591
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(847) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association	(202) 737-2926

	www.nadca.com	
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193, ext. 453
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (303) 697-8441
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890

NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.com	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)	
NWWDA	National Wood Window and Door Association (Now WDMA)	
OPL	Omega Point Laboratories, Inc. (Now ITS)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America) www.landcarenetwork.org	(800) 395-2522 (703) 736-9666

PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(703) 683-2075
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance	(800) 523-6154

	(Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tilerroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800

USGBC	U.S. Green Building Council www.usgbc.org	(202) 828-7422
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association (Now WCSC)	
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association) www.windowcoverings.org	(800) 506-4636 (212) 297-2109
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WIC	Woodwork Institute of California (Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

- C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

BOCA BOCA International, Inc.
(See ICC)

IAPMO International Association of Plumbing and Mechanical Officials
www.iapmo.org (909) 472-4100

ICBO	International Conference of Building Officials (See ICC)	
ICBO ES	ICBO Evaluation Service, Inc. (See ICC-ES)	
ICC	International Code Council www.iccsafe.org	(888) 422-7233 (703) 931-4533
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
SBCCI	Southern Building Code Congress International, Inc. (See ICC)	
UBC	Uniform Building Code (See ICC)	

- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332

GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Building Service (See GSA)	
PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations	(866) 512-1800

	Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(202) 512-1800
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
	Available from Defense Standardization Program www.dps.dla.mil	
	Available from General Services Administration www.gsa.gov	(202) 619-8925
	Available from National Institute of Building Sciences www.wbdg.org/ccb	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
F.	State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.	
CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 574-2041
CCR	California Code of Regulations	(916) 323-6815

www.calregs.com

CPUC California Public Utilities Commission
www.cpuc.ca.gov

(415) 703-2782

TFS Texas Forest Service
Forest Resource Development
<http://txforests-service.tamu.edu>

(979) 458-6650

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Sanitary facilities, including toilet facilities.
 - 2. Electric power service.
- C. Support facilities include, but are not limited to, the following:
 - 1. Waste disposal facilities.
 - 2. Construction aids and miscellaneous services and facilities.
 - 3. Security and protection facilities include, but are not limited to, the following:
 - 4. Security enclosure and lockup.
 - 5. Temporary enclosures.

1.03 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.04 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum.
- B. The use of existing power, and water will be allowed for Work in the existing building only.

1.05 QUALITY ASSURANCE

- A. The Contractor is responsible for the implementation, monitoring, and maintenance of job site safety program for the duration of the contract.

1.06 PROJECT CONDITIONS

- A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.

- B. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.
- C. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
 - 1. Keep temporary services and facilities clean and neat.
 - 2. Relocate temporary services and facilities as required by progress of the Work.
- D. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site. Construction noise from loud machinery, equipment, hammering and similar loud noises shall be restricted to the hours when the facility is not in use. Obey State and local noise ordinances.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

2.02 EQUIPMENT

- A. General: Provide equipment suitable for use intended.
- B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
 - 1. Coordinate with the Engineer and Owner at the preconstruction meeting.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. Add provisions for work not in the Contract but served by temporary facilities if required.
- B. Water Service: Obtain water required for the work from location designated by the Owner.
- C. Electrical Service: Provide required power cords and connect to existing outlets where available and approved for use by the owner. Provide portable power generator in all other areas.
- D. Internet Service: Limited wireless internet connection is available at the site. Coordinate with the Owner for connection to the University service. Limit use of service to authorized personnel only, for specific project business only.

3.03 SUPPORT FACILITIES INSTALLATION

- A. Waste Disposal Facilities: Provide waste-collection dumpsters and containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.
 - 1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
 - 2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

3.04 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Restoration of Roadways and Pavement: Roadways, pavements and curbs that are broken, damaged, settled, or otherwise defective as a result of receiving, handling, storage of materials or the performance of any work under this Contract, shall be fully restored to the satisfaction of the owner and authorities having jurisdiction.
- C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are the property of Contractor.
 - 2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 01 Section "Closeout Procedures."

END OF SECTION 01 50 00

This Page Left Intentionally Blank

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
 - 1. Section 01 63 00 "Substitutions and Product Options" for procedures and requirements for product substitutions.
 - 2. Section 01 77 00 "Closeout Procedures" for submitting warranties for Contract closeout.
 - 3. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.03 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.04 SUBMITTALS

- A. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.05 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
 - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Store cementitious products and materials on elevated platforms.
 - 5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 7. Protect stored products from damage and liquids from freezing.
 - 8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.07 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on

product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
 3. Refer to Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
 3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.

4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
 - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 01 63 00
SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Substitution procedures during the bid period shall be followed to provide equality of bids. Substitutions approved by the Architect will be issued by addendum during the bid period. Substitutions not approved by addendum shall not be included in the bid. The Architect and Owner will not consider substitutions submitted after bids are received. Contractors submitting substitutions after bids are received will not be given additional compensation for rejected submittals.

1.02 SUBSTITUTIONS

- A. Submit two copies of request for substitution. Include in the request:
1. Complete data substantiating compliance of proposed substitution with Contract Documents.
 2. For Products:
 - a. Product identification including manufacturer's name and address.
 - b. Manufacturer's Literature:
 - 1) Product description.
 - 2) Performance and test data.
 - 3) Reference standards.
 - c. Samples.
 - d. Name and address of similar projects on which product was used, and date of installation.
 3. Itemized comparison of product substitution with product specified.
 4. Changes in construction schedule.
 5. Accurate cost data on proposed substitution in comparison with product specified.
- B. In Making Request for Substitution, the Contractor Represents:
1. Contractor has investigated proposed product or method and determined that it is equal or superior in all respects to that specified.
 2. Contractor will provide the same or greater guarantee for substitution as for product specified.
 3. Contractor will coordinate installation of accepted substitution into work, making such changes as required for work to be completed.
 4. Contractor waives all claims for additional costs related to substitution in which it becomes apparent before, during or after installation.
 5. Requested substitution is compatible with other portions of the Work. All sizes, dimensions, locations for connections to other items as designed, clearances from building structure and other equipment have been verified and is acknowledged in the substitution request
 6. Contractor requesting substitution shall bear additional costs to all parties due to his substitution, including Architect's fees.

- C. Substitutions Will Not Be Considered If:
 - 1. They are indicated or implied on shop drawings or project submittals without formal request.
 - 2. Acceptance will require substantial revision of Contract Documents.
 - 3. Not readily serviceable in the area or may cause the Owner to stock extra parts.
- D. Substitutions not approved before the last addendum is distributed shall not be considered in the Base Bid.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 016300

SUBSTITUTION REQUEST FORM

Project: _____ Substitution Request Number: _____
To: _____ From: _____
Re: _____ Date: _____
Specification Title: _____ Description: _____
Section: _____ Page: _____ Article/Paragraph: _____
Proposed Substitution: _____ Manufacturer: _____
Address: _____ Phone: _____
Trade Name: _____ Model No. _____

Attached data includes product description, specifications, drawings, cost data, and performance and test data adequate for evaluation of the request: applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitutions will require for its proper installation.

Attached data includes a detailed itemized comparison list of product substitution with product specified.

The Undersigned certifies:

1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the Substitution as for the specified Product.
3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner. All sizes, dimensions, locations for connections to other items as designed, clearances from building structure and other equipment have been verified.
4. Will remove substitution and pay all costs if differences discovered later that were not identified on the substitution request are found that make the substitution unacceptable with no additional cost to Owner.
5. Waive claims for additional costs or time extension that may subsequently become apparent.
6. Will reimburse Owner and Architect/Engineer for review or redesign services associated with substitution.
7. They are authorized to sign this form for the product manufacturer and commit to the terms of Section "Substitutions and Product Options," and this substitution request form.

Submitted By: _____

Signed By: _____

Firm: _____

Address: _____

Telephone: _____ Fax: _____

A/E's REVIEW AND ACTION

- ☐ Submission approved - Make submittals in accordance with Specification Section 013300.
- ☐ Submission approved as noted - Make submittals in accordance with Specification Section 013300.
- ☐ Submission rejected - Use specified materials.
- ☐ Submission request received too late - Use specified materials.

Signed by: _____ Date: _____

Supporting Data Attached:

- ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports
- ☐ Comparison list ☐ Other

This Page Left Intentionally Blank

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
 - 1. For correction of installed work.
 - 2. For repairs due to testing.
- B. Related Sections include the following:
 - 1. Divisions 02 through 33 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.03 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.04 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
 - 2. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.05 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:

1. Primary operational systems and equipment.
 2. Control systems.
 3. Communication systems.
 4. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.
 3. Equipment supports.
 4. Piping, ductwork, vessels, and equipment.
 5. Noise and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.06 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.03 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
 - 5. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.
 - 4. Recycling of DEP-Regulated Universal waste.
- B. Related Requirements:
 - 1. Section 024119 "Selective Demolition and Alterations" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
 - 2. Refer to drawings for additional information.

1.03 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Reused or Salvaged: Recovery of demolition or construction waste and subsequent sale, donation, or reuse in another facility or incorporated into the Work.
- F. Universal Waste: Any waste designated by the Maine Department of Environmental Protection as Universal Waste i.e. fluorescent lamps, ballasts, thermostats and other lead and mercury containing devices. Information can be found on the DEP's website: <http://www.maine.gov/dep/index.html>

1.04 PERFORMANCE REQUIREMENTS

- A. General: Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators by sorting prior to leaving the jobsite. Facilitate recycling and salvage of materials. All waste must be disposed of at facilities that operate in accordance with all local, state, and federal waste regulations. Documentation of compliance can be requested by the University of Maine System at any time.

1.05 SUBMITTALS

- A. Submit 'Anticipated Project Waste Sheet' before commencement of work.
- B. Submit 'Waste Reporting Sheet' monthly with each Pay Requisition during the course of the project and prior to Final Requisition.
 - 1. Include the following information on Waste Reporting Sheet:
 - a. Date of disposal
 - b. Type of material(s)
 - c. Method(s) of disposal: recycled, reused/salvaged, landfilled, incinerated.
 - d. Weight(s): attach copies of scale tickets to form (see below)
- C. Copies of scale tickets from waste facilities, including transfer and processing facilities, for each haul must be attached to monthly 'Project Waste Sheet' on which the waste is listed.
- D. Copies of Certificates of Recycling from DEP-approved consolidators for all hauls over the course of the project which involved Universal Waste must be attached to final Waste Reporting Sheet at conclusion of project.
- E. Copy of Certificate of Refrigerant Recovery must be attached to Waste Reporting Sheet on which device is listed. Refrigerant Recovery must be performed by an EPA-approved Refrigerant Recovery Technician.

1.06 QUALITY ASSURANCE

- A. Contractors must designate someone in their employ (a direct paid employee of the general contractor) to be the contact for waste reporting for the duration of the project.
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
 - 1. For any questions or clarifications of waste handling procedures contact the UMS CPPM project manager directly.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 RECYCLING/SALVAGING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers in accordance with UMS and USM Waste Minimization policy.
- B. Preparation of Waste: Prepare and maintain recyclable and salvageable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling or reusing process.
- C. Procedures: Separate recyclable and salvageable waste from other waste materials, trash, and debris. Sort recyclable waste by type at Project site to the maximum extent practical.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - 2. Inspect containers and bins for contamination and remove contaminated materials if found.

3.02 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged/reused or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

END OF SECTION 01 74 19

This Page Left Intentionally Blank

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for substantial completion, final acceptance, contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
- B. Related Sections include the following:
 - 1. Section 01 29 00 "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
 - 2. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 3. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 8. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
 - 10. Submit initial draft copy of operation and maintenance manuals at least 15 days before requesting inspection for Substantial Completion.

B. Inspection:

1. When Contractor considers work, or designated portion of work, is substantially complete, submit written notice with list of items to be completed or corrected.
2. Should Owner inspection find work is not substantially complete, Owner will promptly notify Contractor in writing, listing observed deficiencies.
3. Contractor shall remedy deficiencies and send a second written notice of substantial completion to request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
4. When Owner finds work is substantially complete, Owner will prepare a Certificate of Substantial Completion in accordance with provisions of the General Conditions.
5. Results of completed inspection will form the basis of requirements for Final Completion.

1.04 FINAL COMPLETION

A. When Contractor considers work is complete, submit written certification that:

1. Contract Documents have been reviewed.
2. Work has been inspected for compliance with Contract Documents.
3. Work has been completed in accordance with Contract Documents and deficiencies listed with Certificate of Substantial Completion have been corrected.
4. Equipment and systems have been tested, adjusted and balanced and are fully operational.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
6. Work is complete and ready for final inspection.

B. On receipt of request, Owner will either proceed with inspection or notify Contractor of unfulfilled requirements.

C. Should Owner inspection find work incomplete, Owner will promptly notify Contractor in writing, listing observed deficiencies.

D. Contractor shall remedy deficiencies and send a second certification of final completion.

E. When Owner finds work is complete, Owner will consider closeout submittals.

F. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Warranties and bonds. Submit originals and in PDF format.

C. Spare parts and maintenance Materials.

D. Evidence of payment and Releases of Lien.

1.06 APPLICATION FOR FINAL PAYMENT

- A. Submit application for final payment in accordance with provisions of Conditions of the Contract.

1.07 GUARANTEE

- A. Neither the final requisition for payment nor any provision in the Contract Documents nor partial or entire use or occupancy of the building by the Owner shall constitute an acceptance of work done in accordance with the Contract Documents or relieve the Contractor of liability in respect to express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom which shall appear within one year from the date of final acceptance unless a longer period is specified. The Owner will give notice of observed defects with reasonable promptness.
- B. Although subcontractors shall, throughout these Specifications, be required to provide guarantees for their respective work, the Contractor, in the last analysis, shall be responsible for all work and the guarantee thereof. In the case of disputes between subcontractors as to fault of problems, it is up to the Contractor to resolve these disputes or accept the cost of repair or replacement himself.

1.08 INSPECTION FEES

- A. If the Architect Performs Reinspections Due to Failure of the Work to Comply with the Claims of Status of Completion Made by the Contractor, Or, Should the Contractor fail to complete the work, Or, Should the Contractor fail to promptly correct warranty items or work later found to be deficient:
 - 1. Owner will compensate Architect for such additional services.
 - 2. Owner will deduct the amount of such compensation from the final payment to the Contractor.
- B. If the Work is not completed by the date set in the Agreement, and the Architect needs to perform additional Contract Administrative and on site observation duties:
 - 1. Owner will compensate Architect for such additional services.
 - 2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

1.09 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order.
 - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.

- d. Name of Contractor.
- e. Page number.

1.10 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated in the contract documents.
 - 1. Unless indicated otherwise, all warranties shall commence on the date of Substantial Completion.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Submit final warranties as a package for the entire project, assembled and identified as described below.
 - 2. Bind warranties and bonds in heavy-duty, D-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents but not greater than 2 inches, and sized to receive 8-1/2-by-11-inch paper. Do not over fill D-ring, allowing 1/2-inch space for future additions.
 - 3. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 4. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 5. Electronic Media: Submit copy of warranty binder on a flash drive or CD-R in .PDF format. Bookmark based on the table of contents, and for each warranty within each section.
- C. Provide additional electronic media copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - f. Leave Project clean and ready for occupancy.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 77 00

This Page Left Intentionally Blank

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Operation manuals for systems, subsystems, and equipment.
 - 3. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.
- B. Related Sections include the following:
 - 1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
 - 3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
 - 4. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.03 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.04 SUBMITTALS

- A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will review concurrently with Owner for comment. Architect will return copy of draft and mark whether general scope and content of manual are acceptable.
- B. Final Submittal: Submit 2 copies of each manual in final form at least 15 days before final inspection. Architect will review concurrently with Owner for comment. Architect will return copy with comments after final inspection.
 - 1. Correct or modify each manual to comply with comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments.

- C. Preliminary Operation and Maintenance Manual Summary: Submit two copies concurrently with the submittal of the Schedule of Values in accordance with Division 01 section, "Submittal Procedures."

1.05 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents.

2.02 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name, address, and telephone number of Contractor and primary subcontractors.
 - 6. Name and address of Architect.

7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, D-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents but not greater than 2 inches, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets. Do not over fill D-ring, allowing 1/2-inch space for future additions.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. Maximum size of drawings to be included in the binders shall not exceed 11-by-17-inch. Fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and submit envelopes with manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
- E. Electronic Media: Submit one copy of each complete manual, including Record Shop Drawings and Product Data on CD-R in .PDF format. Bookmark based on the specifications table of contents and manual dividers.

2.03 OPERATION MANUALS

- A. Content: Daily operations and management of systems and equipment. In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.

4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.04 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.

4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.05 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard printed maintenance instructions and bulletins.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training videotape, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.

2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
- G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

This Page Left Intentionally Blank

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Record Shop Drawings.
- B. Related Sections include the following:
 - 1. Division 01 Section "Closeout Procedures" for general closeout procedures.
 - 2. Divisions 02 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.03 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Submit one set(s) of marked-up Record Prints
- B. Record Specifications: Submit one hard copy and one copy on electronic media of Project's Specifications, including addenda and contract modifications.
- C. Record Shop Drawings and Product Data: Submit one hard copy and one copy on electronic media of each Product Data submittal.
 - 1. Where Record Shop Drawings and Product Data is required as part of operation and maintenance manuals, submit marked-up Shop Drawings and Product Data as an insert in manual instead of submittal as Record Shop Drawings and Product Data. Insert typewritten pages indicating typewritten pages indicating drawing titles, descriptions of contents, and Record Shop Drawings and Product Data locations drawing locations that are part of operation and maintenance manuals.
 - 2. Electronic Media: In addition to paper copy, submit record copy of record Shop Drawings and Product Data specification on CD-R in .PDF format. Bookmark Product Data based on the table of contents.
- D. Directories: Material supplier directory and subcontractor directory.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
 - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Locations and depths of underground utilities.
 - d. Revisions to routing of piping and conduits.
 - e. Revisions to electrical circuitry.
 - f. Actual equipment locations.
 - g. Changes made by Change Order or Construction Change Directive.
 - h. Changes made following Architect's written orders.
 - i. Details not on the original Contract Drawings.
 - j. Field records for variable and concealed conditions.
 - k. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2.02 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions, change orders and product options selected.

3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
6. Electronic Media: Submit record copy of record specification on CD-R in .PDF format. Bookmark based on the table of contents.

2.03 RECORD SHOP DRAWINGS AND PRODUCT DATA

- A. Preparation: Mark Shop Drawings and Product Data to indicate the actual product installation where installation varies substantially from that indicated in Shop Drawings and Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
 4. Bind product data in heavy-duty, D-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents but not greater than 2 inches, and sized to receive 8-1/2-by-11-inch paper. Do not over fill D-ring, allowing 1/2 inch space for future additions.
 5. Provide heavy paper dividers with plastic-covered tabs for each specification section with product data. Mark tab to identify the specification section. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 6. Identify each binder on the front and spine with the typed or printed title "PRODUCT DATA," Project name, and name of Contractor.
 7. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. Maximum size of drawings to be included in the binders shall not exceed 11-by-17-inch. Fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and submit envelopes with manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
 8. Electronic Media: Submit record copy of marked-up Shop Drawings and Product Data on CD-R in .PDF format. Bookmark based on the table of contents, and for each Shop Drawings and Product Data within each section. Where Record Shop Drawings and Product Data is required as part of operation and maintenance manuals, submit electronic media of marked-up Shop Drawings and Product Data as part of manual instead of submittal as Record Shop Drawings and Product Data.

2.04 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

- B. Subcontractor Directory: Name, address and telephone number for all major subcontractors, organized by specification section.
- C. Material Supplier Directory: Name, address and telephone number for major material suppliers, organized by specification section.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training videos.
- B. Related Sections include the following:
 - 1. Division 01 Section "Project Management and Coordination" for requirements for preconstruction conferences.
 - 2. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.03 SUBMITTALS

- A. Demonstration and Training: Submit list of systems and equipment to be demonstrated and training provided.
- B. At completion of training, submit one complete training/instruction/operation manual(s) for Owner's use.
 - 1. Submit one electronic copy on CD in .PDF format.
- C. Attendance Record: For each training session, submit list of participants and person(s) providing training.

1.04 QUALITY ASSURANCE

- A. Demonstrator and Trainer Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.05 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

- B. Coordinate providing notification of dates, times, length of instruction time, and training content.
- C. Coordinate content of training with content of approved operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

- A. Program: Develop an instruction program that includes individual training for each system and equipment not part of a system, as required by individual Specification Sections, and including the following:
 - 1. HVAC systems, including instrumentation and controls.
 - 2. Electrical service and distribution, including switchboards, and panelboards.
 - 3. As required by sections in Division 02 through 33.
- B. Training: Include instruction as applicable for the following:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Operations and maintenance manuals.
 - b. Project Record Documents.
 - c. Warranties and bonds.
 - d. Maintenance service agreements and similar continuing commitments.
 - e. Applicable video presentations.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Startup procedures.
 - c. Equipment or system break-in procedures.
 - d. Routine and normal operating instructions.
 - e. Regulation and control procedures.
 - f. Control sequences.
 - g. Safety procedures.
 - h. Instructions on stopping.
 - i. Normal and emergency shutdown instructions.
 - j. Operating procedures for system, subsystem, or equipment failure.

- k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Assemble materials necessary for instruction.

3.02 DEMONSTRATION AND TRAINING INSTRUCTION

- A. Engage qualified personnel to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide demonstration and training instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner with at least fourteen days' advance notice.

END OF SECTION 01 79 00

Sample

(Modify objectives and agenda subjects for systems and equipment being covered)

TRAINING AND ORIENTATION AGENDA

Project: _____

Date: _____

Equipment / System: _____ Spec Section: _____

Section 1. Audience and General Scope

Intended audience type (enter number of staff): ____ facility manager, ____ facility engineer, ____ facility technician, ____ project manager, ____ tenant, ____ other: _____

General objectives and scope of training: (check all that apply)

- ____ A. Provide an overview of the purpose and operation of this equipment, including required interactions of trainees with the equipment.
- ____ B. Provide technical information regarding the purpose, operation and maintenance of this equipment at an intermediate level, expecting that serious malfunctions will be addressed by factory reps.
- ____ C. Provide technical information regarding the purpose, operation, troubleshooting and maintenance of this equipment at a very detailed level, expecting that almost all operation, service and repair will be provided by the trainees.

Section 2. Instructors

<u>ID</u>	<u>Trainer</u>	<u>Company</u>	<u>Position / Qualifications</u>
1)	_____	_____	_____
2)	_____	_____	_____
3)	_____	_____	_____

Section 3. Agenda [The responsible contractors have their trainers fill out this section and submit to Owner and Commissioning Agent for review and approval prior to conducting training.]

Location: ____ site _____ Date _____
____ classroom (location) _____, Date _____

Agenda of general subjects covered

(√ all that will be covered)	(√ when completed)	<u>Duration</u> (min.)	<u>Instructor</u> (ID)	<u>Completed</u> (√)
____ General purpose of this system or equipment (design intent)	_____	_____	_____	_____
____ Review of control drawings and schematics (have copies for attendees)	_____	_____	_____	_____
____ Startup, loading, normal operation, unloading, shutdown, unoccupied operation, seasonal changeover, etc., as applicable	_____	_____	_____	_____
____ Integral controls (packaged): programming, troubleshooting, alarms, manual operation	_____	_____	_____	_____
____ Building automation controls (BAS): programming, troubleshooting, alarms, manual operation, interface with integral controls	_____	_____	_____	_____
____ Interactions with other systems, operation during power outage and fire	_____	_____	_____	_____
____ Relevant health and safety issues and concerns and special safety features	_____	_____	_____	_____

___ Energy conserving operation and strategies	_____	_____	_____
___ Any special issues to maintain warranty	_____	_____	_____
___ Common troubleshooting issues and methods, control system warnings and error messages, including using the control system for diagnostics	_____	_____	_____
___ Special requirements of tenants for this equipment's function	_____	_____	_____
___ Service, maintenance, and preventative maintenance (sources, spare parts inventory, special tools, etc.)	_____	_____	_____
___ Question and answer period	_____	_____	_____

<u>Other subjects covered, specific to the equipment:</u>	<u>Duration</u>	<u>Instructor</u>	<u>Completed</u>

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Total duration of training (hrs) ----->

Training methods that will be included (clarify as needed): (Trainer checks all that apply)

- ___ use of the O&M manuals, illustrating where the verbal training information is found in writing
- ___ each attendee will be provided: 1) the control drawing schematic and sequence of operations;
2) a copy of this agenda.
- ___ discussion/lecture at site _____
- ___ site demonstration of equipment operation _____
- ___ written handouts _____
- ___ manufacturer training manuals _____
- ___ classroom lecture _____
- ___ classroom hands-on equipment _____
- ___ video presentation _____
- ___ question and answer period _____

Section 4. Approvals and Use [Once the Agenda has been filled out by the Trainer, the Owner and Commissioning Agent review, make edits, sign and return to Contractor who provides to the Trainer for use during training. Copies of Agenda shall be provided to trainees.]

This *plan* has been approved by the following individuals, subject to the additions and clarifications noted in the left columns marked "add." (This is not an approval of training completion.)

_____	_____
Owner's Representative	Date

_____	_____
Commissioning Agent	Date

This Page Intentionally Left Blank

SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The intent of this section is to require the Contractor to provide qualified testing expertise to organize, schedule, coordinate, and perform functional performance testing prior to commissioning of building's electrical systems.
- B. The Commissioning Agent shall be contracted directly with the Contractor. The Contractor shall coordinate with and provide assistance to the Commissioning Agent as described in this section. The Commissioning Agent shall be a Registered Professional Engineer in the State of Maine. The individual shall have close working knowledge of the systems (for example, the System Designer) in the building and shall be independent from the Installing Contractor.
- C. The Commissioning Agent shall coordinate electrical commissioning with the commissioning of the new Power Distribution Center (PDC).
- D. Provide the services of Subcontractors as appropriate in planning and performing testing and troubleshooting of equipment and systems as described in these specifications prior to and during the commissioning of the electrical systems.
- E. No commissioning is required for HVAC systems.

1.02 QUALITY ASSURANCE

- A. References
 - 1. ASHRAE Guideline 230 Requirements for The Commissioning Process.

1.03 DOCUMENTATION

- A. Provide the Commissioning Agent with the following:
 - 1. Project Plans and Specification (Contract Documents), including authorized revisions and addenda.
 - 2. Final approved Electrical Shop Drawings and Submittals.
 - 3. Equipment Start-up and Certification Reports.
 - 4. Any other documentation deemed by the Commissioning Agent to be pertinent to the commissioning process.

1.04 SUBMITTALS

- A. Prior to starting the commissioning process, the Commissioning Agent shall submit to Owner for approval a detailed commissioning schedule.
- B. When the commissioning process is completed, the Commissioning Agent shall submit final copies of the commissioning report to the following:
 - 1. 2 copies to the Owner.
 - 2. 1 copy to the Contractor.

3. 1 copy to the Architect.

1.05 RESPONSIBILITIES

A. Contractor Responsibilities:

1. Procure the Commissioning Agent.
2. Verify completeness of the building penetrations, perimeter and interior items which affect proper operation and control of Electrical equipment and systems.
3. Ensure participation and cooperation of specialty Subcontractors (including, but not limited to Electrical and Telecommunications) as required to facilitate the commissioning process.
4. Provide labor, material, equipment, and appurtenances, required to facilitate the commissioning process. Perform test and verification procedures required by the commissioning process when requested by the Commissioning Agent.
5. Review functional start-up and performance tests and documentation required by the Contract Documents and equipment manufacturers, for equipment and systems, as performed by Subcontractors and vendors.
6. Develop schedules for testing, integrate testing into the master construction activity schedules, and coordinate Subcontractors' start-up procedures as required. Update as required.
7. Follow manufacturer's start-up procedures and provide documentation of equipment start-up, system functional tests, and cross-system functional tests. Start-up procedures shall be in accordance with equipment manufacturer's recommendations, where applicable. Start-up procedures shall fully describe system configuration and steps required for each test, appropriately documented so that another party can repeat the procedure with virtually identical results.
8. Submit start-up and test procedure schedule, procedures, forms, and other documentation to the Commissioning Agent and the Owner for approval two months prior to starting any testing.
9. Provide written notice to Commissioning Agent and the Owner when systems have been successfully started in accordance with manufacturer's guidelines and project document requirements and are ready for commissioning.
10. Coordinate Subcontractors on the project specific to their responsibilities and contractual obligations.
11. Provide engineering and technical expertise to oversee and direct the correction of deficiencies found during the commissioning process.
12. Observe the start-up and testing of equipment by Subcontractors.
13. Manage cross-system testing such as fire alarm, emergency power, and life safety.
14. Note any inconsistencies or deficiencies in system operations and enforce system compliance or recommend to the Architect modification of system design which will enhance system performance.
15. Coordinate with the Architect/Engineer (A/E), Commissioning Agent, and Owner during commissioning final test procedures, after verifying that pretests have been satisfactorily conducted and final tests are ready to be performed.
16. In the event that a functional test performed by or in the presence of the Commissioning Agent fails, determine the cause of failure and rectify the problem as soon as possible, and then retest. If more than two functional tests of the same system(s) are required, reimburse associated costs for the extraordinary participation of the A/E, Commissioning Agent, and Owner's staff, as required by the particular test being performed.
17. Review operations and maintenance information and as-built drawings provided by the various Subcontractors and vendors for verification, organization and distribution.

18. Obtain documentation from tests and assemble a final test report to be submitted to the Architect and the Commissioning Agent for approval.
19. As Electrical systems become ready for commissioning, notify the Commissioning Agent by “signing off” on the commissioning readiness checklist, which shall be prepared by the Commissioning Agent and presented to the Contractor. Commissioning of Electrical systems shall not be performed until they have been “signed off” by the Contractor.

B. Commissioning Agent Responsibilities:

1. Plan, organize, and implement the commissioning process as specified herein.
2. Prepare the commissioning plan and ensure its distribution for review and comment.
3. Revise the commissioning plan as required during construction.
4. Chair commissioning meetings and prepare and distribute minutes to commissioning team members, whether or not they attend the meeting,
5. Coordinate commissioning activities with the Contractor.
6. Ensure required instruction and demonstrations are provided to the Owner’s designated operating staff.
7. Work with the Contractor in the development and execution of the commissioning program.
8. Review the Contractor’s system start-up plans.
9. Review the Contractor’s equipment and component test procedures.
10. Review the Contractor’s systems and inter-systems functional performance test procedures.
11. Witness, verify, and approve satisfactory completion of equipment and component tests and systems and inter-systems functional performance tests.
12. Review and approve specified documentation.
13. Coordinate participation of Owner’s personnel involved with equipment, component and system performance verification and participation in required training.
14. When commissioning has been successfully completed, recommend final acceptance to the Owner.
15. Communicate as follows:
 - a. Formally communicate with the Contractor via approved project channels.
 - b. Keep the Owner advised regarding commissioning activities, progress, problems which may develop, solutions to problems, systems performance, and schedules.

C. Owner Responsibilities:

1. If desired, schedule personnel to participate in Electrical commissioning process.
2. Work with the Commissioning Agent and the Contractor as required to schedule commissioning work in occupied areas.
3. Advise the Commissioning Agent regarding change in building occupancy and/or usage.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 DOCUMENTATION

- A. The Commissioning Agent shall prepare a commissioning readiness checklist which shall be used by the Contractor as “sign off” of readiness of systems for commissioning. The

commissioning readiness checklist shall list individually systems which shall be commissioned. Submit the commissioning readiness checklist to the Architect for approval. Once the Architect has approved the commissioning readiness checklist, furnish it to the Contractor for his use. As systems become ready for commissioning, the Contractor shall sign and date the appropriate areas and shall submit copies to the Architect and the Commissioning Agent.

COMMISSIONING OF SYSTEMS SHALL NOT BE PERFORMED UNTIL THEY HAVE BEEN "SIGNED OFF" BY THE CONTRACTOR

- B. The Commissioning Agent shall submit the following to the Architect for approval before commissioning of electrical systems begins:
 - 1. Detailed procedures for testing to be performed by each party in the commissioning process.
 - 2. Samples of report forms that will be used to submit test data and results.
 - 3. Calibration data for test equipment.
 - 4. Sequence and schedule of procedures.

- C. The final commissioning report shall include the results of commissioning tests performed on the following systems:
 - 1. Every mode of systems operation, system equipment, components and zones, and every item in the automatic temperature controls sequence of operation description shall be proven operational under normal operational modes, including part and full load, and under abnormal or emergency conditions. This shall include, but not be limited to, the following:
 - a. Electrical MV Switch.
 - b. Electrical MV Transformer.
 - c. Power Monitoring Equipment.
 - d. Telecommunications connections for MV and monitoring Equipment.
 - e. Each system shall be tested through all modes of system operation.
 - 2. Verify the performance of life safety devices and systems that interface with Electrical systems.

- D. Any approved changes in system operation shall be documented by the Commissioning Agent.

END OF SECTION 01 91 13

SECTION 02 41 19
SELECTIVE DEMOLITION AND ALTERATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of a building or structure.
 - 2. Disconnecting, capping or sealing, and abandoning utilities.
 - 3. Repair procedures for selective demolition operations.
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Progress Documentation" for preconstruction photographs taken before selective demolition.
 - 2. Division 01 Section "Cutting and Patching" for additional cutting and patching procedures for selective demolition operations.
 - 3. Division 01 Section "Construction Waste Management and Disposal" for handling and processing demolition and construction debris.
 - 4. Division 01 Section "Project Record Documents" for documentation of capped utilities and other subsurface structural, electrical or mechanical conditions.
 - 5. Division 23 Sections for additional requirements regarding demolishing, cutting, patching, or relocating mechanical items.
 - 6. Division 26 Sections for additional requirements regarding demolishing, cutting, patching, or relocating electrical items.

1.03 DEFINITIONS

- A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.
- B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.
- C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
- D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.

1.04 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.
- B. Carefully remove items indicated to be salvaged in a manner to prevent damage and deliver promptly to the Owner.
- C. Historic items, relics, and similar objects including, but not limited to, commemorative plaques and tablets, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1.05 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- D. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 - 2. Interruption of utility services
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
 - 5. Locations of proposed dust- and noise-control temporary partitions and means of egress. Indicate the proposed time frame for their operation.
 - 6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 - 7. Locations of temporary partitions and means of egress.
 - 8. Coordination of removals with the installation of new materials to prevent unauthorized entry into the building, and for protection of existing materials and finishes to remain from damage from the weather.
- E. Inventory of items to be removed and salvaged.
- F. Inventory of items to be removed by Owner.
- G. Record Drawings at Project closeout according to Division 01 Section "Project Record Documents."
 - 1. Identify and accurately locate capped utilities and other subsurface or hidden structural, electrical, or mechanical conditions.

1.06 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.
- D. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review shoring sequencing for maintaining existing structure without damage during removal of structural components.
 - 5. Review methods of protecting remaining surfaces in weathertight conditions without damage during selective demolition operations and ensuing time frame until exterior envelope can be made permanently weathertight.
 - 6. Review methods of protecting remaining surfaces from damage from demolition and construction operations.
 - 7. Review procedures for noise control and dust control.
 - 8. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
 - 10. Provide 7 business days minimum advance notice to participants prior to convening pre-demolition conference.

1.07 PROJECT CONDITIONS

- A. Owner will occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 72 hours' to Owner of activities that will affect Owner's operations.
- B. Owner assumes no responsibility for condition of areas to be selectively demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Maintain access to existing walkways, and other adjacent occupied portions of building.
 - 1. Do not close or obstruct walkways, or other occupied or used portions of building without written permission from Owner and authorities having jurisdiction.
 - 2. If materials suspected of containing asbestos or PCB are encountered during the course of construction, do not disturb; immediately notify Architect and Owner.
 - 3. Coordinate demolition schedule and activities with the Owner's abatement contractor.
- D. Storage or sale of removed items or materials on-site will not be permitted.

- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.08 SCHEDULING

- A. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

PART 2 - PRODUCTS

2.01 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
 - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 2. Use materials whose installed performance equals or surpasses that of existing materials.
- B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to the Architect.
- E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
 - 1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner or authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.
 - a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.

- B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
1. Owner will arrange to shut off indicated utilities when requested by Contractor.
 2. Where utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 4. Existing piping, conduit, and panels to remain that are supported by walls and ceilings to be demolished, shall be temporarily re-supported to the existing structure until permanent construction is in place.
- C. Utility Requirements: Refer to Divisions 23 and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.03 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities outside limits of Work, as defined on Drawings, without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by Owner or governing regulations.
 2. Erect construction fence with entry gates around new construction areas.
 3. Protect existing site improvements, appurtenances, and landscaping to remain.
 4. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations. Surfaces to remain that damaged by demolition and construction operations shall be repaired at no additional cost to Owner.
 4. Flooring Protection:
 - a. Where existing flooring is to remain, cover flooring with protection board that will prevent damage from construction activities, including moving of equipment and lifts, metal cuttings from steel cutting and threading operations, oils and fluids that could discolor flooring, water, construction worker traffic and activities.
 5. Cover and protect furniture, furnishings, and equipment that have not been removed that are indicated to remain.
 6. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

- C. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, unauthorized entry and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- D. Core Drilling and Saw Cutting: All penetrations shall be fully planned and coordinated by the Contractor. Vacuum up water created by cutting operations to prevent damage to materials to remain.
- E. Enclose openings to the exterior and to unconditioned spaces to prevent heat loss and maintain temperature at an acceptable level for Owner.
- F. Salvaged Items: Comply with the following:
 - 1. Remove items to be salvaged carefully to prevent damage. Parts and pieces shall be placed in containers and labeled.
 - 2. Clean salvaged items of dirt and demolition debris.
 - 3. Store items in a secure area until delivery to Owner's designated recipient.
 - 4. Transport items to storage area where directed by the Owner.
 - 5. Protect items from damage during transport and storage.
- G. Contractor Removed and Reinstalled Items:
 - 1. Remove items to be salvaged carefully to prevent damage. Parts and pieces shall be placed in containers and labeled.
 - 2. Clean and repair items to functional condition adequate for intended reuse.
 - 3. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - 4. Protect items from damage during transport and storage.
 - 5. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.04 POLLUTION CONTROLS

- A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
 - 1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- B. Disposal: Remove and transport debris in a manner that will prevent spillage and/or damage on adjacent surfaces and areas.
- C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.05 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during and after flame-cutting operations, until risk of fire has past.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 8. Break up and remove concrete slabs on grade and foundations where indicated.
 9. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."
 10. Remove and replace or reinstall existing construction as necessary to permit installation and alteration of mechanical and electrical work. Coordinate all removals with appropriate trades.
 11. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.
 12. Where exterior removals occur, the Contractor shall provide necessary temporary coverings and enclosures to maintain the building in a watertight condition and prevent unauthorized entrance. See Division 01 Section "Temporary Facilities and Controls for additional requirements.
- B. Existing Facilities: Comply with Owner's requirements for using and protecting walkways, building entries, and other building facilities during selective demolition operations.
- C. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- D. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- E. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.06 PATCHING AND REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

- B. Patching: Comply with this section and additional requirements in Division 01 Section "Cutting and Patching."
- C. Work Exposed to View: Do not cut or patch in a manner that would, in the Architect's opinion, result in a lessening of the building's aesthetic qualities. Generally, cut from exposed side into concealed spaces to avoid unnecessary damage to finish. Do not cut and patch in a manner that would result in substantial visual evidence of cut and patch work. Restore exposed finishes of patched areas in a manner, which eliminates evidence of patching and refinishing. For continuous surfaces, extend refinish to nearest intersection, with a neat transition to adjacent surfaces.
- D. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
 - 1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.
- E. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- F. Floors, Walls, and Ceilings: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - 2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
 - 3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.
- D. Waste Reduction: To the maximum extent possible, removals shall be salvaged or recycled. See Division 01 Section "Construction Waste Management and Disposal" for additional requirements.

3.08 CLEANING

- A. Sweep the building broom clean on completion of selective demolition operation.

END OF SECTION 02 41 19

This Page Left Intentionally Blank

SECTION 07 84 13
THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
 - 3. Penetrations in smoke barriers.
- B. Related Sections:
 - 1. Section 079200 "Joint Sealants" for non-fire-resistive joint sealants.
 - 2. Division 23 Sections specifying duct and piping penetrations, including fire-suppression piping.
 - 3. Division 26 Sections specifying cable and conduit penetrations.

1.03 SUBMITTALS

- A. General: Submit in accordance with Division 01.
- B. Product Data: For each type of product indicated. Include installation instructions.
- C. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition required.
 - 1. Submit documentation, including illustrations applicable to each through-penetration firestop system configuration for construction and penetrating items.
- D. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
 - 1. Retain catalogue of systems installed in site office, for review by the authority having jurisdiction.
 - 2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- E. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified, independent testing agency, for penetration firestopping.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that required for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
 - b. Classification markings on penetration firestopping correspond to designations listed by the following:
 - 1) UL in its "Fire Resistance Directory."
 - 2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
 - 3) FM Global in its "Building Materials Approval Guide."
- D. Provide through-penetration firestop system products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, subpart F, Appendix A, Section 1, "Polarized Light Microscopy."
- E. Preinstallation Conference: Conduct conference at Project site.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.07 COORDINATION

- A. Coordinate Work of this Section with the work of other trades to assure the proper sequencing of each installation and to provide a fire- and smoke-resistant installation.
- B. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- D. Notify testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.
- E. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by inspecting agency and building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. A/D Fire Protection Systems Inc.
 - 2. Grace Construction Products.
 - 3. Hilti, Inc.
 - 4. Johns Manville.
 - 5. Nelson Firestop Products.
 - 6. NUCO Inc.
 - 7. Passive Fire Protection Partners.
 - 8. RectorSeal Corporation.
 - 9. Specified Technologies Inc.
 - 10. 3M Fire Protection Products.
 - 11. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - 12. USG Corporation.

2.02 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements required, resist passage of smoke and other gases, and maintain original fire-

resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Provide paintable through-penetration firestop products at locations exposed to view in public spaces. Mechanical, electrical and similar type utility rooms are not considered public spaces.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Fire-resistance-rated walls include fire walls, fire-barrier walls, smoke-barrier walls and fire partitions.
 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. Horizontal assemblies include ceiling membranes of roof/ceiling assemblies.
 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.

2.03 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.04 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application required.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.03 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency, UL system number and date.

4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.05 FIELD QUALITY CONTROL

- A. The Contractor shall engage a qualified testing agency to perform tests and inspections as required.
- B. Allow for 3 random samples of each type of firestopping system to be inspected. Reinstall disturbed samples to comply with requirements.
- C. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.06 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

This Page Left Intentionally Blank

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Provide labor, materials, accessories, and other related items as required to complete operations in connection with the complete installation of the HVAC and mechanical systems as indicated on the Drawings and as specified herein.

1.02 RELATED REQUIREMENTS

- A. Conditions of the Contract apply to the work, including the work of this Division. Examine Contract Documents for requirements affecting the work.

1.03 MECHANICAL PRE-CONSTRUCTION MEETING

- A. Conduct a mechanical conference at Project site to comply with requirements of Division 01 Section "Project Management and Coordination" and the following:
 - 1. At least 14 days prior to beginning of mechanical work, conduct a meeting to review detailed requirements for mechanical systems installation and testing requirements. Review mechanical Drawings and Specifications, discuss project specific details and requirements, and review and discuss expectations for quality control. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with mechanical systems installation to attend conference, including, but not limited to, the following:
 - a. General Contractor's superintendent.
 - b. Mechanical Subcontractors' project managers.
 - c. Mechanical Subcontractors' job foremen.
 - d. Sheetmetal job foreman.
 - e. Plumbing job foreman.
 - f. Controls job foreman.
 - g. Project mechanical Engineer/designer.
 - h. Job clerk.
 - i. Architect's construction administrator.

1.04 CONTRACT DOCUMENTS

- A. The general location of the apparatus and the details of the work are indicated on the Drawings. Exact locations not indicated shall be determined at the site as the work progresses and shall be subject to the Architect's approval.
- B. It is not intended that the Drawings shall show every pipe, pipe rise, pipe drop, duct rise, duct drop, duct fitting, or appliance, but it shall be a requirement to furnish, without additional expense, material and labor necessary to complete the systems in accordance with the design intent and with the highest possible quality available.
- C. The Contractor shall take no advantage of any apparent error or omission in the Drawings and

Specifications, and the Designer shall be permitted to make such corrections and interpretations as may be deemed necessary for the fulfillment of the intent of the Drawings and Specifications. Where errors or omissions appear in the Contract Documents, the Contractor shall promptly notify the Designer in writing of such errors or omissions. Inconsistencies in the contract documents are to be reported before proposals are received, whenever found.

- D. Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written addendum to the Contract Documents.

1.05 ALTERATIONS

- A. Execute alterations, additions, removals, relocations, new work, and other related items as indicated or required to provide a complete installation in accordance with the intent of the Contract Documents, including changes required by building alterations.
- B. Existing work disturbed or damaged by the alterations or the new work shall be repaired or replaced to the Architect's satisfaction and at no additional cost to the Owner.
- C. Existing ductwork, piping, and other systems indicated to be removed, shall be removed from the site. Cap off existing services remaining. The Owner retains the right to ownership of heating and ventilating equipment scheduled to be removed; store such equipment where requested by the Owner. Material not retained by the Owner shall be removed from the site.

1.06 CONTINUITY OF SERVICE

- A. Arrange to execute the work at such times and in such locations as may be required to provide uninterrupted service for the building or any of its locations. Any unavoidable conditions requiring reduced building capacity shall be arranged for by programming with the Owner's duly authorized representative at the building subject to the Architect's approval. If necessary, temporary work shall be installed to provide for the condition. Authorization for interrupting service shall be obtained in writing from the Owner. Any interruption of normal service shall be performed during an overtime period to be scheduled with the Owner. Costs for overtime work shall be included in the Bid.

1.07 REQUIREMENTS

- A. Installation Instructions: Obtain manufacturer's printed installation instructions to aid in properly executing work on major pieces of equipment. Install equipment in accordance with manufacturer's recommendations.
- B. Objectionable Noise, Fumes and Vibration:
 - 1. Mechanical and electrical equipment shall operate without creating objectionable noise, fumes, or vibration, as determined by the Architect.
 - 2. If such objectionable noise, fumes, or vibration is produced and transmitted to occupied portions of building by apparatus, piping, ducts, or any other part of mechanical and electrical work, make necessary changes and additions, as approved, without extra cost to Owner.

- C. Equipment Design and Installation:
 - 1. Uniformity: Unless otherwise specified, equipment or material of same type or classification, used for same purposes, shall be product of same manufacturer.
 - 2. Design: Equipment and accessories not specifically described or identified by manufacturer's catalog number shall be designed in conformity with ASME, IEEE, or other applicable technical standards, suitable for maximum working pressure, and with neat and finished appearance.
 - 3. Installation: Erect equipment aligned, level, and adjusted for satisfactory operation. Install so that connecting and disconnecting of piping and accessories can be made readily, and so that parts are easily accessible for inspection, operation, maintenance and repair. Minor deviations from indicated arrangements may be made, as approved.
- D. Hanging of Equipment, Ductwork:
 - 1. Attach supports only to structural framing members and non-metal deck concrete slabs.
 - 2. Support equipment, ductwork from the top chord of bar joists at the "Panel Points" or from the top flange of beams. Provide intermediate support consisting of steel angle or equal as required where supports are installed between joist spaces.
 - 3. Do not anchor supports to metal decking with or without a concreted slab.
- E. Protection of Equipment and Materials: Responsibility for care and protection of materials and mechanical work rests with the Contractor until the entire project has been completed, tested and the project is accepted by the Owner.
- F. Ceiling Mounting: Where ceiling mounting is indicated or specified, use suspended platform, threaded rod, or strap hangers, bracket or shelf, whichever is most suitable for equipment and its location. Construct of structural steel members, steel plates, or rods, as required; brace and fasten to building structure or to inserts as approved, or as detailed.
- G. Foundations: Provide Housekeeping pad in accordance with Section "Hangers and Supports for HVAC Piping and Equipment"

1.08 ELECTRIC WORK

- A. Provide motors, pilot lights, controllers, limit switches, and other related items for equipment provided under Division 23.
- B. Except as noted, required line switches, fused switches, and other related items and necessary wiring to properly connect equipment to motors and switches shall be furnished and installed under Division 26, Electric.
- C. Provide complete wiring system for automatic temperature controls as specified under Section Division 23 Section "Instrumentation and Controls for Mechanical Systems."
- D. Wiring shall conform to the requirements of the National Electrical Code.

1.09 SUBMITTALS

- A. After award of Contract and before installation, submit for approval Shop Drawings, bulletins, Product Data, Samples, and other related items.
- B. Submit Shop Drawings and Product Data as required in each Section. Submittal shall include

physical data and performance data required to verify compliance with the Contract Documents.

- C. Submit Samples as required in each Section, and as indicated on the Drawings. These will generally be retained by the Architect/Engineer, unless otherwise indicated. Contractor may request these items returned; provide return shipping for returns.
- D. Submit Mock-Ups as required in each Section, and as indicated on the Drawings. For general mock-up procedures, refer to Division 01 Section "Quality Requirements." Deliver to the Architect/Engineer for review if so indicated. Provide return shipping.
- E. Architect/Engineer's review will not include the review, coordination, or verification of dimensions or quantities; these shall be the responsibility of the Contractor.

1.10 SUBSTITUTIONS

- A. Comply with provisions of the Instructions to Bidders and General Requirements of the Specifications.
- B. The first item listed under "Acceptable Manufacturers", "Approved Manufacturers" or "Manufacturers" is the design basis.
 - 1. Other manufacturers listed may be used in the base Bid, but conformance with details of the Specifications, as well as dimensional and electrical data, shall be verified by the Contractor.
 - 2. Architect/Engineer has not verified that each listed manufacturer has the ability to provide an acceptable substitution for the basis-of-design product. Contractor may not assume that substitutions will be approved.
 - 3. Modifications required as a result of differences between the design basis item and the submitted and approved item must be approved by the Architect and made at the Contractor's expense. As an example, if a rooftop HVAC unit is submitted and approved and if the unit's dimensions and weight are different from those of the unit which was used as the design basis, the Contractor shall be responsible for building structural modifications required to accommodate the submitted and approved unit, at no additional cost to the Owner.
 - 4. When, in the Architect or Engineer's opinion, architectural or engineering services are necessary for the coordination of substituted items, the Contractor shall reimburse the Owner for the cost of these services.
 - 5. For items which have no manufacturers listed, any item conforming with the Contract Documents is acceptable.
- C. Substitutions from manufacturers or providers which are not listed may be proposed within the time allowed in the General Requirements of the Specifications.
 - 1. The exception to this is products for which the list of manufacturers or providers is limited by the wording "no substitutions" or similar wording.

1.11 COORDINATION

- A. Coordinate scheduling, submittals, and Work of the various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

- B. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Divisions having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas, conceal ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean-up of work of separate Sections in preparation for Substantial Completion.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.12 REQUESTS FOR ARCHITECT'S CADD DRAWINGS

- A. In lieu of generating their own CADD drawings, the Contractor may elect to use the Architect's electronic copies of CADD drawings for the purpose of developing coordination drawings, developing control system graphics or for other reasons that pertain to the requirements of this Contract. If the Contractor elects to utilize the Architect's electronic copies of CADD drawings, the electronic files shall be purchased from the Architect at the Architect's current billing rate per drawing. The Contractor shall provide payment and shall sign a release-of-liability form before electronic CADD drawings are released.

1.13 CLEANING

- A. Remove debris from site daily.
- B. Material and pieces of equipment shall be turned over to the Owner free of dust and dirt, both inside and out.
- C. At the completion of the Project, equipment shall have a clean, neat appearance of factory finish by cleaning or repainting as required.
- D. At the completion of the Project, surfaces exposed to view shall have a clean, neat appearance of finish free from smudges and scratches by cleaning or repainting as required.

1.14 STARTING SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect/Engineer 7 days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
- D. Verify that tests, meter readings, and specified electrical characteristics agree with those

required by the equipment or system manufacturer.

- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of responsible manufacturer's representative in accordance with manufacturer's instructions.
- G. When specified in individual Specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

1.15 ADJUSTMENTS AND OWNER'S INSTRUCTIONS

- A. After completion of the installation work called for in the Contract Documents, furnish necessary mechanics or engineers for the adjustment and operation of the systems, to the end that the systems are perfectly adjusted and turned over to the Owner in perfect working order. Further instruct the Owner's authorized representative in the care and operation of the installation, providing framed instruction charts, directions, and other related items.
- B. Instructors providing Owner training shall be experienced and familiar with the jobsite.

1.16 COMPLETION OF SYSTEMS

- A. The following mechanical systems shall not be complete until the following conditions are satisfied:
 - 1. Ductwork Systems:
 - a. Ductwork and related components and accessories shall be completely installed and insulated as specified.
 - b. Ductwork leakage testing shall be completed and leakage testing reports shall be submitted and approved.
 - c. Ductwork shall be balanced and a balancing report shall be submitted and approved.
 - 2. Equipment:
 - a. Equipment, including but not limited to boilers, heat exchangers, terminal heat transfer units, pumps, air handling units, condensing units, chillers, split system air conditioning equipment, and exhaust fans, shall be completely installed.
 - b. Equipment start-up reports shall be completed, submitted and approved.
 - c. Equipment balancing shall be completed and the balancing report shall be submitted and approved.
 - 3. Automatic Temperature Controls (ATC):
 - a. ATC system shall be completely installed.
 - b. ATC system shall operate in an automatic mode for a minimum of 4 months during Owner occupancy without substantial deficiencies.

1.17 OPERATING AND MAINTENANCE MANUALS

- A. Furnish quantity required in Division 01 of the Specifications, of bound operating and

maintenance manuals. Deliver to the Architect for review. Required quantity is for the Owner; the Architect will not retain a bound copy.

- B. For maintenance purposes, provide approved Submittals, parts lists, specifications, and manufacturer's maintenance bulletins for each piece of equipment. For materials used which have been submitted to the Architect for approval but do not require regular maintenance, such as piping, ductwork, and insulation, provide one copy of approved Submittals.
- C. Provide name, address and telephone number of the manufacturer's representative and service company, for each piece of equipment or material so that service or spare parts can be readily obtained.

1.18 WARRANTY

- A. Provide guarantees and warranties for work under this Contract as indicated in the General Requirements of the Specifications.
- B. Provide manufacturers' standard warranties and guarantees for work by the mechanical trades. However, such warranties and guarantees shall be in addition to and not in lieu of other liabilities which the manufacturer and the Mechanical Contractor may have by law or by other provisions of the Contract Documents.
- C. Guarantee that elements of the systems provided under this Contract are of sufficient capacity to meet the specified performance requirements as set forth in these Specifications or as indicated on the Drawings.
- D. Upon receipt of notice from the Owner of failure of any part of the mechanical systems or equipment during the warranty period, the Mechanical Subcontractor shall replace the affected part or parts.
- E. Furnish a written guarantee covering the above requirements before submitting the application for final payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 23 05 00

This Page Left Intentionally Blank

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Common requirements for electric motors furnished on equipment specified in other Sections, including single phase and three phase electric motors.
- B. Starters.
- C. Thermal Overload Protection.

1.02 REFERENCES

- A. Division 01 Section "References": Requirements for references and standards.
- B. AFBMA.
- C. NEMA MG 1 - Motors and Generators.
- D. NFPA 70 - National Electrical Code.
- E. UL.

1.03 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum 3 years' experience.
- B. Installer Qualifications: Company specializing in performing the work of this Section with minimum 3 years' experience.

1.04 REGULATORY REQUIREMENTS

- A. Conform to UL Component Recognition for appropriate sizes.
- B. Conform to NFPA 70 and local energy code.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Division 01 Section "Product Requirements": Transport, handle, store, and protect products.
- B. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 - PRODUCTS

2.01 MOTORS

A. Acceptable Manufacturers:

1. A.O. Smith.
2. Baldor.
3. Emerson Motor Technologies.
4. General Electric.
5. Greenheck Fan Corporation
6. Marathon Electric.
7. Siemens.
8. Teco-Westinghouse.
9. Toshiba.
10. U.S. Motors (division of Emerson Motor Technologies).
11. WEG.
12. Substitutions: Approved equal. See Section 016000 - Product Requirements.

B. General Construction and Requirements:

1. Motors Less Than 250 Watts, for Intermittent Service: Equipment manufacturer's standard and need not conform to these Specifications.
2. Motors shall have integral thermal overload protection.
3. Single Phase Motors for general applications: PSC (permanent split capacitor) where available.
4. Single Phase Motors for fans:
 - a. EC (electronically commutated) where available.
 - b. PSC (permanent split capacitor) where available, if EC is not available.
5. Open drip-proof type except where specifically noted otherwise.
6. Design for continuous operation in 40 degrees C environment.
7. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
8. Explosion-Proof Motors: UL approved for hazard classification.
9. Visible Nameplate: Indicating manufacturer's name and model number, motor horsepower, RPM, frame size, voltage, phase, cycles, full load amps, insulation system class, service factor, maximum ambient temperature, temperature rise at rated horsepower, minimum efficiency.

C. Single-Phase Power for Fans - Electronically-Commutated (EC) Motors - Also Known As Brush-Free DC (BFDC) Motors:

1. Drive: Direct-drive only, not for use with belt drive.
2. Power Supply: Internal motor circuitry shall convert AC power supplied to DC power to operate the motor.
3. Turndown: Speed-controllable down to 20 percent of full speed (80 percent turndown).
4. Speed Control: Integral potentiometer with screwdriver setting, remote potentiometer dial with 24 VDC transformer to generate a 0-10 VDC signal, or integral circuitry to accept a 0-10 VDC signal from the building control system, as indicated and specified.
5. Efficiency: Minimum of 85 percent efficient at all speeds.
6. Soft-start type, capable of reliable start at any speed setting.
7. Enclosure: Open drip-proof.
8. Bearings: Permanently lubricated heavy duty ball bearings.

9. Overload Protection:
 - a. Automatic Speed Control: In the event of overheating or overloading, the motor electronics slow the motor to operate within its acceptable range.
 - b. Thermal Overload: Internally fused, one-shot type as a last resort to prevent fires.
 - c. Locked Rotor: If the motor sees a locked rotor condition, it will automatically shut itself down, then try to restart 3 times. After the 3rd try, the motor will not attempt to restart until the power is cycled.

2.02 STARTERS AND OVERLOADS

- A. Acceptable Manufacturers:
 1. Cerus Industrial, Inc.
 2. Allen-Bradley (division of Rockwell Automation).
 3. Cutler Hammer (division of Eaton Corporation).
 4. General Electric.
 5. Siemens.
 6. Square D (division of Schneider Electric).
 7. Substitutions: Approved equal. See Section 016000 - Product Requirements.
- B. Provide motor starters for motors provided under this Division of these Specifications.
- C. Cerus Industrial “BAS” building automation HVAC starters are the basis of design. Features of starters/contactors, disconnects, and temperature controls shall be combined in a single package using these starters. Coordination with Automatic Temperature Controls supplier and installer is required to reduce total project costs.
 1. 3-phase starter features include:
 - a. Multi-tap control power transformer (CPT) for universal control voltage.
 - b. Motor circuit protector disconnect (MCP) with high interrupt rating and lockable operator handle.
 - c. Contactors rated as high as 2.5 million electrical operations and 25 million mechanical operations.
 - d. Anti-cycling feature.
 - e. Solid-state electronic overloads with wide adjustment range and highly accurate digital motor protection, including protection for phase loss, phase unbalance, stall and locked rotor conditions. Class 1-30.
 - f. Digital keypad, featuring an H-O-A (Hand, Off, Auto) panel with large, clearly labeled push buttons including a front panel reset function and high-intensity LED indicators for settings.
 - g. Damper and valve actuator control, to open the actuator before starting the fan or pump motor.
 - h. Permissive auto control to disable auto inputs. Commonly used with a high pressure limit switch.
 - i. Universal control inputs, including auto dry input, and wet input for voltages from 20 to 138 VAC or VDC.
 - j. Power failure reset.
 - k. Fireman’s override.
 - l. NEMA 1 enclosure with prepunched knockouts. NEMA 3R, 4, 4X, and 12 as required.
 - m. BACnet embedded communications option available.
 - n. UL Listed assembly.
 - o. 5-year warranty.

- p. Factory printed label or engraved nameplate, designating the equipment served.
- 2. Single-phase starter (Cerus BAS-1P series) features include:
 - a. Manually operated quick-make toggle mechanism lockable in the “Off” position, which shall also function as the motor disconnect.
 - b. Hand/Auto switch, concealed behind sliding cover to discourage tampering.
 - c. Capability to operate in both manual and automatic control modes. In automatic mode, the starter shall have the capability to integrate with a building automation system by providing terminals for run input, run status output, and fault output.
 - d. Control terminals integrated in the starter.
 - e. Power, run status, and fault LED pilot lights.
 - f. Interposing run relay and current sensing status output relay.
 - g. Voltage and dry inputs for auto run command.
 - h. System override mode (fireman’s, occupancy, or manual).
 - i. Solid-state electronic overload with wide adjustment range and highly accurate digital motor protection, including protection for stall and locked rotor conditions. Class 10. Concealed adjustment behind sliding cover.
 - j. Surface mount enclosure, UL Type 1, single gang box installation, with sliding covers for concealed items.
 - k. Power Input: 1-phase, 110-240 VAC, 1-16 Amps, 0.1-1 HP (75 to 745 W).
 - l. Universal Control Inputs: Voltage auto-run 10-130 VAC/DC to energize. Dry auto-run normally-open dry contact closure.
 - m. Control Outputs: Proof of run and fault, normally-open 0.3 Amps at 125 VAC, 1 Amp at 24 VAC.
 - n. Ambient operating temperature -5 to 140 degrees F (-20 to 60 degrees C).
 - o. UL 508A Listed.
 - p. 5-year warranty.
- D. Feature Descriptions:
 - 1. Fireman’s Override Input: Causes the starter to run the motor in any mode (Hand, Off or Auto) regardless of other inputs or lack of inputs either manual or auto. The purpose of the Fireman’s Override input is to act as a smoke purge function. Fireman’s Override has priority over the Emergency Shutdown input.
 - 2. Emergency Shutdown Input: Disables the starter from operating in either Hand or Auto mode regardless of other inputs either manual or auto.
 - 3. Phase Failure Protection: Initiates when phase loss is greater than 70 percent for 3 seconds or phase unbalance is greater than 50 percent for more than 5 seconds.
 - 4. Cycling Fault Protection: Activates whenever the starter is cycled at a rate of more than 1000 cycles in a one hour period. This feature shall be selectable to be disabled. Cycling fault shall cause overload LED to blink rapidly.
- E. Contactors in starters shall be general purpose NEMA rated for connected H.P. (definite purpose starters not acceptable). Coordinate control voltage with Controls Contractor. Provide auxiliary contacts where required for interlocking of electrical equipment. Provide 2-speed motor starters where indicated or required.
- F. Single phase motors shall have one of the following factory wired methods of motor protection:
 - 1. Integral thermal overload protection in motor and cord with plug and receptacle in unit casing.
 - 2. Integral thermal overload protection in motor and disconnecting switch mounted in or on casing as specified with equipment.

3. Switch with thermal overload protection for unprotected motors with switch serving as disconnect device.
- G. For starters associated with equipment that is required to be shut down upon a fire alarm condition, provide input contacts within the starter enclosure to interface with the building's fire alarm system. Upon receipt of a signal from the building's fire alarm system, power to load side of the starter shall be turned off. Circuitry shall be provided to ensure that power is off whether the starter is in the "AUTO", "HAND" or "BYPASS" mode. If this feature is not available from the starter manufacturer, provide a contactor on the line side of the starter to accomplish the same function. The contactor shall meet the requirements of Division 26.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Division 01 Section "Quality Requirements": Manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Coordinate with Division 26 "Electrical."
- D. Check line voltage and phase and direction of rotation, and ensure agreement with nameplate.
- E. Install guards in accordance with Codes and OSHA requirements.
- F. Adjust motor overload devices based on motor amperage ratings and field measurements of running amps, to ensure protection of the motor and eliminate nuisance trips.
- G. Disconnect Switch Mounting Height: Install at height above finished floor in accordance with NFPA 70.
 1. In most instances, the center of the grip of the disconnect switch operating handle in its highest position shall be no more than 79 inches (2.0 m) above finished floor or working platform.
 2. Switches and circuit breakers installed adjacent to the equipment served (and within 79 inches (2.0 m) above finished floor or working platform.

END OF SECTION 23 05 13

This Page Left Intentionally Blank

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Pipe and equipment hangers and supports.
- B. Equipment bases and supports.
- C. Sleeves and seals.

1.02 REFERENCES

- A. ASME.
- B. ASTM
- C. MSS.
- D. NFPA 70 - National Electrical Code

1.03 SUBMITTALS

- A. Submit under provisions of Division 01 Section "Submittal Procedures".
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data: Provide manufacturers catalog data including load capacity.
- D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- E. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.04 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum 3 years' experience.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable Codes for support of piping.
- B. Supports for Electrical: In conformance with NFPA 70 and Division 26 of the Specifications.

PART 2 - PRODUCTS

2.01 HANGERS, SUPPORTS, & PIPE CLAMPS

- A. Manufacturers:
 - 1. Strut Hangers:
 - a. Unistrut (division of Tyco).
 - b. Anvil International.
 - c. Cooper B-Line.
 - d. Hydra-Zorb Company.
 - e. Thomas & Betts - Superstrut line.
 - f. Tolco (division of Cooper B-Line).
 - g. Substitutions: Not permitted.
- B. Strut hangers shall be standard 1-5/8 inches x 1-5/8 inches (41x41 mm) size.
- C. Pipe hanger rods and nuts shall be plated to match the hangers. Nuts shall be self-locking type, or provide double nuts tightened to lock together. Rods shall be threaded one end, or continuous threaded. Provide washers at each nut.

2.02 INSERTS

- A. Manufacturers:
 - 1. Cooper B-Line.
 - 2. Grinnell.
 - 3. Substitutions: Approved equal. See Section 016000 - Product Requirements
- B. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.02 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- D. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.
- E. Do not anchor supports to metal decking with or without a concreted slab.

3.03 SUPPORTING OTHER TRADES

- A. Supports furnished under Division 23 of the Specifications may also be used to support conduits furnished under Division 26 “Electrical” if this Subcontractor is willing to allow this. Supports shared with other trades shall be designed to accommodate the weight, expansion/contraction, vibration, and other requirements of the other trades’ items without detriment to the function, accessibility, and serviceability of the HVAC items or those of the other trades. Provide flexible sections of piping and conduit as required to allow each trade’s items to expand and contract along with the other trades, and to absorb vibration caused by the other trades.
- B. Electrical lighting fixtures and equipment, and architectural items such as ceilings, may not be supported from supports furnished under this Section.
- C. Prevent contact between components of other trades, such as architectural suspended ceiling support wires, and HVAC supports which may transmit vibration to the occupied space.

END OF SECTION 23 05 29

This Page Left Intentionally Blank

SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Labels.
- D. Stencils.
- E. Lockout Devices.

1.02 REFERENCES

- A. Division 01 Section "References": Requirements for references and standards.
- B. ASME A13.1 - Scheme for the Identification of Piping Systems (2007 edition or newer).
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.03 SUBMITTALS

- A. Division 01 Section "Submittal Procedures."
- B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Samples: Submit 2 tags, 1-1/2 inches (38 mm) in size.
- F. Samples: Submit 2 labels, 1.9 x 0.75 inches (48 x 19 mm) in size.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit under Division 01 Section "Closeout Procedures."
- B. Record actual locations of tagged valves; include valve tag numbers.

1.05 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 01 Section "Operation and Maintenance Data."
- B. Include valve tag chart.

1.06 REGULATORY REQUIREMENTS

- A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

PART 2 - PRODUCTS

2.01 NAMEPLATES

- A. Manufacturers:
 - 1. Seton Identification Products.
 - 2. E.R. Perry Signs & Engraving.
 - 3. Brimar Industries, Inc., PipeMarker division.
 - 4. Substitutions: Not permitted
- B. Plastic Nameplates: Laminated 3-layer plastic with beveled edges and engraved letters on contrasting background color, 1/16 inch (1.58 mm) thick. Letters shall be black on light backgrounds, or white on dark backgrounds, as applicable. Service temperature range -40 to 175 degrees F (-40 to 79 degrees C); minimum application temperature for adhesive 50 degrees F (10 degrees C). Suitable for average outdoor lifespan of at least 2-3 years.
- C. Aluminum Nameplates: For higher temperature applications, and for outdoor applications when manufacturer does not recommend their plastic nameplates for use outdoors, provide aluminum nameplates, with integral anodized or painted surface color coating and natural aluminum engraved letters, 1/32-inch (0.78 mm) thick. Service temperature range -40 to 350 degrees F (-40 to 177 degrees C); minimum application temperature for adhesive 50 degrees F (10 degrees C). Suitable for average outdoor lifespan of at least 2-3 years.
- D. Colors: Select background color as appropriate for the application. Color for general applications shall be white (except that aluminum nameplate standard color shall be black). Color for general warnings shall be red or yellow. Colors for fluid services shall comply with ASME A13.1-2007. Comply with ASME/ANSI standards and other regulations as applicable.
- E. Provide with factory adhesive, and with side holes for fastener attachment as applicable. Mechanical fasteners are required for applications which are outdoors or otherwise exposed to weather or sunlight, or in moist areas such as kitchens and locker rooms, or on cooled surfaces subject to condensation, or on surfaces with operating temperatures above 150 degrees F (65 degrees C). Where nameplate is on an irregular surface and cannot make complete contact, provide mechanical fasteners or ties in addition to adhesive.

2.02 TAGS

- A. Plastic Tags:
 - 1. Manufacturers:
 - a. Seton Identification Products.
 - b. E.R. Perry Signs & Engraving.
 - c. Brimar Industries, Inc., PipeMarker division.
 - d. Substitutions: Not permitted.
 - 2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches (38 mm) diameter.

- B. Metal Tags:
 - 1. Manufacturers:
 - a. Seton Identification Products.
 - b. Brady Worldwide, Inc.
 - c. Brimar Industries, Inc., PipeMarker division.
 - d. Substitutions: Not permitted.
 - 2. Brass with stamped letters; tag size minimum 1-1/2 inches (38 mm) diameter with smooth edges.
- C. Information Tags:
 - 1. Manufacturer: Seton Identification Products.
 - 2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches (83 x 143 mm) with grommet and self-locking nylon ties.
- D. Tag Chains and Hooks: Brass or stainless steel compatible with tag material for general applications. Brass where in contact with copper piping or other copper-alloy materials.
- E. Tag Chart: Typewritten letter size list in anodized aluminum frame with plexiglass cover.

2.03 LABELS

- A. Manufacturer:
 - 1. Seton Identification Products.
 - 2. Substitutions: Approved equal. See Section 016000 - Product Requirements
- B. Description: Polyester, size 1.9 x 0.75 inches (48 x 19 mm), adhesive backed with printed identification.

2.04 STENCILS

- A. Manufacturers:
 - 1. Seton Identification Products.
 - 2. Brimar Industries, Inc., PipeMarker division.
 - 3. Substitutions: Approved equal. See Section 016000 - Product Requirements
- B. Stencils: With clean cut symbols and letters of following size:
 - 1. Up to 2 inch (51 mm) Outside Diameter of Insulation or Pipe: 1/2 inch (13 mm) high letters.
 - 2. 2-1/2 to 6 inches (64-150 mm) Outside Diameter of Insulation or Pipe: 1 inch (25 mm) high letters.
 - 3. Over 6 inches (150 mm) Outside Diameter of Insulation or Pipe: 1-3/4 inches (44 mm) high letters.
 - 4. Ductwork and Equipment: 1-3/4 inches (44 mm) high letters.

2.05 LOCKOUT DEVICES

- A. Lockout Hasps:
 - 1. Manufacturers:
 - a. Seton Identification Products.
 - b. Brady Worldwide, Inc.
 - c. Master Lock.

- d. Substitutions: Approved equal. See Section 016000 - Product Requirements
- 2. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches (184 x 76 mm).

PART 3 - EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Division 01 Section "Quality Requirements": Manufacturer's instructions.
- B. Install identifying devices after completion of coverings and painting.
- C. Install plastic or aluminum engraved nameplates with corrosion-resistant mechanical fasteners, or adhesive, as specified. In outdoor locations, where lifetime of nameplates is limited, fasteners shall be removable screws or bolts for ease of nameplate replacement.
- D. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- E. Install tags using corrosion resistant chain. Number tags consecutively by location.
- F. Identify items of mechanical equipment such as chillers, fans, terminal units, air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- G. Tag automatic controls, instruments, and relays. Key to control schematic.
- H. Identify ductwork with stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- I. Identify duct access doors at fire dampers, smoke dampers, and smoke detectors with 1/2 inch (12.7 mm) lettering to indicate the fire protection device(s) within, in accordance with NFPA 90A.

3.03 COORDINATION WITH EXISTING EQUIPMENT

- A. Where an existing equipment identification system is involved, the new system shall be coordinated and compatible with the existing system.

END OF SECTION 23 05 53

SECTION 23 07 13
DUCT INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Ductwork Insulation.

1.02 RELATED SECTIONS

- A. Division 23 Section "Identification for HVAC Piping and Equipment."
- B. Division 23 Section "Metal Ducts": Factory-insulated flexible ductwork.
- C. Division 23 Section "Metal Ducts": Ductwork.

1.03 REFERENCES

- A. Division 01 Section "References": Requirements for references and standards.
- B. ASTM
- C. NAIMA - National Insulation Standards.
- D. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- E. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- F. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- G. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

- A. Division 01 Section "Submittal Procedures".
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum 3 years' experience.
- B. Applicator Qualifications: Company specializing in performing the work of this Section with minimum 3 years' experience.

1.06 REGULATORY REQUIREMENTS

- A. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255 and UL 723. For elastomeric foam insulation, rating shall apply for thicknesses up to 2 inches (50 mm).
- B. Insulation materials shall be asbestos free. No fibers with dimensions similar to asbestos fibers shall be released from any material.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Division 01 Section "Product Requirements": Transport, handle, store, and protect products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 Section "Product Requirements": Environmental conditions affecting products on site.
- B. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- C. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Glass and Mineral Fiber Products:
 - 1. Knauf Insulation.
 - 2. Certainteed Corporation.
 - 3. Johns Manville.
 - 4. Owens Corning.
 - 5. Substitutions: Not permitted.
- B. Glass Fiber Insulation Sealing Tapes:
 - 1. Venture Tape Corporation.
 - 2. 3M Company.
 - 3. Ideal Tape Co., division of American Biltrite Inc.
 - 4. Nashua Tape Products, division of Berry Plastics Corp.
 - 5. Substitutions: Not permitted.
- C. Accessories:
 - 1. Ceel-Co division of Johns Manville (product: plastic jacket systems).
 - 2. Foster Products, division of Specialty Construction Brands, Inc., a subsidiary of H.B.

- Fuller (mastics, sealants, reinforcing membranes, and accessories).
- 3. Johns Manville (products: Super-Seal acrylic polymer coatings, Zeston plastic jacket systems).
- 4. Pabco/Childers Metals, division of ITW Insulation Systems (products: metal jacket systems, and accessories).
- 5. Vac Systems International (product: Tough Coat acrylic polymer mechanical insulation repair coating).
- 6. Venture Tape Corporation (product: Jacket for outdoor insulation).
- 7. Substitutions: Approved equal. See Section 016000 - Product Requirements.

2.02 GLASS FIBER, RIGID

- A. Insulation: ASTM C612; rigid, noncombustible blanket. Supplied in board form.
 - 1. 'K' ('Ksi') value: ASTM C518, 0.24 at 75 degrees F (0.036 at 24 degrees C).
 - 2. Maximum service temperature: 450 degrees F (232 degrees C).
 - 3. Maximum moisture absorption: 1.0 percent by volume.
 - 4. Density: 3.0 lb/cu. ft. (48 kg/cu m).
- B. Vapor Barrier Jacket:
 - 1. ASTM C1136, kraft paper reinforced with glass fiber yarn and bonded to aluminized film. Facing as required for the application.
 - a. Aluminum Faced: FSK (foil-scrim-kraft) construction
 - b. White Faced: ASJ (all-service jacket) construction.
 - 2. Moisture vapor transmission: ASTM E96; 0.02 perm.
 - 3. Suitable for insulation surface temperatures up to 150 degrees F (66 degrees C).
 - 4. Overlap longitudinal laps and butt strips.
 - 5. Secure insulation with mechanical fasteners to substrate, and seal jacket with pressure sensitive tape.
- C. Vapor Barrier Tape: See article "Glass Fiber Insulation Sealing Tape" in this Section.
- D. Indoor Vapor Barrier Finish:
 - 1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight, glass fabric.
 - 2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.03 GLASS FIBER INSULATION SEALING TAPE

- A. Manufacturer:
 - 1. 3M VentureTape,
 - 2. Ideal Tape
 - 3. Insulation manufacturer
 - 4. Substitutions: Approved equal. See Section 016000 - Product Requirements
- B. Self-adhesive tape with integral vapor barrier, pressure sensitive acrylic-based or rubber-based adhesive, and release liner strip. Width 3 inch (76 mm) nominal.
- C. Types:
 - 1. For rigid and semi-rigid insulations, tape shall be reinforced type. For flexible "duct wrap" insulation, tape shall be either reinforced or non-reinforced.
 - 2. White or aluminum outer surface to match the insulation.

3. Reinforced: Kraft paper reinforced with glass fiber yarn and bonded to vapor barrier layer.
 - a. Aluminum Finish with FSK: VentureTape 1525CW.
 - b. White Finish with ASJ: VentureTape 1540CW
 - c. White Finish with PSK: VentureTape 1531CW.
4. Non-Reinforced: Foil insulation tape. Dead-soft temper 2 mil (0.05 mm) thick aluminum foil, without reinforcement. Hand-tearable.
5. Performance:
 - a. Peel Adhesion: PSTC-101 with 20 minute dwell, 45 oz/in. (12.5 N / 25 mm).
 - b. Shear Adhesion: PSTC-107, 2.2 psi (15.2 kPa) after 24 hours.
 - c. Tensile Strength: PSTC-131:
 - 1) Reinforced Types: 40 lb/in. (180.8 N / 25 mm).
 - 2) Non-reinforced Types: 21 lb/in. (94.9 N / 25 mm).
 - d. Elongation: PSTC 131, 6 percent maximum.
 - e. Service Temperature: -40 to 240 degrees F (-40 to 116 degrees C).
 - f. UL 723 listed or classified (flame/smoke rating)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Division 01 Section "Project Management and Coordination": Verification of existing conditions before starting work.
- B. Verify that ductwork has been tested before applying insulation materials.
- C. Verify that surfaces are clean, foreign material removed, and dry.
- D. Verify that insulation materials are clean and dry. Discard any materials that exhibit signs of moisture damage, contamination, mold, mildew, or other biological growth. Discard any materials used in the air handling airstream if they have been exposed to water.

3.02 INSTALLATION

- A. Division 01 Section "Quality Requirements": Manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Provide insulation for surfaces of ductwork, as indicated and specified. Insulation values shall meet or exceed the requirements of ASHRAE 90.1-2010, State Energy Codes, and Table I, whichever is greater. In addition, comply with the other requirements of this Section.
- D. Ductwork Exposed below 10 feet (3 meters) above finished floor in Mechanical Equipment Rooms or below 8 feet (2.4 meters) above finished floor in Finished Spaces: Provide glass fiber rigid insulation with vapor barrier jacket.
- E. Where rigid glass fiber insulation is scheduled, semi-rigid glass fiber insulation may be used on round and flat oval ducts and irregular shapes, and preformed pipe insulation may be used on small diameter round ducts.

- F. Inspection Plates and Test Holes: Provide, where required, in ductwork or casings for balance measurements. Test holes shall be factory fabricated, airtight, and noncorrosive with screw cap and gasket. Extend cap through insulation.
- G. Install insulation after ductwork and equipment have been tested and approved.
- H. Ensure that surface is clean and dry prior to installation. Ensure that insulation is dry before and during application. Finish with system at operating conditions.
- I. Ensure that insulation is continuous through inside walls. Pack around ducts with fireproof self-supporting insulation material, properly sealed.
- J. Finish insulation neatly at hangers, supports and other protrusions.
- K. Locate insulation or cover seams in least visible locations.
- L. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.
- M. Standing seams, supporting angles and flanges on insulated ductwork shall be insulated with thickness equal to the duct and edges shall be finished and vapor sealed.
- N. Mechanical fasteners shall not be riveted or screwed to the duct and shall not penetrate the metalwork.

3.03 FIELD INSPECTION

- A. Visually inspect to ensure that materials used conform to Specifications. Inspect installations progressively for compliance with requirements.

TABLE I
DUCTWORK INSULATION MATERIAL AND WALL THICKNESS

DUCTWORK TYPE	INSULATION MATERIAL	VAPOR BARRIER REQUIRED	INSULATION WALL THICKNESS
Exhaust ductwork from exterior building openings (such as louvers and roof hoods) to 4 feet (1.2 m) interior of motorized damper or backdraft damper.			
	Glass Fiber, Rigid	Yes	1 ½ inch (38.1 mm)

END OF SECTION 23 07 13

SECTION 23 31 13
METAL DUCTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Metal Ductwork.
- B. Casing and Plenums.

1.02 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Division 23 Section "Air Duct Accessories": Kitchen hoods.

1.03 RELATED SECTIONS

- A. Division 23 Section "Hangers and Supports for HVAC Piping and Equipment": Sleeves.
- B. Division 23 Section "Duct Insulation": External insulation and duct liner.
- C. Division 23 Section "Air Duct Accessories"
- D. Division 23 Section "Air Outlets and Inlets."

1.04 REFERENCES

- A. ASTM
- B. AWS D9.1 - Welding of Sheet Metal.
- C. NBS PS 15 - Voluntary Product Standard for Custom Contact-Molded Reinforced-Polyester Chemical Resistant Process Equipment.
- D. NFPA
- E. SMACNA
- F. UL.

1.05 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes is permitted except by written permission from the Architect. Size proposed substitutions of round ducts in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.06 SUBMITTALS

- A. Submit under provisions of Division 01 Section "Submittal Procedures".
- B. Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and

configuration. Submit prior to start of work.

- C. Product Data: Provide data for duct materials, duct liner and duct connectors.
- D. Test Reports: Submit testing apparatus, procedures, and preliminary forms prior to performing tests. On final reports, indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.07 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 Section "Closeout Procedures."
- B. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Indicate additional fittings used.

1.08 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA HVACDCS.

1.09 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum 3 years' experience.
- B. Installer: Company specializing in performing the work of this Section with minimum 3 years' experience.

1.10 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A, NFPA 90B and NFPA 96 standards.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealants.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufactured Ductwork - Round and Flat Oval:
 - 1. McGill AirFlow LLC, a subsidiary of United McGill Corporation.
 - 2. Aero Heating & Ventilating, Inc.; Portland, ME.
 - 3. Air Purchases, Inc.; Manchester, NH – spiral duct lengths.
 - 4. Atlantic Air Products LLC; Bow, NH.
 - 5. Hahnel Brothers; Bangor and Lewiston, ME.
 - 6. Lindab, Inc. – duct fittings only.
 - 7. Macy Industries, Inc.; Hookset, NH.
 - 8. Northeastern Sheet Metal Inc.; Goffstown, NH.

9. Semco Inc., division of the Flakt Woods Group.
10. Total Air Supply; Nashua, NH – spiral duct lengths.
11. Substitutions: Not permitted.

B. Manufactured Ductwork - Transverse Duct Connection System:

1. Ductmate.
2. HFC Enterprises; Baldwin Park, CA – Dura Flange product line, for round and flat oval ducts only
3. Substitutions: Approved equal. See Section 016000 - Product Requirements.

C. Sealants:

1. Hardcast, a division of Carlisle Corporation.
2. 3M Company.
3. Ductmate.
4. Foster.
5. McGill AirSeal LLC, a subsidiary of United McGill Corporation.
6. Mon-Eco Industries, Inc - Eco product line.
7. Polymer Adhesive Sealant Systems.
8. Substitutions: Approved equal. See Section 016000 - Product Requirements

2.02 MATERIALS

A. Galvanized Steel Ducts:

1. Steel sheet metal components of galvanized ductwork in this Specification Section shall be galvanized steel sheet, lock-forming quality, having G60 or heavier zinc coating (G90 minimum for outdoor or moist applications) conforming to ASTM A653 rating system and tested in accordance with ASTM A90.
2. Provide paint-grip exterior surfaces for exposed ducts, where available.
3. Sheet metal gauge shall be not less than 24 gauge.

2.03 ACCESSORIES

- A. Fasteners: Rivets, bolts, or sheet metal screws.
- B. Sealants: See Duct Sealant portion of this Specification.
- C. Hanger Rod: ASTM A36; galvanized steel; threaded both ends, threaded one end, or continuously threaded.

2.04 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVACDCS, as specified or as indicated on the drawings. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- B. SMACNA Duct Construction Manuals:
 1. The SMACNA recommendations shall be considered as mandatory requirements.
 2. Substitute the word "shall" for the word "should" in these manuals.
 3. Where the Contract Specifications differ from SMACNA recommendations, the more stringent requirements (as determined by the Architect) shall take precedence.
 4. Details on the Contract Drawings take precedence over SMACNA standards.

- C. Sheet metal shall be galvanized steel as specified in Part 2 paragraph "Materials" in this Section, unless otherwise indicated or specified.
- D. Construct Tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.
 - 1. Where space is too restricted for full-radius elbows, provide mitered (square-throat) elbows with single wall turning vanes. Do not use air foil turning vanes.
 - 2. Mitered elbows in round or flat-oval ductwork shall be factory-manufactured.
 - 3. Radiused elbows with throat radius 1/2 times width of duct (centerline radius 1 width of duct) may be used instead of mitered elbows, but only where space is too restricted for full radius.
 - 4. Fittings not conforming to these requirements will be ordered removed and replaced with proper fittings.
- E. Increase duct sizes gradually, not exceeding 15 degrees divergence or convergence (per side) wherever possible; maximum 30 degrees divergence (per side) upstream of equipment and 45 degrees convergence (per side) downstream.
- F. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- G. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- H. Longitudinal locks or seams known as "button-punch-snap-lock" and other "snap-lock" types will not be permitted in rectangular duct. Snap-lock longitudinal seams may be used on round ducts up to 8 inches diameter, with screws provided to secure the seams at 24 inches on center maximum spacing.
- I. Exposed Ducts: Select and handle materials with care for a neat appearance. Joint connections on round and flat oval ducts shall be sleeve or flanged type; drawbands are not acceptable.

2.05 MANUFACTURED DUCTWORK AND FITTINGS

- A. Manufacturers:
 - 1. McGill Airflow: Standard Uni-Seal product line (smooth surface between spiral lockseams)
 - 2. Uni-Rib product line (one standing seam reinforcement between each pair of spiral lockseams).
 - 3. Substitutions: Approved equal. See Section 016000 - Product Requirements
 - a. Standard spiral product line (smooth surface between spiral lockseams).
- B. Manufactured ductwork and fittings listed above are acceptable alternatives to standard ductwork systems. For exposed round and flat oval ductwork, factory-manufactured ductwork and fittings are required.
- C. Manufacture in accordance with SMACNA HVACDCS, and as specified or as indicated on the drawings. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

- D. Ductwork and fittings shall be products of a single manufacturer.
- E. Exposed Ducts:
 - 1. Select and handle materials with care for a neat appearance.
 - 2. Joint connections on round ducts shall be sleeve or flanged type; drawbands are not acceptable. Joint connections on flat oval ducts 42 inches and wider shall be flanged type to ensure tight fit and good appearance.
 - 3. Provide exterior reinforcing only where required, with prior approval from the Architect.
- F. Galvanized sheet metal used in fabrication shall be not less than 26 gauge thickness. Aluminum shall be not less than 0.025 in. nominal thickness. This requirement supersedes SMACNA requirements.
- G. Inner tie-rod reinforcement is not allowed. Increase duct sheet metal gauge or external reinforcement as required.
- H. Transverse Duct Connection System: SMACNA "F" rated or SMACNA "J" rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips. Product shall be Ductmate factory-manufactured connectors, or field-formed flanges using a specialized machine.

2.06 PRESSURE CLASSIFICATION

- A. Ratings as indicated on the Drawings or as specified. See Ductwork Pressure Class Schedule in Part 3 of this Section.
- B. If no ratings are indicated, ductwork shall be rated for the external static pressure of the system plus 25 percent.
 - 1. If 4 dampers (of any type) or fewer can isolate a duct system, that portion of the system shall be rated for the shut-off pressure of the system fans.

2.07 DUCT SEALING

- A. Seal ductwork as outlined in the SMACNA HVACDCS. Seal ductwork to a minimum of class A (transverse joints, longitudinal seams, and duct wall penetrations), regardless of pressure class.
- B. Seal ductwork systems as required to ensure that maximum duct leakage does not exceed that allowed by the latest edition of the SMACNA HVAC Air Duct Leakage Test Manual. Allow sealant to dry in accordance with manufacturer's requirements of time and environmental conditions before ductwork systems are pressurized.
- C. Duct sealing materials used shall be non-flammable and non-combustible in both liquid and solid states.
- D. Seal Pittsburgh hammered lockseams by flooding the joint with sealant prior to assembly.
- E. Seal exposed ducts by applying mastic-type or gasket-type sealer just before the joint or seam is made; remove excess sealant for a neat appearance.
- F. Fill (with matching duct material such as sheet metal) any gaps in duct which exceed the

recommendations of the sealant manufacturer, and in no case shall liquid or mastic sealant be used to fill gaps or openings which exceed 1/8 inch in any direction. Verify that system air pressure acting on a wide gap will not exert enough force to damage or loosen the sealant.

G. Materials for Sealing:

1. Hardcast: Flex-Grip 550 or Iron-Grip 601 mastic.
2. Hardcast: gypsum-based tape and mastic, waterproof type when used on moist-air exhaust or in humid or outdoor locations.
3. Ductmate: Flanged lateral joints with gaskets.
4. Ductmate: PROseal.
5. Foster: Duct-Fas or Safetee mastic sealant. Duct-Fas is UV resistant and recommended for applications exposed to sunlight.
6. Mon-Eco: Eco-Duct Seal 4450 (red color) or 4452 (grey color). Use grey color where ducts will be unpainted and exposed to public view.
7. Polymer Adhesives Sealant Systems: Airseal No. 11 premium sealant.

2.08 UNIFORMITY OF MATERIALS

- A. Ductwork accessories, including but not limited to volume dampers, smoke dampers, fire dampers, combination fire/smoke dampers, backdraft dampers and motorized dampers, shall be fabricated of materials that are similar to the ductwork in which they are installed.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components furnished under other Section and Divisions of the Specifications.
- C. Install ducts in accordance with SMACNA HVACDCS.
- D. Duct Hangers and Supports:
1. Provide in accordance with SMACNA HVAC Duct Construction Standards, Section 4.
 2. Regardless of SMACNA standards, duct hangers shall be provided as follows:
 - a. Hang ducts up to and including 36 inches (914 in width by a minimum of 1 in x 16 ga flat straps on each side of the duct on 4 ft centers, bent under bottom of duct a minimum of 2 inches and securely fastened to duct. Hang ducts larger than 36 inches in width by 3/8 inch steel rods and 2 x 2 x 1/4-inch steel angle trapeze hangers, spaced 4 ft on center. Anchor risers in the center of the vertical run to allow ends of riser free vertical movements.
 - b. Ducts with Extra Weight Such As Lead Lining or Lagging: Include the extra weight in determination of suitable hangers and supports.
- E. Hanging of Ductwork:
1. Attach supports only to structural framing members and non-metal deck concrete slabs.
 2. Support ductwork from the top chord of bar joists at the "Panel Points" or from the top flange of beams. Provide intermediate support consisting of steel angle or equal as required where supports are installed between joist spaces.
 3. Do not anchor supports to metal decking with or without a concreted slab.

- F. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- G. “Fishmouth” duct connections are not allowed.
- H. Inner tie-rod reinforcement is not allowed. Increase duct sheet metal gauge or external reinforcement as required.
- I. Exposed Ducts:
 - 1. Handle with care for a neat appearance. Repair or replace dented or damaged ductwork as required by the Architect. Select hangers for appearance, and to prevent sagging or distortion of duct.
 - 2. Seal ductwork from inside, do not permit exterior sealant to remain.
 - 3. Remove labels attached to ducts before receiving paint.
- J. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- K. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- L. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- M. Use double nuts and lock washers on threaded rod supports. Strap hangers shall be minimum 16 gauge x 1 inch galvanized straps. Hanger and support components including but not limited to “unistrut” shall be galvanized steel except that where other duct materials are used, the hanger materials shall be compatible and non-corrosive to the duct. Wire hangers are not acceptable.
- N. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system. Do not start ducted air moving equipment until construction is completed to a stage where airborne construction dust is no longer present. At the time of substantial completion, the entire air distribution system shall be turned over to the Owner clear of construction dust and debris. If the interior surfaces of any ducted air moving equipment or the interior surfaces of any portion of the ductwork distribution system are found, as determined by the Architect, to contain significant construction dust and debris, the entire air distribution system shall be cleaned in accordance with Division 23. If proper precautions are taken to prevent construction dust and debris from entering the ductwork during construction and if the Architect finds all ductwork to be free from such dust and debris, air duct cleaning shall not be required.
- O. For fresh air intake and exhaust plenums connected to louvers or brick or block vents, pitch bottom of plenums down to bottom of louver at minimum 1/4 inch per foot (2 percent). Seal connections and joints on bottom of plenums watertight with mastic. Connect bottom of plenum to top-inside edge of bottom louver blade or waterstop as detailed on the Drawings, to ensure positive drainage.
- P. Install duct-mounted components furnished under other Sections of this Specification, such as smoke dampers, control dampers, control sensors, and smoke detectors. Install with straight

lengths of duct as required for proper operation. Provide access at such components as required. Install in accessible locations for maintenance; notify the Architect if a location indicated or selected requires addition of access by other trades.

3.02 AIR DUCT LEAKAGE TESTS

- A. Perform air duct leakage tests in accordance with the testing procedures outlined in the latest edition of the SMACNA HVAC Air Duct Leakage Test Manual.
- B. Leakage testing shall be performed on complete ductwork including fittings and accessories such as dampers, access doors, branch connections, and inlets and outlets. Flexible ducts, VAV boxes, air handling units, and duct coils may be excluded. Ducts may be temporarily sectioned and capped for testing, for reasons of limited test apparatus capacity, or requirements of construction phasing.
- C. Leakage tests, including retests as required, shall be performed prior to concealment and insulation.
- D. The Following Duct Systems Shall Be Tested for Leakage, regardless of whether or not SMACNA recommends testing:
 - 1. Ductwork.
- E. Submit testing apparatus, procedures, and preliminary forms prior to performing tests.
- F. Once leakage tests are complete, submit leakage test report. Leakage test report forms shall include the following:
 - 1. Project and system identification data
 - 2. Description of ductwork under test
 - 3. Leakage class specified
 - 4. Test pressure specified
 - 5. Duct construction pressure class
 - 6. Duct design air flow
 - 7. Surface area of ductwork under test
 - 8. Maximum allowable leakage factor
 - 9. Calculated allowable leakage
 - 10. Test apparatus
 - a. Blower
 - b. Orifice, tube size
 - c. Orifice size
 - d. Orifice coefficient
 - e. Calibration date
 - 11. Test orifice differential pressure
 - 12. Leakage for tested section
 - 13. Total leakage for system
 - 14. Date of test
 - 15. Witnesses
- G. Air duct leakage testing shall be performed by an experienced agency
- H. Leakage Class Schedule:

DUCT PRESSURE CLASS	DUCT TYPE	LEAKAGE CLASS
Below 3 inch W.G.	Rectangular Metal	12
Below 3 inch W.G.	Round Metal	6

3.03 SCHEDULES

A. Ductwork Material Schedule

AIR SYSTEM

General Exhaust

MATERIAL

Galvanized Steel, Aluminum

END OF SECTION 23 31 13

This Page Left Intentionally Blank

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Duct Access Doors.
- B. Duct Test Holes.
- C. Wire Mesh for Screens.

1.02 RELATED SECTIONS

- A. Division 01 Section "Operation and Maintenance Data."
- B. Division 23 Section "Common Work Results for HVAC"
- C. Division 23 Section "Identification for HVAC Piping and Equipment."
- D. Division 23 Section "Metal Ducts."
- E. Division 26 "Electrical": Electrical characteristics and wiring connections.

1.03 REFERENCES

- A. ASTM C423-02a - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- B. ASTM E477-99 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
- C. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- D. NFPA 70 - National Electrical Code.
- E. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.
- F. SMACNA - HVAC Duct Construction Standards - Metal and Flexible, Third Edition - 2005 (HVACDCS).
- G. SMACNA - Seismic Restraint Manual - Guidelines for Mechanical Systems (SRMGMS).
- H. UL 33 - Heat Responsive Links for Fire-Protection Service.
- I. UL 94 - Safety of Flammability of Plastic Materials for Parts in Devices and Appliances Testing.

- J. UL 1995 - Heating and Cooling Systems.

1.04 SUBMITTALS

- A. Submit under provisions of Division 01 Section “Submittal Procedures.”
- B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors and duct test holes.
- C. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes and hardware used. Include electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Indicate for fire dampers and combination fire and smoke dampers.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 Section “Closeout Procedures.”
- B. Record actual locations of access doors and test holes.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum 3 years' experience.

1.07 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 01 Section “Product Requirements.”
- B. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.01 GALVANIZED STEEL

- A. Steel sheet metal components of accessories in this Specification Section shall be galvanized steel sheet, lock-forming quality, having G60 or heavier zinc coating conforming to ASTM A653 rating system and tested in accordance with ASTM A90. Provide paint-grip exterior surfaces for exposed ducts, where available.

2.02 DUCT ACCESS DOORS

- A. Manufacturers:
1. Standard Doors:
 - a) Ruskin.
 - b) Air Balance, Inc.
 - c) Arrow.
 - d) Buckley Associates.
 - e) Cesco.
 - f) DuctMate.
 - g) Greenheck.
 - h) Nailor.
 - i) Vent Products, Inc.
 - j) Shop fabricated.
 - k) Substitutions: Approved equal. See Section 016000 - Product Requirements
 2. Medium and High-Pressure Doors:
 - a) Ruskin.
 - b) DuctMate.
 - c) Greenheck.
 - d) Nailor.
 - e) Substitutions: Not permitted.
 3. Grease Duct Doors:
 - a) Ductmate.
 - b) Shop fabricated.
 - c) Substitutions: Approved equal. See Section 016000 - Product Requirements
- B. Fabricated in accordance with SMACNA HVACDCS, and as specified or as indicated on the Drawings. Standard access doors and access doors for grease ducts may be shop-fabricated. Pressure rating shall be equal to the rating of the associated ductwork; see Part 3 Division 23 Section "Metal Ducts" for schedule of pressure classes.
- C. Standard Doors: Removable, with retainer chain. Rigid and close-fitting with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum 1 inch (25 mm) thick insulation with galvanized steel sheet metal airstream-side cover.
1. 16 inches (406 mm) Square and Smaller: Secure with two sash locks.
 2. Over 16 inches (406 mm), up to 24 inches (610 mm) Square: Provide four sash locks.
 3. Larger Sizes: Hinges and two compression latches with outside and inside handles.
 4. Clamping-type doors with knob handles, as manufactured by Ductmate, may be substituted for standard sizes.
 5. Material: Galvanized steel in galvanized steel ductwork. Stainless steel in stainless steel ductwork. Aluminum as manufactured by Arrow in aluminum ductwork.
 6. Provide in negative-pressure systems, and in positive-pressure systems with specified pressure class at or below 2 in. WG (498 Pa).
- D. Medium- and High-Pressure Positive-Pressure Ducts:
1. Ruskin ADHP-3 high pressure access door rated up to 12 in. WG (2985 Pa), with spring latches to allow the door to open temporarily to relieve negative pressures.
 2. Provide in positive-pressure systems with specified pressure class above 2 in. WG (498 Pa).

- E. Access doors with sheet metal screw fasteners are not acceptable.
- F. Sizing: Select sizes to allow testing, service, and maintenance within the ductwork. Such access may require the insertion of one or both hands, arms, and shoulders as appropriate. Doors sized for viewing-only are not acceptable. Doors found to be of inadequate size shall be replaced with proper size.

2.03 DUCT TEST HOLES

- A. Manufacturers:
 - 1. Ductmate.
 - 2. Carlyle Corporation.
 - 3. Duro-Dyne.
 - 4. Ventfabrics.
 - 5. Substitutions: Approved equal. See Section 016000 - Product Requirements
- B. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- C. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.04 WIRE MESH FOR SCREENS

- A. Manufacturers:
 - 1. McNichols Co.
 - 2. Banker Wire and Iron Works, Inc.
 - 3. Belleville Wire Cloth Co.
 - 4. Edward J. Darby & Son, Inc.
 - 5. Substitutions: Not permitted.
- B. Galvanized Welded Wire Mesh: Hardware and industrial class welded wire square mesh, hot dipped galvanized, welded trimmed construction, 2 mesh (2 openings per inch, wires ½ inch on center), 0.0630 inch wire nominal diameter parallel to width and length, 0.437 inch openings, 76 percent open area, 0.51 lb/sq. ft weight. Specification is the minimum acceptable for strength and weight of materials.
- C. Material to Match Ductwork: Where screens are installed in ductwork or louvers of other materials such as stainless steel or aluminum, provide screens of material to match the ductwork or louver, with strength equal to the requirements specified for galvanized mesh. Aluminum screens may be fabricated of expanded metal instead of welded wire.
- D. Provide mesh installed in a removable frame to support the mesh completely flat and rigid, with fasteners in an accessible location.

2.05 UNIFORMITY OF MATERIALS

- A. Ductwork accessories, including but not limited to volume dampers, smoke dampers, fire dampers, combination fire/smoke dampers, backdraft dampers and motorized dampers, shall be fabricated of materials that are similar to the ductwork in which they are installed.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVACDCS. Refer to Division 23 Section "Metal Ducts" for duct construction and pressure class.
- ~~B.~~ Install components furnished under other Section and Divisions of the Specifications.
- C. Duct Hangers and Supports: SMACNA HVACDCS, Section 4.
 - 1. Flexible Ducts: Support ducts by hangers every 3 feet (0.9 m), unless supported by ceiling construction. Stretch flexible air ducts to smooth out corrugations, and long radius elbows, where possible, using a minimum length to make connections.
 - 2. Flexible Connectors: Provide flexible connectors between fans and ducts or casings and where ducts are of dissimilar metals. For round ducts, securely fasten flexible connectors by zinc-coated steel clinch-type draw-bands. For rectangular ducts, lock flexible connectors to metal collars.
- D. Attach supports only to structural framing members and non-metal deck concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing member, provide suitable intermediate metal framing. Where C clamps are used, use retainer clips.
- E. Access Doors:
 - 1. Provide duct access doors in horizontal return air, exhaust air and fresh air intake ductwork to facilitate the removal of accumulations of dust and combustible materials in accordance with NFPA 90A. Install access doors at maximum 20 foot (6 m) intervals and at the base of each vertical riser.
 - 2. Provide duct access doors for inspection, servicing, and cleaning before filters, before and after coils, before and after fans, before automatic dampers, at fire dampers, at smoke dampers, at combination fire and smoke dampers, at smoke detector sampling tubes (upstream of the sampling tube), at multiple blade volume dampers, at backdraft and counterbalanced dampers, and elsewhere as specified or as indicated on the Drawings. Provide at changes in direction of kitchen exhaust ductwork and as otherwise required for cleaning kitchen exhaust ductwork in accordance with NFPA 96. Provide minimum 8 x 8 inch (200 x 200 mm) size for hand access, 18 x 18 inch (450 x 450 mm) size for shoulder access, and as specified or as indicated on the Drawings. Review locations prior to fabrication.

- F. Provide duct test holes where indicated and required for testing and balancing purposes.
- G. Provide interconnecting power and control wiring as required, in accordance with Division 26.

END OF SECTION 23 33 00

SECTION 23 34 00
HVAC FANS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Power Ventilators:
 - 1. Ceiling Exhaust Fans.
- B. Motors and Drives.
- C. Fan Accessories.

1.02 RELATED SECTIONS

- A. Division 23 Section "Common Motor Requirements for HVAC Equipment."
- B. Division 23 Section "Duct Insulation."
- C. Division 23 Section "Metal Ducts."
- D. Division 23 Section "Air Duct Accessories": Backdraft dampers.
- E. Division 26 "Electrical."

1.03 REFERENCES

- A. Division 01 Section "Quality Requirements."
- B. ANSI/ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- C. ANSI/ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- D. AMCA 99 - Standards Handbook.
- E. AMCA 210 - Laboratory Methods of Testing Fans for Rating.
- F. AMCA 261 - Directory of Products Licensed to Use the AMCA Certified Ratings Seal.
- G. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
- H. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- I. NEMA MG1 - Motors and Generators.
- J. NFPA 70 - National Electrical Code.
- K. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

- L. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease Vapors from Commercial cooking Equipment.
- M. UL 705 - Power Ventilators.
- N. UL 762 - Power Roof Ventilators For Restaurant Exhaust Appliances.

1.04 SUBMITTALS

- A. Division 01 Section “Submittal Procedures.”
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate assembly of fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

1.05 SUBMITTALS AT PROJECT CLOSEOUT

- A. Division 01 Section “Closeout Procedures”: Procedures for submittals.
- B. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum 3 years experience.

1.07 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND PROTECTION

- A. Division 01 Section “Product Requirements”: Transport, handle, store, and protect products.
- B. Protect motors, shafts, and bearings from weather and construction dust.

1.09 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 Section “Product Requirements”: Environmental conditions affecting products on site.
- B. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test-run under observation.

PART 2 - PRODUCTS

2.01 ELECTRONICALLY-COMMUTATED (EC) MOTORS - ALSO KNOWN AS BRUSH-FREE DC (BFDC) MOTORS

- A. Manufacturers:
 - 1. Greenheck Fan Corporation - "Vari-Green" motor.
 - 2. General Electric.
 - 3. Twin City Fan Co.
 - 4. Substitutions: Approved equal. See Section 016000 - Product Requirements
- B. Applications: Ceiling and cabinet fans, centrifugal inline fans, centrifugal roof exhaust fans, and centrifugal upblast exhaust fans, in sizes up to 3/4 hp (0.56 kW). Voltage 115V/1ph/60Hz.
- C. See Division 23 Section "Common Motor Requirements for HVAC Equipment" for general requirements.
- D. Speed Control:
 - 1. Typical motor speed range is 350 RPM to 1725 RPM.
 - 2. Motor operates on a voltage signal of 2-10 VDC, with 15-20 percent speed at 2V and 100 percent speed at 10V. Motor is switched off when the signal is 0-1.9 VDC.
 - 3. Control method furnished with the motor shall be one of the following, as indicated on the Drawings or in the Specifications:
 - a. Motor-mounted potentiometer with screwdriver setting. Provide this unless otherwise indicated or specified.
 - b. Remote-mounted Belimo potentiometer with calibrated 0-100 percent dial. Potentiometer includes a toggle switch to select an output range of 0-10V or 2-10V, so that with the 0-10 V setting the control can turn the fan off. Factory-mounted 24 VDC transformer in a junction box.
 - c. Factory-furnished circuitry to accept a 0-10V signal from the building control system. Requires an additional 24 VDC power supply to the motor's controls, 0.70 VA capacity.
 - 4. Provide field-furnished metal 2 x 4 in. (50 x 100 mm) junction box for mounting remote potentiometer dials.
 - 5. Provide field-furnished interconnecting power and control wiring as required, including separate flexible conduits for line-voltage and low-voltage wiring.

2.02 POWER VENTILATORS

- A. Manufacturers:
 - 1. Greenheck.
 - 2. Loren Cook.
 - 3. Acme.
 - 4. Hartzell.
 - 5. Penn Barry.
 - 6. Twin City Fan Co.
 - 7. Substitutions: Approved equal. See Section 016000 - Product Requirements
- B. Product Requirements:
 - 1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating

- Seal.
 - 2. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
 - 3. Fabrication: Conform to AMCA 99.
 - 4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- C. Cabinet and Ceiling Exhaust Fans:
- 1. Centrifugal Fan Unit: Centrifugal impeller, V-belt or direct driven as scheduled on the Drawings, with galvanized steel housing, resilient mounted motor, gravity backdraft damper in discharge.
 - 2. Speed Control Switchunit mounted solid state speed controller.
 - 3. Sheaves: For V-belt drives, provide cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Division 01 Section "Quality Requirements": Manufacturer's instructions.
- B. Install flexible connections between fan inlet and outlet and ductwork, including roof and wall-mounted fans unless otherwise indicated; refer to Division 23 Section "Air Duct Accessories." Ensure metal bands of connectors are parallel with minimum 1 inch (25 mm) flex between ductwork and fan while running.
- C. Hung Cabinet Fans:
 - 1. Install fans with resilient mountings and flexible electrical leads. Refer to Division 23 Section "Common Motor Requirements for HVAC Equipment."
- D. Provide safety screen where inlet or outlet is exposed.
- E. Do not operate fans in normal operation until ductwork is clean, filters are in place, bearings are lubricated, and fan has been test run under observation.

END OF SECTION 23 34 00

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Louvers.

1.02 REFERENCES

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
- B. ADC 1062 - Certification, Rating and Test Manual.
- C. AMCA 500 - Test Method for Louvers, Dampers and Shutters.
- D. AMCA 511 - Certified Ratings Program for Air Control Devices
- E. ARI 650 - Air Outlets and Inlets.
- F. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
- G. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- H. ASTM E413 - Classification for Rating Sound Insulation.
- I. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- J. NFPA 70 - National Electrical Code.
- K. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

1.03 SUBMITTALS

- A. Submit under provisions of Division 01 Section "Submittal Procedures."
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets indicating type, size, application, rated airflow, noise level, pressure drop, and throw distance as applicable. Submit both manufacturer's standard performance tables and graphs, AND tabulated selection data specific to this project. NOTE: Submittals without complete and sufficient information, to verify the performance specified and scheduled on the Drawings, shall be rejected.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 Section "Closeout Procedures."

- B. Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.
- B. Test and rate louver performance in accordance with AMCA 500.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum 3 years' experience.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Louvers (Non-acoustical Type):
 - 1. Greenheck.
 - 2. Airolite.
 - 3. American Warming and Ventilating.
 - 4. Arrow.
 - 5. Ruskin.
 - 6. United Enertech.
 - 7. Nailor
 - 8. Substitutions: Not permitted

2.02 LOUVERS (4-INCH)

- A. Louvers shall be equal to, and shall have free areas no less than, Greenheck Model ESD-403. Acceptable substitutes by other listed manufacturers (subject to performance specified and scheduled on Drawings) shall be:
 - 1. Ruskin: Model ELF445DX.
 - 2. American Warming & Ventilating: Model LE-23.
 - 3. Airolite: Model
 - 4. Arrow: Model EA-415-D.
 - 5. United Enertech: Model D-HFA-4.
 - 6. Substitutions: Approved equal. See Section 016000 - Product Requirements
- B. For reference, free area of a model ESD-403 in 48 inch x 48 inch (1.2 m x 1.2 m) size is 8.0 sq. ft (0.74 m²).
- C. Free area velocity at beginning of water penetration shall be at least 1000 fpm (5.0 m/sec). Beginning of water penetration is defined by AMCA as 0.01 oz. per sq. ft (3 g/m²).
- D. Air pressure drop for intake air at an air velocity of 1000 fpm (5.0m/sec) in intake mode shall not exceed 0.20 in.wg (49.8Pa).
- E. Testing for water penetration and air performance shall be in accordance with AMCA Standard

511, using a 48 inch x 48 inch (1.2 m x 1.2 m) louver.

- F. Type: 4 inch (100 mm) deep with drainable blades on approximately 37 to 45 degree slope, heavy channel frame, removable expanded aluminum bird screen with 1/2 inch (13mm) mesh mounted on interior face.
- G. Fabrication: 0.081 inch (2.05 mm) thick 6063-T5 extruded aluminum alloy, welded assembly.
- H. Mounting: Furnish with standard box frame and angles for installation.
- I. Finish: Factory 2-coat, 1.2-mil (0.03 mm) thickness 70 percent Kynar 500/Hylar 5000 fluoropolymer finish, with 10-year warranty. Submit manufacturer's standard color chart. The Architect will select color for each louver individually, with up to 4 different colors for the project. Accessories visible from outdoors or exposed to the airstream, such as interior and exterior screens, shall have finish identical to the louver.
- J. Louvers shall bear the AMCA rating seal for water penetration and air performance.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.
- C. Install outlets and inlets to ductwork with air tight connection.
- D. Slope ducts or plenums at louvers, and at brick or block vents, to drain outward, and seal bottoms watertight.
- E. Surfaces exposed to view shall be clean, and free of stains, smudges, and scratches.
- F. Provide hex-head fasteners to curb in each hole in curb caps or bases of roof-mounted units. Provide protection between dissimilar metals.

END OF SECTION 23 37 00

This Page Left Intentionally Blank

SECTION 26 00 10
SUPPLEMENTAL REQUIREMENTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Supplemental requirements applicable to Work specified in Division 26.

1.02 REFERENCES

A. Abbreviations and Acronyms for Electrical Terms and Units of Measure:

1. 8PSJ or 8P8C: Miniature 8-position series jack, also called an 8-position 8-contact modular jack for some applications.
2. A: Ampere, unit of electrical current.
3. AC or ac: Alternating current.
4. AFCI: Arc-fault circuit interrupter.
5. AIC: Ampere interrupting capacity.
6. AL, Al, or ALUM: Aluminum.
7. ASD: Adjustable-speed drive.
8. ATS: Automatic transfer switch.
9. AWG: American wire gauge; see ASTM B258.
10. BAS: Building automation system.
11. BIL: Basic impulse insulation level.
12. BIM: Building information modeling.
13. CAD: Computer-aided design or drafting.
14. CATV: Community antenna television.
15. CB: Circuit breaker.
16. CO/ALR: Copper-aluminum, revised.
17. COPS: Critical operations power system.
18. CU or Cu: Copper.
19. CU-AL or AL-CU: Copper-aluminum.
20. dB: Decibel, a unitless logarithmic ratio of two electrical, acoustical, or optical power values.
21. dB(A-weighted) or dB(A): Decibel acoustical sound pressure level with A-weighting applied in accordance with IEC 61672-1.
22. dB(adjusted) or dBa: Decibel weighted absolute noise power with respect to 3.16 pW (minus 85 dBm).
23. dBm: Decibel absolute power with respect to 1 mW.
24. DC or dc: Direct current.
25. DCOA: Designated critical operations area.
26. DDC: Direct digital control (HVAC).
27. EGC: Equipment grounding conductor.
28. EMF: Electromotive force.
29. EMI: Electromagnetic interference.
30. EPM: Electrical preventive maintenance.

- 31. EPS: Emergency power supply.
- 32. EPSS: Emergency power supply system.
- 33. ESS: Energy storage system.
- 34. EV: Electric vehicle.
- 35. EVPE: Electric vehicle power export equipment.
- 36. EVSE: Electric vehicle supply equipment.
- 37. fc: Footcandle, a unit of illuminance equal to one lumen per square foot.
- 38. FLC: Full-load current.
- 39. ft: Foot.
- 40. GEC: Grounding electrode conductor.
- 41. GFCI: Ground-fault circuit interrupter.
- 42. GFPE: Ground-fault protection of equipment.
- 43. GND: Ground.
- 44. HACR: Heating, air conditioning, and refrigeration.
- 45. HDPE: High-density polyethylene.
- 46. HID: High-intensity discharge.
- 47. HP or hp: Horsepower.
- 48. HVAC: Heating, ventilating, and air conditioning.
- 49. Hz: Hertz.
- 50. IBT: Intersystem bonding termination.
- 51. inch: Inch. To avoid confusion, the abbreviation "in." is not used.
- 52. IP: Ingress protection rating (enclosures); Internet protocol (communications).
- 53. IR: Infrared.
- 54. IS: Intrinsically safe.
- 55. IT&R: Inspecting, testing, and repair.
- 56. ITE: Information technology equipment.
- 57. kAIC: Kiloampere interrupting capacity.
- 58. kmil or MCM: One thousand circular mils.
- 59. kV: Kilovolt.
- 60. kVA: Kilovolt-ampere.
- 61. kVA_r or kVAR: Kilovolt-ampere reactive.
- 62. kW: Kilowatt.
- 63. kWh: Kilowatt-hour.
- 64. LAN: Local area network.
- 65. lb: Pound (weight).
- 66. LCD: Liquid-crystal display.
- 67. LCDI: Leakage-current detector-interrupter.
- 68. LED: Light-emitting diode.
- 69. LNG: Liquefied natural gas.
- 70. LP-Gas: Liquefied petroleum gas.
- 71. LRC: Locked-rotor current.
- 72. MCC: Motor-control center.
- 73. MDC: Modular data center.
- 74. MG set: Motor-generator set.
- 75. MIDI: Musical instrument digital interface.
- 76. MLO: Main lugs only.
- 77. MVA: Megavolt-ampere.
- 78. mW: Milliwatt.
- 79. MW: Megawatt.
- 80. MWh: Megawatt-hour.
- 81. NC: Normally closed.

82. NiCd: Nickel cadmium.
83. NIU: Network interface unit.
84. NO: Normally open.
85. NPT: National (American) standard pipe taper.
86. OCPD: Overcurrent protective device.
87. ONT: Optical network terminal.
88. PC: Personal computer.
89. PCS: Power conversion system.
90. PCU: Power-conditioning unit.
91. PF or pf: Power factor.
92. PHEV: Plug-in hybrid electric vehicle.
93. PLC: Programmable logic controller.
94. PLFA: Power-limited fire alarm.
95. PoE: Power over Ethernet.
96. PV: Photovoltaic.
97. PVC: Polyvinyl chloride.
98. pW: Picowatt.
99. RFI: Radio-frequency interference (electrical); Request for interpretation (contract).
100. RMS or rms: Root-mean-square.
101. RPM or rpm: Revolutions per minute.
102. SCADA: Supervisory control and data acquisition.
103. SCR: Silicon-controlled rectifier.
104. SPD: Surge protective device.
105. sq.: Square.
106. SWD: Switching duty.
107. TCP/IP: Transmission control protocol/Internet protocol.
108. TEFC: Totally enclosed fan-cooled.
109. TR: Tamper resistant.
110. TVSS: Transient voltage surge suppressor.
111. UL: Underwriters Laboratories, Inc. (standards) or UL LLC (services).
112. UL CCN: UL Category Control Number.
113. UPS: Uninterruptible power supply.
114. USB: Universal serial bus.
115. UV: Ultraviolet.
116. V: Volt, unit of electromotive force.
117. V(ac): Volt, alternating current.
118. V(dc): Volt, direct current.
119. VA: Volt-ampere, unit of complex electrical power.
120. VAR: Volt-ampere reactive, unit of reactive electrical power.
121. VFC: Variable-frequency controller.
122. VOM: Volt-ohm-multimeter.
123. VPN: Virtual private network.
124. VRLA: Valve-regulated lead acid.
125. W: Watt, unit of real electrical power.
126. Wh: Watt-hour, unit of electrical energy usage.
127. WPT: Wireless power transfer.
128. WPTE: Wireless power transfer equipment.
129. WR: Weather resistant.

B. Abbreviations and Acronyms for Electrical Raceway Types:

1. EMT: Electrical metallic tubing.

2. EMT-A: Aluminum electrical metallic tubing.
3. EMT-S: Steel electrical metallic tubing.
4. EMT-SS: Stainless steel electrical metallic tubing.
5. ENT: Electrical nonmetallic tubing.
6. EPEC: Electrical HDPE underground conduit.
7. EPEC-40: Schedule 40 electrical HDPE underground conduit.
8. EPEC-80: Schedule 80 electrical HDPE underground conduit.
9. EPEC-A: Type A electrical HDPE underground conduit.
10. EPEC-B: Type B electrical HDPE underground conduit.
11. ERMC: Electrical rigid metal conduit.
12. ERMC-A: Aluminum electrical rigid metal conduit.
13. ERMC-S: Steel electrical rigid metal conduit.
14. ERMC-S-G: Galvanized-steel electrical rigid metal conduit.
15. ERMC-S-PVC: PVC-coated-steel electrical rigid metal conduit.
16. ERMC-SS: Stainless steel electrical rigid metal conduit.
17. FMC: Flexible metal conduit.
18. FMC-A: Aluminum flexible metal conduit.
19. FMC-S: Steel flexible metal conduit.
20. FMT: Steel flexible metallic tubing.
21. FNMC: Flexible nonmetallic conduit. See LFNC.
22. HDPE: See EPEC.
23. IMC: Steel electrical intermediate metal conduit.
24. LFMC: Liquidtight flexible metal conduit.
25. LFMC-A: Aluminum liquidtight flexible metal conduit.
26. LFMC-S: Steel liquidtight flexible metal conduit.
27. LFMC-SS: Stainless steel liquidtight flexible metal conduit.
28. LFNC: Liquidtight flexible nonmetallic conduit.
29. LFNC-A: Layered (Type A) liquidtight flexible nonmetallic conduit.
30. LFNC-B: Integral (Type B) liquidtight flexible nonmetallic conduit.
31. LFNC-C: Corrugated (Type C) liquidtight flexible nonmetallic conduit.
32. PVC: Rigid PVC conduit.
33. PVC-40: Schedule 40 rigid PVC conduit.
34. PVC-80: Schedule 80 rigid PVC Conduit.
35. PVC-A: Type A rigid PVC concrete-encased conduit.
36. PVC-EB: Type EB rigid PVC concrete-encased underground conduit.
37. RGS: See ERMC-S-G.
38. RMC: See ERMC.
39. RTRC: Reinforced thermosetting resin conduit.
40. RTRC-AG: Low-halogen, aboveground reinforced thermosetting resin conduit.
41. RTRC-AG-HW: Heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
42. RTRC-AG-SW: Standard wall, low-halogen, aboveground reinforced thermosetting resin conduit.
43. RTRC-AG-XW: Extra heavy wall, low-halogen, aboveground reinforced thermosetting resin conduit.
44. RTRC-BG: Low-halogen, belowground reinforced thermosetting resin conduit.

C. Abbreviations and Acronyms for Electrical Cable Types:

1. AC: Armored cable.
2. CATV: Coaxial general-purpose cable.
3. CATVP: Coaxial plenum cable.

4. CATVR: Coaxial riser cable.
5. CI: Circuit integrity cable.
6. CL2: Class 2 cable.
7. CL2P: Class 2 plenum cable.
8. CL2R: Class 2 riser cable.
9. CL2X: Class 2 cable, limited use.
10. CL3: Class 3 cable.
11. CL3P: Class 3 plenum cable.
12. CL3R: Class 3 riser cable.
13. CL3X: Class 3 cable, limited use.
14. CM: Communications general-purpose cable.
15. CMG: Communications general-purpose cable.
16. CMP: Communications plenum cable.
17. CMR: Communications riser cable.
18. CMUC: Under-carpet communications wire and cable.
19. CMX: Communications cable, limited use.
20. DG: Distributed generation cable.
21. FC: Flat cable.
22. FCC: Flat conductor cable.
23. FPL: Power-limited fire-alarm cable.
24. FPLP: Power-limited fire-alarm plenum cable.
25. FPLR: Power-limited fire-alarm riser cable.
26. IGS: Integrated gas spacer cable.
27. ITC: Instrumentation tray cable.
28. ITC-ER: Instrumentation tray cable, exposed run.
29. MC: Metal-clad cable.
30. MC-HL: Metal-clad cable, hazardous location.
31. MI: Mineral-insulated, metal-sheathed cable.
32. MTW: Moisture-, heat-, and oil-resistant thermoplastic cable (machine tool wiring).
33. MV: Medium-voltage cable.
34. NM: Nonmetallic sheathed cable.
35. NMC: Nonmetallic sheathed cable with corrosion-resistant nonmetallic jacket.
36. NMS: Nonmetallic sheathed cable with signaling, data, and communications conductors, plus power or control conductors.
37. NPLF: Non-power-limited fire-alarm circuit cable.
38. NPLFP: Non-power-limited fire-alarm circuit cable for environmental air spaces.
39. NPLFR: Non-power-limited fire-alarm circuit riser cable.
40. NUCC: Nonmetallic underground conduit with conductors.
41. OFC: Conductive optical fiber general-purpose cable.
42. OFCG: Conductive optical fiber general-purpose cable.
43. OFCP: Conductive optical fiber plenum cable.
44. OFCR: Conductive optical fiber riser cable.
45. OFN: Nonconductive optical fiber general-purpose cable.
46. OFNG: Nonconductive optical fiber general-purpose cable.
47. OFNP: Nonconductive optical fiber plenum cable.
48. OFNR: Nonconductive optical fiber riser cable.
49. P: Marine shipboard cable.
50. PLTC: Power-limited tray cable.
51. PLTC-ER: Power-limited tray cable, exposed run.
52. PV: Photovoltaic cable.
53. RHH: Thermoset rubber, heat-resistant cable (high heat).

54. RHW: Thermoset rubber, moisture-resistant cable.
55. SA: Silicone rubber cable.
56. SE: Service-entrance cable.
57. SER: Service-entrance cable, round.
58. SEU: Service-entrance cable, flat.
59. SIS: Thermoset cable for switchboard and switchgear wiring.
60. TBS: Thermoplastic cable with outer braid.
61. TC: Tray cable.
62. TC-ER: Tray cable, exposed run.
63. TC-ER-HL: Tray cable, exposed run, hazardous location.
64. THW: Thermoplastic, heat- and moisture-resistant cable.
65. THHN: Thermoplastic, heat-resistant cable with nylon jacket outer sheath.
66. THHW: Thermoplastic, heat- and moisture-resistant cable.
67. THWN: Thermoplastic, moisture- and heat-resistant cable with nylon jacket outer sheath.
68. TW: Thermoplastic, moisture-resistant cable.
69. UF: Underground feeder and branch-circuit cable.
70. USE: Underground service-entrance cable.
71. XHH: Cross-linked polyethylene, heat-resistant cable.
72. XHHW: Cross-linked polyethylene, heat- and moisture-resistant cable.

D. Definitions:

1. Basic Impulse Insulation Level: Reference insulation level expressed in impulse crest voltage with a standard wave not longer than 1.5 times 50 microseconds and 1.5 times 40 microseconds.
2. Communications Jack: A fixed connecting device designed for insertion of a communications cable plug.
3. Communications Outlet: One or more communications jacks, or cables and plugs, mounted in a box or ring, with a suitable protective cover.
4. Designated Seismic System: A system component that requires design in accordance with ASCE/SEI 7, Ch. 13 and for which the Component Importance Factor is greater than 1.0.
5. Direct Buried: Installed underground without encasement in concrete or other protective material.
6. Enclosure: The case or housing of an apparatus, or the fence or wall(s) surrounding an installation, to prevent personnel from accidentally contacting energized parts or to protect the equipment from physical damage. Types of enclosures and enclosure covers include the following:
 - a. Cabinet: An enclosure that is designed for either surface mounting or flush mounting and is provided with a frame, mat, or trim in which a swinging door or doors are or can be hung.
 - b. Concrete Box: A box intended for use in poured concrete.
 - c. Conduit Body: A means for providing access to the interior of a conduit or tubing system through one or more removable covers at a junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
 - d. Conduit Box: A box having threaded openings or knockouts for conduit, EMT, or fittings.
 - e. Cutout Box: An enclosure designed for surface mounting that has swinging doors or covers secured directly to and telescoping with the walls of the enclosure.
 - f. Device Box: A box with provisions for mounting a wiring device directly to the box.

- g. Extension Ring: A ring intended to extend the sides of an outlet box or device box to increase the box depth, volume, or both.
 - h. Floor Box: A box mounted in the floor intended for use with a floor box cover and other components to complete the floor box enclosure.
 - i. Floor-Mounted Enclosure: A floor box and floor box cover assembly with means to mount in the floor that is sealed against the entrance of scrub water at the floor level.
 - j. Floor Nozzle: An enclosure used on a wiring system, intended primarily as a housing for a receptacle, provided with a means, such as a collar, for surface-mounting on a floor, which may or may not include a stem to support it above the floor level, and is sealed against the entrance of scrub water at the floor level.
 - k. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.
 - l. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.
 - m. Pedestal Floor Box Cover: A floor box cover that, when installed as intended, provides a means for typically vertical or near-vertical mounting of receptacle outlets above the floor's finished surface.
 - n. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.
 - o. Raised-Floor Box: A floor box intended for use in raised floors.
 - p. Recessed Access Floor Box: A floor box with provisions for mounting wiring devices below the floor surface.
 - q. Recessed Access Floor Box Cover: A floor box cover with provisions for passage of cords to recessed wiring devices mounted within a recessed floor box.
 - r. Raised Ring: A sleeve, which is not necessarily round, used for positioning a recessed wiring device flush with the plaster, concrete, drywall, or other wall surface.
 - s. Ring Cover: A box cover, with raised center portion to accommodate a specific wall or ceiling thickness, for mounting wiring devices or luminaires flush with the surface.
 - t. Sleeves: Mechanical protection for cable/conduits that pass through a wall or floor.
 - u. Termination Box: An enclosure designed for installation of termination base assemblies consisting of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors, or both.
7. Emergency Systems: Those systems legally required and classed as emergency by municipal, state, federal, or other codes, or by any governmental agency having jurisdiction that are designed to ensure continuity of lighting, electrical power, or both, to designated areas and equipment in the event of failure of the normal supply for safety to human life.
 8. Essential Electrical Systems: Those systems designed to ensure continuity of electrical power to designated areas and functions of a healthcare facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system. (healthcare facilities)
 9. High-Performance Building: A building that integrates and optimizes on a life-cycle basis all major high-performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations.

10. Jacket: A continuous nonmetallic outer covering for conductors or cables.
11. Luminaire: A complete lighting unit consisting of a light source such as a lamp, together with the parts designed to position the light source and connect it to the power supply. It may also include parts to protect the light source or the ballast or to distribute the light.
12. Miniature 8-Position Series Jack (8PSJ): Also called an 8-position 8-contact (8P8C) modular jack. An unkeyed jack with up to eight contacts commonly used to terminate twisted-pair and multiconductor Ethernet cable. Shape and dimensions are specified by TIA-1096.
 - a. Caution: An 8PSJ is not the same thing as an FCC "registered jack" RJ45S, now called a miniature 8-position keyed jack (8PKJ). Ethernet cable plugs do not have rejection keys. Many manufacturers and suppliers incorrectly use "RJ45" as a generic term to describe any 8-position series plug or jack whether it has a rejection key or not.
13. Mode: The terms "Active Mode," "Off Mode," and "Standby Mode" are used as defined in the Energy Independence and Security Act (EISA) of 2007.
14. Multi-Outlet Assembly: A type of surface, flush, or freestanding raceway designed to hold conductors, receptacles, and switches, assembled in the field or at the factory.
15. Plenum: A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.
16. Provide: As used in this section, "provide" shall mean, "Furnish and install". "Furnish" shall mean "to purchase and deliver to the project site complete with every necessary appurtenance and support", and "install" shall mean "to unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project."
17. Receptacle: A fixed connecting device arranged for insertion of a power cord plug. Also called a power jack.
18. Receptacle Outlet: One or more receptacles mounted in a box with a suitable protective cover.
19. Sheath: A continuous metallic covering for conductors or cables.
20. UL Category Control Number: An alphabetic or alphanumeric code used to identify product categories covered by UL's Listing, Classification, and Recognition Services.
21. Voltage Class: For specified circuits and equipment, voltage classes are defined as follows:
 - a. Control Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is supplied from a battery or other Class 2 or Class 3 power-limited source.
 - b. Line Voltage: (1) (controls) Designed to operate using the supplied low-voltage power without transformation. (2) (transmission lines, transformers, SPDs) The line-to-line voltage of the supplying power system.
 - c. Extra-Low Voltage: Not having electromotive force between any two conductors, or between a single conductor and ground, exceeding 30 V(ac rms), 42 V(ac peak), or 60 V(dc).
 - d. Low Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 30 V but not exceeding 1000 V.
 - e. Medium Voltage: Having electromotive force between any two conductors, or between a single conductor and ground, that is rated about 1 kV but not exceeding 69 kV.
 - f. High Voltage: (1) (circuits) Having electromotive force between any two conductors, or between a single conductor and ground, that is rated above 69 kV but not exceeding 230 kV. (2) (safety) Having sufficient electromotive force to inflict bodily harm or injury.

1.03 PROJECT/SITE CONDITIONS

- A. Coordinate with all other trades to ensure proper access and space requirements.
- B. Where project conditions occur necessitating departures from the drawings, submit for approval the details of and reasons for departures prior to implementing any change.
- C. Alterations
 - 1. Visit the site and become familiar with the existing conditions, and the requirements of the Plans and Specifications. No claim will be recognized for extra compensation due to failure of becoming familiar with the conditions and extent of the proposed work.
 - 2. Execute all alterations, additions, removals, relocations, or new work, etc., as indicated or required to provide a complete installation in accordance with the intent of the Drawings and Specifications.
 - 3. Repair or replace to the Owner's satisfaction, all existing work disturbed or damaged by the alterations.
 - 4. Except as follows, Retain ownership and remove from site all existing materials, equipment, fixtures, wiring and devices disconnected and not reused; Pay all charges for proper disposal of materials:
 - a. Materials specifically indicated to be returned to Owner.
 - b. Deliver to Owner: Transformers, single phase medium voltage switches, and all other equipment specified within the project electrical specifications and drawings.
 - c. Obtain receipt of delivery from Owner's Representative.
 - 5. Do not reuse existing wiring except as specifically indicated. Existing conduit raceways may be reused, provided that the existing wires are removed and new wires are installed.
 - 6. Provide finished blank plates on all existing ceiling and wall boxes which can not be removed.
 - 7. Ensure all circuits in existing buildings are re-energized where existing panelboards are replaced, or existing wiring is rerouted, disconnected, or disturbed. Provide and install new wiring as required to meet this condition. Verify breaker/fuse sizes on existing circuits and do not load wiring to beyond 75% of their ampacities.

1.04 COORDINATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions:
 - 1. Notify the University no fewer than seven days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without the University's written permission.
 - 3. Coordinate interruption with systems impacted by outage including, but not limited to, the following:
 - a. Exercising generators.
 - b. Emergency lighting.
 - c. Elevators.
 - d. Fire-alarm systems.

- B. Temporary electrical service shall be provided by under this Division 26.

1.05 PREINSTALLATION MEETINGS

- A. Electrical Preconstruction Conference: Schedule conference with Architect and Owner as required in Division 01 specification, after notice to proceed. Agenda topics include, but are not limited to, the following:
 - 1. Electrical installation schedule.
 - 2. Status of power system studies.
 - 3. Utility work coordination and class of service requests.
 - 4. Commissioning activities.

1.06 SEQUENCING

- A. Conduct and submit results of power system studies before submitting Product Data and Shop Drawings for electrical equipment.

1.07 SCHEDULING

- A. All schedules shall be submitted to the University for approval.

1.08 INFORMATIONAL SUBMITTALS

- A. Electrical Installation Schedule: At preconstruction meeting, and periodically thereafter as dates change, provide schedule for electrical installation Work to Owner and Architect including, but not limited to, milestone dates for the following activities:
 - 1. Submission of power system studies.
 - 2. Submission of specified coordination drawings.
 - 3. Submission of action submittals specified in Division 26.
 - 4. Orders placed for major electrical equipment.
 - 5. Arrival of major electrical equipment on-site.
 - 6. Preinstallation meetings specified in Division 26.
 - 7. Service outages.
 - 8. Service inspection and activation.
 - 9. System startup, testing, and commissioning activities for major electrical equipment.
 - 10. System startup, testing, and commissioning activities for emergency lighting.
 - 11. System startup, testing, and commissioning activities for automation systems (SCADA, BMS, lighting, HVAC, fire alarm, fire pump, etc.).
 - 12. Pouring of concrete housekeeping pads for electrical equipment and testing of concrete samples.
 - 13. Requests for special inspections.
 - 14. Requests for inspections by authorities having jurisdiction.
- B. Certificates:
 - 1. Welding certificates.

1.09 CLOSEOUT SUBMITTALS

- A. Updated Facility EPM Program Binders:
 - 1. Complete Set: On USB media that is clearly and permanently labeled with attached placard on lanyard to prevent misplacement.
 - 2. Volumes 2 and 8: Reproducible hardcopy on archival quality, 28 lb (105 GSM), acid-free, bond paper.
- B. Operation and Maintenance Data:
 - 1. Provide emergency, operation, and maintenance manuals for each major system component, equipment, and device.
 - 2. Include the following information:
 - a. Manufacturer's operating specifications.
 - b. User's guides for software and hardware.
 - c. Schedule of maintenance material items recommended to be stored at Project site.
 - d. Detailed instructions covering operation under both normal and abnormal conditions.
 - e. Time-current curves for overcurrent protective devices and manufacturer's written instructions for testing and adjusting their settings.
 - f. List of load-current and overload-relay heaters with related motor nameplate data.
 - g. List of lamp types and photoelectric relays used on Project, with ANSI and manufacturers' codes.
 - h. Manufacturer's instructions for setting field-adjustable components.
 - i. Manufacturer's instructions for testing, adjusting, and reprogramming microprocessor controls.
 - j. EPSS: Manufacturer's system checklists, maintenance schedule, and maintenance log sheets in accordance with NFPA 110.
 - k. Exterior pole inspection and repair procedures.
- C. Software:
 - 1. Program Software Backup: Provide USB media that is clearly and permanently labeled with attached placard on lanyard to prevent misplacement.
 - 2. Provide to the university upgrades and unrestricted licenses for installed and backup software, including operating systems and programming tools required for operation and maintenance.

1.10 FIELD CONDITIONS

- A. Service Conditions for Electrical Power Equipment: specified electrical power equipment must be suitable for operation under service conditions specified as usual service conditions in applicable NEMA PB series, IEEE C37 series, and IEEE C57 series standards.

PART 2 - PRODUCTS

2.01 SUBSTITUTION LIMITATIONS FOR ELECTRICAL EQUIPMENT

- A. Substitution requests for electrical equipment will be entertained under the following conditions:

1. Substitution requests may be submitted for consideration prior to the Electrical Preconstruction Conference if accompanied by value analysis data indicating that substitution will comply with Project performance requirements while significantly increasing value for Owner throughout life of facility.
2. Substitution requests may be submitted for consideration concurrently with submission of power system study reports when those reports indicate that substitution is necessary for safety of maintenance personnel and facility occupants.
3. Contractor is responsible for sequencing and scheduling power system studies and electrical equipment procurement. After the Electrical Preconstruction Conference, insufficient lead time for electrical equipment delivery will not be considered a valid reason for substitution.

PART 3 - EXECUTION

3.01 WORKMANSHIP AND INSTALLATION

- A. Execute all work in a neat manner acceptable to the Local and State Electrical Inspector and Engineer. Follow manufacturer's installation recommendations.
- B. All electrical components and their attachments shall be properly supported and where required shall be designed for seismic forces.
- C. Perform all electrical work by licensed electricians well skilled in the trade and supervised by a Master Electrician.
- D. Replace or repair to new condition, defective equipment and equipment damaged during installation or testing.
- E. Transformers: Transformers within the building construction shall be mounted on Type DNP isolators.
- F. Isolation Mounts: All mounts shall be aligned squarely above or below mounting points for the supported equipment.
- G. Position isolated electrical equipment so that it is free standing and does not come in rigid contact with the building structure or other systems.

3.02 TESTING AND ADJUSTING

- A. The entire installation shall be free from short circuits and improper grounds. Test in the presence of the Architects or their representatives.
- B. Test feeders with the feeders disconnected from the branch circuit panels.
- C. Test each individual branch circuit at the panel. In testing for insulation resistance to ground, the power equipment shall be connected for proper operation. In no case shall the insulation resistance be less than that required by the National Electrical Code and the manufacturer's recommendations. Correct failure in a manner satisfactory to the Architect and Engineers.

- D. Completely test and adjust each system specified under Division 26 for proper operation.

3.03 SLEEVES, INSERTS AND OPENINGS

- A. Sleeves:
 - 1. Furnish and install all sleeves required for the work.
 - 2. Sleeves through exterior building walls or through concrete construction shall be rigid galvanized steel.
 - 3. Sleeves shall be sized to provide a total of not less than 1/2-inch clearance around conduit.
 - 4. Sleeves for setting into walls shall be flush with finished construction. Sleeves for setting into floor shall be embedded in concrete slab and extend approximately 2 inches above finished floors.
 - 5. All sleeved openings within building shall be sealed airtight using fire barrier caulking with a UL classification for use as a fire penetration seal for walls and floors with up to a 3-hour fire rating expanded.
 - 6. Sleeves shall be provided in all locations where cables and conduits penetrate walls and floors.
 - 7. Selection of firestopping materials and installation shall be in accordance with specifications Division 07 Section "Through Penetration Firestop Systems" for Firestopping".

3.04 DEVELOPMENT OF FACILITY EPM PROGRAM

- A. Facility EPM Program must be developed by qualified EPM specialist.
- B. Conduct Facility EPM Program analysis in accordance with NFPA 70B recommendations.
 - 1. Renovation Projects:
 - a. Facility diagrams must include connected existing equipment for entire facility where known. Areas of uncertainty should be clearly indicated.
 - b. Obtain copies of existing operation and maintenance data and existing Facility EPM Program information from Owner.
 - c. Facility EPM Program analysis should identify existing equipment that does not have available operation and maintenance data, and should explain the Owner's risks because this equipment is not included in Facility EPM Program.
 - d. Data for existing equipment outside scope of Project may be inserted in Facility EPM Program Binders without analysis.
 - e. Data for existing equipment impacted by scope of Project should be analyzed and documented similar to Project's new equipment data as much as possible.
- C. Compile operation and maintenance data from Facility EPM Program analysis and submit updated Facility EPM Program Binders.

3.05 INSTALLATION OF ELECTRICAL WORK

- A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' written instructions, comply with NFPA 70 and NECA NEIS 1 for installation of Work specified in Division 26. Consult Architect for resolution of conflicting requirements.

3.06 FIELD QUALITY CONTROL

- A. Administrant for Medium-Voltage and Low-Voltage Electrical Tests and Inspections:
 - 1. Engage qualified medium-voltage and low-voltage electrical testing and inspecting agency to administer and perform tests and inspections.

3.07 CLOSEOUT ACTIVITIES

- A. Demonstration:
 - 1. With assistance from factory-authorized service representatives, demonstrate to Owner's maintenance personnel how to operate the following systems and equipment:
 - a. Electronic metering specified in Section 260913 "Electrical Power Monitoring."
 - 2. Allow Owner to record demonstrations.
- B. Training:
 - 1. With assistance from factory-authorized service representatives as appropriate, train Owner's maintenance personnel on all applicable topics addressed within Electrical specifications.
 - 2. Allow Owner to record training sessions.

3.08 RECORD DRAWINGS

- A. Submit under provisions of Division 01 Sections "Operation and Maintenance Data" and "Project Record Documents".
- B. Keep a marked set of Drawings at the site as a record set indicating all revisions in the work as the work progresses. At the completion of the work, mark the Drawings "As-Built Drawings" with the Contractor's name and date, and deliver to the Architect.

3.09 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of the latest edition of ANSI/NFPA 70 National Electrical Code (N.E.C.).
- B. Conform to requirements of all local, State and Federal laws and regulations, plus local electric utility company's rules, and the Fire Underwriters' requirements.
- C. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.
- D. Secure and pay for all permits and certificates as required by local, State and Federal laws.
- E. Request inspections from authority having jurisdiction.
- F. Run separate circuits for lighting and receptacle outlets as indicated.
 - 1. Circuits shall be balanced and loads and capacities shall be in accordance with requirements of local electric light company and National Board of Fire Underwriters.
 - 2. Do not share neutral on branch circuits.

- G. The entire electrical system shall be permanently and effectively grounded in accordance with Code requirements.
- H. The Drawings indicate only diagrammatically the extent, layout and the general location and arrangement of equipment, conduit and wiring. Become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment will be properly located and readily accessible.

END OF SECTION 26 00 10

This Page Left Intentionally Blank

SECTION 26 05 00
SERVICE ENTRANCE SWITCHES AND CABINETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Installation of the Medium Voltage Pad Mounted (three phase) Switch furnished by the University.
- B. Coordination of delivery, unloading, storing, setting and installation of medium voltage pad mounted switch.

1.02 RELATED SECTIONS

- A. Division 26 Section 260010 – “Supplemental Requirements for Electrical”
- B. Division 26 Section 260543 – “Underground Ducts and Raceways for Electrical Systems”
- C. Division 26 Section 260513 – “Medium-Voltage Cables”
- D. Division 26 Section 260533 – “Raceway and Boxes for Electrical Systems”
- E. Division 26 Section 260526 - “Grounding and Bonding for Electrical Systems”
- F. Division 26 Section 260544 – “Sleeves and Sleeve Seals for Electrical Raceways and Cabling”
- G. Division 31 Section 311000 “Site Clearing.”
- H. Division 31 Section 312000 “Earth Moving.”

1.03 REFERENCES

- A. NEMA Standards.
- B. ANSI/IEEE C2 - National Electrical Safety Code.

C. NFPA 70 (N.E.C.) Latest Edition.

D. U.L. Standards.

E. ANSI Standards.

1.04 SYSTEM DESCRIPTION

A. System Voltage: 480y/277 volts, three phase, four wire, 60 Hertz.

B. Service Entrance: As indicated on Drawings.

C. Primary System Voltage: 15.5k volts. Three phase with neutral.

1.05 REFERENCES

A. NEMA Standards.

B. NFPA 70 (N.E.C.) latest edition.

C. U.L. Standards.

D. ANSI Standards.

1.06 PERFORMANCE REQUIREMENTS

A. Medium voltage is defined as 1,000 to 35,000 volts.

B. Medium voltage work for this project is 4160 volts (will be upgraded in the future to 15kv).

1.07 QUALIFICATIONS

A. Manufacturer:

1. Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
2. Company maintaining engineering and service departments capable of rendering advice regarding installation.

3. Company maintaining field service engineers for assistance during start up and testing.
4. G&W Electric, Trident 4-way solid dielectric switch

B. Installer:

1. Company specializing in applying work of this Section with minimum three years documented experience.
2. Company offering repair service contracts.
3. Company with certified trades persons.
4. Cable splicer working on this project shall have a minimum of 5 years experience in terminating and splicing 15 kV medium voltage cable and shall have experience installing the terminations and splices specified.

1.08 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures".
- B. Include all materials, equipment and components specified under this Section.
- C. Include Certification of Competency: Cable splicer's experience during the past three years, describing performance in splicing and terminating cables of the type and classification being provided under the contract.
- D. Submit manufacturers' instructions.
- E. Terminator manufacturer's installation instructions.
- F. Typical installation instructions for splicing and terminating kits.
- G. Include Pad transformer and internal loop feed switch details, primary fusing details, with indication that same was sent to owner for their review.

1.09 PROJECT CONDITIONS

- A. Wire and cable routing, shown on Drawings are approximate unless dimensioned. Route and locate as required to meet Project Conditions.
- B. Details on Drawings are diagrammatic only to show intent. Details of installation shall conform to standards of the Local Authority Having Jurisdiction and Rural Electrification Authority, and ANSI C2.

1.10 EXTRA MATERIALS

- A. Furnish a spare fuse for each fuse provided.

PART 2 - PRODUCTS

2.01 MEDIUM VOLTAGE PAD-MOUNTED SWITCHES

- A. The switchgear shall be in accordance with the one-line diagram, and shall conform to the following specification.
- B. The switchgear shall consist of a 4-way solid dielectric switch with load-interrupter switches and resettable fault interrupters with visible open gaps and integral visible grounds, and a microprocessor-based overcurrent control. Load-interrupter switch terminals shall be equipped with bushings rated 630 amperes continuous, and fault-interrupter terminals shall be equipped with bushings rated 630 amperes continuous to provide for elbow connection. Manual operating mechanisms and viewing windows shall be located on the opposite side of the tank from the bushings and bushing wells so that operating personnel shall not be required to perform any routine operations in close proximity to high-voltage elbows and cables.
- C. The ratings for the integrated switchgear shall be as designated below (all rating shall be confirmed with the campus system rating under shop drawing review process).:

1. Frequency, Hz 60
2. Short-Circuit Rating match the campus system rating.
3. Amperes, RMS Symmetrical 12,500
4. kV, Maximum 15.5
5. kV, BIL 9150
6. Main Bus Continuous, Amperes 630
7. Three-Pole Load-Interrupter Switches
8. Continuous, Amperes 630
9. Load Dropping, Amperes 630
10. Fault-Closing, Duty-Cycle
11. Three-Time, Amperes RMS Symmetrical 12,500
12. Three-Time, Amperes, Peak 32,500
13. 10-Time, Amperes RMS Symmetrical 12,500
14. 10-Time, Amperes, Peak 32,500
15. Fault Interrupters

16.	Continuous, Amperes	630
17.	Load Dropping, Amperes	630
18.	Fault Interrupting, Duty-Cycle	
19.	Three-Time, Amperes RMS Symmetrical	12,500
20.	Ten-Time, Amperes RMS Symmetrical	12,500
21.	Fault-Closing, Duty-Cycle	
22.	Three-Time, Amperes RMS Symmetrical	12,500
23.	Three-Time, Amperes, Peak	32,500
24.	10-Time, Amperes RMS Symmetrical	12,500
25.	0-Time, Amperes, Peak	32,500

D. Certification of Ratings

1. The manufacturer of the switchgear shall be completely and solely responsible for the performance of the load-interrupter switch and fault interrupter as well as the complete integrated assembly as rated.
2. The manufacturer shall furnish, upon request, certification of ratings of the load-interrupter switch, fault interrupter, and the integrated switchgear assembly consisting of switches and fault interrupters in combination with the solid dielectric tank.

E. Compliance with Standards and Codes

1. The switchgear shall conform to or exceed the applicable requirements of the following standards and codes:
2. The applicable portions of ANSI C57.12.28, covering enclosure integrity for pad-mounted equipment.
3. The applicable portions of ANSI C37.71, ANSI C37.72, ANSI C37.73, IEC 56, and IEC 265-1 (Class A), which specify test procedures and sequences for the load-interrupter switches, fault interrupters, and the complete switchgear assembly.

For gear rated 12.5-kA short circuit, the applicable portions of IEC 298, Appendix AA covering arc resistance, through 12.5 kA for 15 cycles.

F. Tank

1. The tank shall be submersible and able to withstand up to 10 feet of water over the base.
2. The tank shall be of welded construction and shall be made of Type 304 L stainless steel,

as specified in Section IV.

3. A means of lifting the tank shall be provided.

G. Viewing Windows

1. Each load-interrupter switch shall be provided with a large viewing window at least 6 inch by 12 inch viewing window to allow visual verification of the switch-blade position (open, closed, and grounded) while shining a flashlight on the blades.
2. Each fault interrupter shall be provided with a large viewing window at least 6 inches by 12 inches to allow visual verification of the disconnect-blade position (open, closed, and grounded) while shining a flashlight on the blades.
3. Viewing windows shall be located on the opposite side of the gear from the bushings and bushing wells so that operating personnel shall not be required to perform any routine operations in close proximity to high-voltage elbows and cables.
4. A cover shall be provided for each viewing window to prevent operating personnel from viewing the flash which may occur during switching operations.

H. High-Voltage Bus

1. Bus and interconnections shall withstand the stresses associated with short-circuit currents up through the maximum rating of the switchgear.
2. Before installation of aluminum bus, all electrical contact surfaces shall first be pre-pared by machine abrading to remove any oxide film. Immediately after this operation, the electrical contact surfaces shall be coated with a uniform coating of an oxide inhibitor and sealant.

I. Provisions for Grounding

1. One ground-connection pad shall be provided for each switched and fault interrupting way on the gas-tight tank of the switchgear.
2. The ground-connection pad shall be constructed of stainless steel and welded to the gas-tight tank, and shall have a short-circuit rating equal to that of the switchgear.

J. Terminations

1. For gear rated 12.5-kA short circuit, terminals for load-interrupter switches shall have 600-ampere bush-ings, and terminals for fault interrupters shall have 200-ampere bushing wells.

2. Bushings and bushing wells shall be located on one side of the gear to reduce the required operating clearance.

K. Bushings

1. Bushings shall conform to ANSI/IEEE Standard 386 (ANSI Standard C119.2).
2. Bushings shall include a semiconductive coating.
3. Bushings shall be mounted in such a way that the semiconductive coating is solidly grounded to the gas-tight tank.

L. Base Spacer

1. A 12" base spacer shall be provided to raise the tank and the enclosure by 12" to allow for cable access under the tank.

M. Load-Interrupter Switches

1. The three-phase, gang-operated load-interrupter switches shall have a three-time and ten-time duty-cycle fault-closing rating as specified under "Ratings." This rating defines the ability to close the switch the designated number of times against a three-phase fault with asymmetrical (peak) current in at least one phase equal to the rated value, with the switch remaining operable and able to carry and interrupt rated current. Certified test abstracts establishing such ratings shall be furnished upon request.
2. The switch shall be provided with an integral ground position that is readily visible through the viewing window to eliminate the need for cable handling and exposure to high voltage to ground the equipment.
3. The ground position shall have a three-time and ten-time duty-cycle fault-closing rating.
4. The switch shall be provided with an open position that is readily visible through the viewing window to eliminate the need for cable handling and exposure to high voltage to establish a visible gap.
5. The open gaps of the switch shall be sized to allow cable testing through a feedthrough bushing or the back of the elbow.

N. Motor control

1. SEL 75I (75I002B1B1B0X110F20) for each way and one SEL 75I (75I002B1B0X0XIIF20)

O. Fault Interrupters

1. Fault interrupters shall have a three-time and ten-time duty-cycle fault-closing and fault interrupting rating as specified under "Ratings." This rating defines the fault interrupter's ability to close the designated number of times against a three-phase fault with asymmetrical (peak) current in at least one phase equal to the rated value and clear the resulting fault current, with the interrupter remaining operable and able to carry and interrupt rated current. Certified test abstracts establishing such ratings shall be furnished upon request.
2. The fault interrupter shall be provided with a disconnect with an integral ground position that is readily visible through the viewing window to eliminate the need for cable handling and exposure to high voltage to ground the equipment.
3. The ground position shall have a three-time and ten-time duty-cycle fault-closing rating.
4. The disconnect shall be provided with an open position that is readily visible through the viewing window to eliminate the need for cable handling and exposure to high voltage to establish a visible gap.
5. The fault interrupter, including its three-position disconnect, shall be a single integrated design so that operation between the closed and open positions or the open and grounded positions is accomplished with a single, intuitive movement.
6. The open gaps of the disconnect shall be sized to allow cable testing through a feedthru bushing or the back of the elbow.
7. An internal indicator shall be provided for each fault interrupter to show when it is in the tripped condition. The indicator shall be clearly visible through the viewing window.

P. Operating Mechanisms

1. Load-interrupter switches and fault interrupters shall be operated by means of a quick-make, quick-break mechanism.
2. The manual handle shall charge the operating mechanism for opening, closing, and grounding of the switches and fault interrupters.
3. A single, integrated operating mechanism shall fully operate each fault interrupter or load interrupter switch in a continuous movement, so that additional operations are not required to establish open or ground positions.
4. Operating mechanisms shall be equipped with an operation selector to prevent inadvertent operation from the closed position directly to the grounded position, or from the grounded position directly to the closed position. The operation selector shall require physical movement to the proper position to permit the next operation.
5. Operating shafts shall be padlockable in any position to prevent operation.
6. The operation selector shall be padlockable to prevent operation to the grounded position.
7. The operating mechanism shall indicate switch position which shall be clearly visible from the normal operating position.

Q. Overcurrent Control

1. A microprocessor-based overcurrent control shall be provided to initiate fault interruption.
2. The control shall be mounted in a watertight enclosure and shall be removable in the field without taking the gear out of service.
3. Control settings shall be field programmable using a personal computer connected via a data port to the control. The data port shall be accessible from the exterior of the enclosure.
4. Power and sensing for the control shall be supplied by integral current transformers.
5. The minimum total clearing time (from initiation of the fault to total clearing) for fault Interruption shall be 40 milliseconds (2.4 cycles) at 60 hertz or 44 milliseconds (2.2 cycles) at 50 hertz.
6. The control shall feature time-current characteristic (TCC) curves including standard E-speed, K-speed, coordinating-speed tap, coordinating-speed main curves, and relay curves per IEEE C37.112-1996. Coordinating-speed tap curves shall optimize coordination with load-side weak-link/backup current-limiting fuse combinations, and coordinating-speed main curves shall optimize coordination with tap-interrupter curves.
7. The standard E-speed curve shall have phase-overcurrent settings ranging from 25E through 400E. The standard K-speed curve shall have phase-overcurrent settings ranging from 25K through 200K. The coordinating-speed tap curve shall have phase-overcurrent and independent ground-overcurrent settings ranging from 50 amperes through 400 amperes. The coordinating-speed main curve shall have phase-overcurrent and independent ground-overcurrent settings ranging from 100 amperes through 800 amperes.
8. The time-overcurrent relay curves conform to IEEE C37.112-1996 IEEE Standard Inverse-Time Characteristic Equations for Overcurrent Relays for the following curves: U.S. Moderately Inverse Curve U1, U.S. Inverse Curve U2, U.S. Very Inverse Curve U3, U.S. Extremely Inverse Curve U4, U.S. Short-Time Inverse Curve U5, I.E.C. Class A Curve (Standard Inverse) C1, I.E.C. Class B Curve (Very Inverse) C2, I.E.C. Class C Curve (Extremely Inverse) C3, I.E.C. Long-Time Inverse Curve C4, and I.E.C. Short-Time Inverse Curve C5.
9. The control shall have instantaneous-trip (1 kA through 8 kA) and definite-time delay (32 ms through 96 ms) settings to allow tailoring of the coordinating-speed tap and coordinating-speed main curves to the application.

R. Voltage Indication

1. Voltage indication with provisions for low-voltage phasing.
2. Voltage indication with provisions for low-voltage phasing for each load-interrupter switch and fault interrupter by means of capacitive taps on the bushings shall be provided to eliminate the need for cable handling and exposure to high voltage to test the cables for voltage and phasing. This feature shall include a flashing LCD display to indicate the

presence of voltage for each phase, and a solar panel to supply power for testing of the complete voltage-indication circuit and phasing circuit.

3. The voltage-indication feature shall be mounted on the covers for the viewing windows on the opposite side of the gear from the bushings and bushing wells so that operating personnel shall not be required to perform any routine operations in close proximity to high-voltage elbows and cables.

S. Pad-Mounted Style

1. To guard against corrosion due to extremely harsh environmental conditions, the tank shall be made of Type 304 L stainless steel.
2. The switchgear shall be provided with a pad-mounted enclosure suitable for installation of the gear on a concrete pad.
3. The pad-mounted enclosure shall be separable from the switchgear to allow clear access to the bushings and bushing wells for cable termination.
4. The basic material shall be 14-gauge hot-rolled, pickled, and oiled steel sheet.
5. The enclosure shall be provided with removable front and back panels, and hinged lift-up roof sections for access to the operating and termination compartments. Each roof section shall have a retainer to hold it in the open position.
6. Lift-up roof sections shall overlap the panels and shall have provisions for pad-locking that incorporate a means to protect the padlock shackle from tampering.
7. The base shall consist of continuous 90-degree flanges, turned inward and welded at the corners, for bolting to the concrete pad.
8. Panel openings shall have 90-degree flanges, facing outward, that shall provide strength and rigidity as well as deep overlapping between panels and panel openings to guard against water entry.
9. For bushings rated 600 amperes continuous, the termination compartment shall be of an adequate depth to accommodate encapsulated surge arresters mounted on 600-ampere elbows having 200-ampere interfaces.
10. An instruction manual holder shall be provided.
11. Non-removable lifting tabs shall be provided.
12. All exterior welded seams shall be filled and sanded smooth for neat appearance.
13. To remove oils and dirt, to form a chemically and anodically neutral conversion coating to improve the finish-to-metal bond, and to retard underfilm propagation of corrosion, all surfaces shall undergo a thorough pretreatment process comprised of a fully automated system of cleaning, rinsing, phosphatizing, sealing, dry-ing, and cooling, before any protective coatings are applied. By utilizing an automated pretreatment process, the enclosure shall receive a highly consistent thorough treatment, eliminating fluctuations in

reaction time, reaction temperature, and chemical concentrations.

14. After pretreatment, protective coatings shall be applied that shall help resist corrosion and protect the steel enclosure. To establish the capability to resist corrosion and protect the enclosure, representative test specimens coated by the manufacturer's finishing system shall satisfactorily pass the following tests:
 - a. 4000 hours of exposure to salt-spray testing per ASTM B 117 with:
 - b. Underfilm corrosion not to extend more than 1/32 in. from the scribe as evaluated per ASTM D 1645, Procedure A, Method 2 (scraping); and
 - c. Loss of adhesion from bare metal not to extend more than 1/8 in. from the scribe.
 - d. 1000 hours of humidity testing per ASTM D 4585 using the Cleveland Condensing Type Humidity Cabi-net with no blistering as evaluated per ASTM D 714.
 - e. 500 hours of accelerated weathering testing per ASTM G 53 using lamp UVB-313 with no chalking as evaluated per ASTM D 659, and no more than 10% reduction of gloss as evaluated per ASTM D 523.
 - f. Crosshatch adhesion testing per ASTM D 3359 Method B with no loss of finish.
 - g. 160-inch-pound impact adhesion testing per ASTM D 2794 with no chip-ping or cracking.
 - h. Oil resistance testing consisting of a 72-hour immersion bath in mineral oil with no shift in color, no streaking, no blistering, and no loss of hardness.
 - i. 3000 cycles of abrasion testing per ASTM 4060 with no penetration to the substrate.
 - j. Certified test abstracts substantiating the above capabilities shall be furnished upon request.

T. Hazard-Alerting Signs

1. The exterior of the pad-mounted enclosure (if furnished) shall be provided with "Warning Keep Out—Hazardous Voltage Inside—Can Shock, Burn, or Cause Death" signs.
2. Each unit of switchgear shall be provided with a "Danger—Hazardous Voltage—Failure to Follow These Instructions Will Likely Cause Shock, Burns, or Death" sign. The text shall further indicate that operating personnel must know and obey the employer's work rules, know the hazards involved, and use proper protective equipment and tools to work on this equipment.
3. Each unit of switchgear shall be provided with a "Danger—Keep Away—Hazardous Voltage—Will Shock, Burn, or Cause Death" sign.

U. Nameplates, Ratings Labels, and Connection Diagrams

1. Each unit of switchgear shall be provided with a nameplate indicating the manufacturer's

name, catalog number, model number, date of manufacture, and serial number.

2. Each unit of switchgear shall be provided with a ratings label indicating the following: voltage rating; main bus continuous rating; short-circuit rating; fault-interrupter ratings including interrupting and duty-cycle fault-closing; and load-interrupter switch ratings including duty-cycle fault-closing and short-time.

V. Accessories

1. An adapter cable for connecting an overcurrent control to a user-furnished personal computer via USB adapter in the field shall be provided.

2.02 OTHER MATERIALS

- A. Bonding and Grounding: Ground rods at pad, at metering, and at riser conduit at utility source pole.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Upon delivery of switchgear and prior to unloading, inspect equipment for damage.
1. Examine tie rods and chains to verify they are undamaged and tight and that blocking and bracing are tight.
 2. Verify that there is no evidence of load shifting in transit and that readings from transportation shock recorders, if equipped, are within manufacturer's recommendations.
 3. Examine switchgear for external damage, including dents or scratches in doors and sill, and termination provisions.
 4. Compare switchgear and accessories received with the bill of materials to verify that the shipment is complete. Verify that switchgear and accessories conform to the manufacturer's quotation and Shop Drawings. If the shipment is not complete or does not comply with project requirements, notify the manufacturer in writing immediately.
 5. Unload switchgear, observing packing label warnings and handling instructions.
 6. Open doors and inspect components for damage or displaced parts, loose or broken connections, cracked or chipped insulators, bent mounting flanges, dirt or foreign material, and water or moisture.
- B. Handling:
1. Handle switchgear, in accordance with manufacturer's recommendations; avoid damage

to the enclosure, termination compartments, base, frame, and internal components. Do not subject switchgear to impact, jolting, jarring, or rough handling.

2. Transport switchgear upright to avoid internal stresses on equipment mounting assemblies. Do not tilt or tip switchgear.
3. Use spreaders or a lifting beam to obtain a vertical lift and to protect switchgear from straps bearing against the enclosure. Lifting cable pull angles may not be greater than 15 degrees from vertical.
4. Do not damage structure when handling switchgear.

C. Storage:

1. Switchgear may be stored outdoors. If possible, store switchgear at final installation locations on concrete pads. If dry concrete surfaces are not available, use pallets of adequate strength to protect switchgear from direct contact with the ground. Ensure switchgear is level.
2. Protect switchgear from physical damage. Do not store switchgear in the presence of corrosive or explosive gases.
3. Store switchgear with doors closed.

D. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.
2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders have to cross section barriers to reach load or line lugs.

E. Pre-Installation Checks:

1. Verify removal of shipping bracing after placement.

F. Verify that ground connections are in place and that requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance must be 5 ohms at switchgear location.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SWITCHGEAR INSTALLATION

- A. Install level and plumb, tilting less than 1.5 degrees when energized.
- B. Maintain minimum clearances and workspace at equipment in accordance with manufacturer's instructions and NFPA 70.
- C. Maintain minimum clearances and workspace at equipment in accordance with manufacturer's instructions and IEEE C2.

3.03 CONNECTIONS

- A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. For counterpoise, use tinned bare copper cable not smaller than No. 4/0 AWG, buried not less than 30 inch (765 mm) below grade interconnecting the grounding electrodes. Bond surge arrester and neutrals directly to the switchgear enclosure and then to the grounding electrode system with bare copper conductors, sized as shown. Keep lead lengths as short as practicable with no kinks or sharp bends.
 - 2. Make joints in grounding conductors and loops by exothermic weld or compression connector.
 - 3. Terminate grounding and bonding conductors on a common equipment grounding terminal on the switchgear enclosure.
 - 4. Complete the switchgear grounding and surge protector connections prior to making other electrical connections.
- B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 - 1. Maintain air clearances between energized live parts and between live parts and ground for exposed connections in accordance with manufacturer recommendations.
 - 2. Bundle associated phase, neutral, and equipment grounding conductors together within the switchgear enclosure. Arrange conductors such that there is not excessive strain on the connections that could cause loose connections. Allow adequate slack for expansion and contraction of conductors.
- C. Terminate medium-voltage cables in incoming section of switchgear in accordance with Section 260513 "Medium-Voltage Cables."

3.04 SIGNS AND LABELS

- A. Comply with the installation requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."
- B. Install warning signs as required to comply with OSHA 29 CFR 1910.269.

3.05 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed by Architect and/or University.
- B. General Field Testing Requirements:
 - 1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" chapter.
 - 2. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
 - 3. After installing switchgear but before primary is energized, verify that grounding system at the switchgear is tested at the specified value or less.

4. After installing switchgear and after electrical circuitry has been energized, test for compliance with requirements.
- C. Medium-Voltage Switchgear Field Tests:
1. Visual and Mechanical Inspection:
 - a. Verify that current and voltage transformer ratios correspond to Drawings.
 - b. Inspect bolted electrical connections using calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels must be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS, Table 100.12. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - c. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
 - 1) Attempt closure on locked-open devices. Attempt to open locked-closed devices.
 - 2) Make key exchange with devices operated in off-normal positions.
 - d. Inspect control power transformers.
 - 1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
 - 2) Verify that primary and secondary fuse or circuit breaker ratings match Drawings.
 2. Electrical Tests:
 - a. Inspect bolted electrical connections using a low-resistance ohmmeter to compare bolted resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - b. Perform dc voltage insulation-resistance tests on each bus section, phase-to-phase and phase-to-ground, for one minute. If the temperature of the bus is other than plus or minus 20 deg C, adjust the resulting resistance as provided in NETA ATS, Table 100.11.
 - 1) Insulation-resistance values of bus insulation must be in accordance with manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Investigate and correct values of insulation resistance less than manufacturer's recommendations or NETA ATS, Table 100.1.
 - 2) Do not proceed to the dielectric withstand voltage tests until insulation-

resistance levels are raised above minimum values.

- c. Perform a dielectric withstand voltage test on each bus section, each phase-to-ground with phases not under test grounded, in accordance with manufacturer's published data. If manufacturer has no recommendation for this test, it must be conducted in accordance with NETA ATS, Table 100.2. Apply the test voltage for one minute.
 - 1) If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the dielectric withstand test, the test specimen is considered to have passed the test.
- d. Perform insulation-resistance tests on control wiring with respect to ground. Applied potential must be 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable. Test duration must be one minute. For units with solid-state components or control devices that cannot tolerate the applied voltage, follow the manufacturer's recommendation.
 - 1) Minimum insulation-resistance values of control wiring must not be less than 2 megohms.
- e. Voltage Transformers:
 - 1) Perform secondary wiring integrity test. Verify correct potential at devices.
 - 2) Verify secondary voltages by energizing the primary winding with system voltage.
- f. Perform current-injection tests on the entire current circuit in each section of switchgear.
 - 1) Perform current tests by secondary injection with magnitudes such that a minimum current of 1.0 A flows in the secondary circuit. Verify correct magnitude of current at each device in the circuit.
- g. Perform system function tests in accordance with "System Function Tests" Article.
- h. Verify operation of space heaters.
- i. Perform phasing checks on double-ended or dual-source switchgear to ensure correct bus phasing from each source.

D. Medium-Voltage Vacuum Interrupter Field Tests:

- 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and required clearances.
 - c. Verify that maintenance devices such as special tools and gages specified by the manufacturer are available for servicing and operating the breaker.

- d. Verify the unit is clean.
 - e. Perform mechanical operation tests on operating mechanism in accordance with manufacturer's published data.
 - f. Measure critical distances on operating mechanism as recommended by the manufacturer. Critical distances of the operating mechanism must be in accordance with manufacturer's published data.
 - g. Verify cell fit and element alignment.
 - h. Verify racking mechanism operation.
 - i. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
 - j. Record as-found and as-left operation counter reading. Operation counter must advance one digit per close-open cycle.
2. Electrical Tests:
- a. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Insulation-resistance values must be in accordance with manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Investigate and correct values of insulation resistance less than this table or manufacturer's recommendations. Dielectric-withstand-voltage tests must not proceed until insulation-resistance levels are raised above minimum values.
 - b. Perform a contact/pole-resistance test. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value. Microhm or dc millivolt drop values must not exceed the high levels of the normal range in accordance with manufacturer's published data. If manufacturer's published data is not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - c. Perform minimum pickup voltage tests on trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the trip and close coils must comply with manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.20.
 - d. Verify correct operation of auxiliary features, such as electrical close and trip operation, trip-free operation, and anti-pump function. Auxiliary features must operate in accordance with manufacturer's published data.
 - e. Trip circuit breaker by operation of each protective device. Reset trip logs and indicators.

- f. Perform power-factor or dissipation-factor tests on each pole with the breaker open and each phase with the breaker closed. Power-factor or dissipation-factor values must comply with manufacturer's published data.
- g. Perform vacuum bottle integrity (dielectric-withstand-voltage) test across each vacuum bottle, with the contacts in the "open" position in accordance with manufacturer's published data. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the vacuum bottle integrity test, the specimen is considered to have passed the test.
- h. Perform a dielectric-withstand-voltage test in accordance with manufacturer's published data. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the dielectric-withstand-voltage test, the specimen is considered to have passed the test.

E. Microprocessor-Based Protective Relay Field Tests:

1. Visual and Mechanical Inspection:

- a. Record model number, style number, serial number, firmware revision, software revision, and rated control voltage.
- b. Verify operation of light-emitting diodes, display, and targets.
- c. Record passwords for each access level.
- d. Clean the front panel and remove foreign material from the case.
- e. Check tightness of connections.
- f. Verify that the frame is grounded in accordance with manufacturer's instructions.
- g. Set the relay in accordance with results in Section 260573.16 "Coordination Studies" and in Section 260573.19 "Arc-Flash Hazard Analysis."
- h. Download settings from the relay. Print a copy of the settings for the report and compare the settings to those specified in the coordination study.

2. Electrical Tests:

- a. Perform insulation-resistance tests from each circuit to the grounded frame in accordance with manufacturer's published data.
- b. Apply voltage or current to analog inputs, and verify correct registration of the relay meter functions.
- c. Functional Operation: Check functional operation of each element used in the protection scheme.
- d. Control Verification:
 - 1) Functional Tests:

- a) Check operation of active digital inputs.
 - b) Check output contacts or silicone-controlled rectifiers, preferably by operating the controlled device, such as circuit breaker, auxiliary relay, or alarm.
 - c) Check internal logic functions used in protection scheme.
 - d) Upon completion of testing, reset min/max recorders, communications statistics, fault counters, sequence-of-events recorder, and event records.
- 2) In-Service Monitoring: After the equipment is initially energized, measure magnitude and phase angle of inputs and verify expected values.

F. Ground Resistance Test:

1. Visual and Mechanical Inspection:

- a. Verify ground system complies with the Contract Documents and NFPA 70 "Grounding and Bonding" Article.
- b. Inspect physical and mechanical condition. Grounding system electrical and mechanical connections must be free of corrosion.
- c. Inspect bolted electrical connections using a calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels must be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS, Table 100.12. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
- d. Inspect anchorage.

2. Electrical Tests:

- a. Perform fall-of-potential or alternative test in accordance with IEEE 81 on the main grounding electrode or system. The resistance between the main grounding electrode and ground must be no more than 5 ohms.
- b. Perform point-to-point tests to determine the resistance between the main grounding system and major electrical equipment frames, system neutral, and derived neutral points. Investigate point-to-point resistance values that exceed 0.5 ohms. Compare equipment nameplate data with Contract Documents.
- c. Inspect bolted electrical connections for high resistance using a low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
- d. Inspect physical and mechanical condition.

e. Inspect anchorage.

G. Nonconforming Work:

1. Switchgear will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

H. Prepare test and inspection reports.

3.06 SYSTEM FUNCTION TESTS

A. System function tests must prove the correct interaction of sensing, processing, and action devices. Perform system function tests after "Field Quality Control" tests have been completed and components have passed specified tests.

1. Develop test parameters and perform tests for evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
3. Verify the correct operation of sensing devices, alarms, and indicating devices.

3.07 FOLLOW-UP SERVICE

A. Infrared Inspection: Perform the survey during periods of maximum possible loading. Remove necessary covers prior to the inspection.

1. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of the electrical power connections of the switchgear.
2. Instrument: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 deg C at 86 deg F (30 deg C).
3. Record of Infrared Inspection: Prepare a certified report that identifies the testing technician and equipment used, and lists the results as follows:
 - a. Description of equipment to be tested.
 - b. Discrepancies.
 - c. Temperature difference between the area of concern and the reference area.
 - d. Probable cause of temperature difference.
 - e. Areas inspected. Identify inaccessible and unobservable areas and equipment.
 - f. Identify load conditions at time of inspection.
 - g. Provide photographs and thermograms of the deficient area.

4. Act on inspection results in accordance with the recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

END OF SECTION 26 04 20

This Page Left Intentionally Blank

SECTION 26 05 13
MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cables.
 - 2. Connectors.
 - 3. Solid terminations.
 - 4. Separable insulated connectors.
 - 5. Splice kits.
 - 6. Medium-voltage tapes.
 - 7. Arc-proofing materials.
 - 8. Fault indicators.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of cable. Include splices and terminations for cables and cable accessories.

1.03 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Indicate location of each cable, splice, and termination.
- B. Material Certificates: For each type of cable and accessory.
- C. Design Data: Cable pulling calculations, including conduit size and fill percentage, pulling tensions, cable sidewall pressure, jam probability, voltage drop, and ground wire sizing for each cable.
- D. Source quality-control reports.
- E. Field quality-control reports.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with IEEE C2 and NFPA 70.
- C. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.02 CABLES

- A. Okonite, or approved equal.
- B. Cable Type: Type MV 105.
- C. Conductor Insulation: Ethylene-propylene rubber/PVC.
 - 1. Voltage Rating: 15-25 Kv (for use on a 4160volt system).
 - 2. Insulation Thickness: 133 percent insulation level.
- D. Conductor: Copper.
- E. Comply with UL 1072, AEIC CS8, ICEA S-93-639/NEMA WC 74, and ICEA S-97-682.
- F. Conductor Stranding: Compact round.
- G. Shielding: Copper tape helically applied over semiconducting insulation shield.
- H. Cable Jacket: Sunlight-resistant PVC.

2.03 CONNECTORS

- A. Eaton/Cooper or approved equal.
- B. Comply with ANSI C119.4 for connectors between aluminum conductors or for connections between aluminum to copper conductors.
- C. Copper-Conductor Connectors: Copper barrel crimped or Aluminum barrel crimped or Copper shear bolt connectors.

2.04 SOLID TERMINATIONS

- A. Eaton/cooper, or approved equal.
 - 1. Heat-shrink sheath seal kit with phase- and ground-conductor rejacketing tubes, cable-end sealing boot, and sealing plugs for unused ground-wire openings in boot.

- B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class shall be equivalent to that of cable. Include shield ground strap for shielded cable terminations.
1. Class 1 Terminations:
 - a. Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone-rubber, insulator modules; shield ground strap; and compression-type connector.
 - b. Heat-shrink type with heat-shrink inner stress control and outer nontracking tubes; multiple, molded, nontracking skirt modules; and compression-type connector.
 - c. Modular type, furnished as a kit, with stress-relief shield terminator; multiple-wet-process, porcelain, insulator modules; shield ground strap; and compression-type connector.
 2. Class 2 Terminations, Indoors: Kit with stress-relief tube, nontracking insulator tube, shield ground strap, and compression-type connector. Include silicone-rubber tape; cold-shrink-rubber sleeve; or heat-shrink, plastic-sleeve moisture seal for end of insulation whether or not supplied with kits.
 3. Class 3 Terminations: Kit with stress cone and compression-type connector.

2.05 SEPARABLE INSULATED CONNECTORS

- A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
- B. Eaton/cooper, or approved equal.
- C. Load-Break Cable Terminators: Elbow-type units with 200 A load make/break and continuous-current rating; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- D. Dead-Break Cable Terminators: Elbow-type unit with **600 A** continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- E. Dead-Front Terminal Junctions: Modular bracket-mounted groups of dead-front stationary terminals that mate and match with above cable terminators. Two-, three-, or four-terminal units as indicated, with fully rated, insulated, watertight conductor connection between terminals and complete with grounding lug, manufacturer's standard accessory stands, stainless steel mounting brackets, and attaching hardware.
1. Protective Cap: Insulating, electrostatic-shielding, water-sealing cap with drain wire.
 2. Portable Feed-Through Accessory: Two-terminal, dead-front junction arranged for removable mounting on accessory stand of stationary terminal junction.
 3. Grounding Kit: Jumpered elbows, portable feed-through accessory units, protective caps, test rods suitable for concurrently grounding three phases of feeders, and carrying case.
 4. Standoff Insulator: Portable, single dead-front terminal for removable mounting on accessory stand of stationary terminal junction. Insulators suitable for fully insulated isolation of energized cable-elbow terminator.

- F. Test-Point Fault Indicators: Applicable current-trip ratings and arranged for installation in test points of load-break separable connectors, and complete with self-resetting indicators capable of being installed with shotgun hot stick and tested with test tool.
- G. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

2.06 SPLICE KITS

- A. Description: For connecting medium voltage cables; type as recommended by cable or splicing kit manufacturer for the application.
- B. Raychem, or approved equal.
- C. Standard: Comply with IEEE 404.
- D. Splicing Products: As recommended, in writing, by splicing kit manufacturer for specific sizes, materials, ratings, and configurations of cable conductors. Include all components required for complete splice, with detailed instructions.
 - 1. Combination tape and cold-shrink-rubber sleeve kit with re-jacketing by cast-epoxy-resin encasement or other waterproof, abrasion-resistant material.
 - 2. Heat-shrink splicing kit of uniform, cross-section, polymeric construction with outer heat-shrink jacket.
 - 3. Premolded, in-line splicing kit.
 - 4. Premolded, EPDM splicing body kit with cable joint sealed by interference fit of mating parts and cable.

2.07 MEDIUM-VOLTAGE TAPES

- A. Description: Electrical grade, insulating tape rated for medium voltage application.
- B. 3M, Raychem, or approved equal.
- C. Ethylene/propylene rubber-based, 30 mil (0.76 mm) splicing tape, rated for 130 deg C operation. Minimum 3/4 inch (20 mm) wide.
- D. Silicone rubber-based, 12 mil (0.30 mm) self-fusing tape, rated for 130 deg C operation. Minimum 1-1/2 inch (38 mm) wide.
- E. Insulating-putty, 125 mil (3.175 mm) elastic filler tape. Minimum 1-1/2 inch (38 mm) wide.

2.08 SOURCE QUALITY CONTROL

- A. Test and inspect cables according to ICEA S-97-682 before shipping.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install cables according to IEEE 576.
- B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inch (1200 to 1800 mm) on the pull rope.
 - 1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.
 - 2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.
- C. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - 1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.
 - 2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.
 - 3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.
 - 4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.
- D. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- E. Install "buried-cable" warning tape 12 inch (305 mm) above cables.
- F. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.
- G. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.
- H. Install cable splices at pull points and elsewhere as indicated; use standard kits. Use dead-front separable watertight connectors in manholes and other locations subject to water infiltration.
- I. Install terminations at ends of conductors, and seal multiconductor cable ends with standard kits.
- J. Install separable insulated-connector components as follows:
 - 1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
 - 2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.
 - 3. Standoff Insulator: At each terminal junction, with one on each terminal.

- K. Seal around cables passing through fire-rated elements according to Section 078413 "Through-Penetration Firestop Systems."
- L. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.
- M. Identify cables according to Section 260553 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

3.02 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
 - 2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
 - 3. Perform direct-current High Potential test of each new conductor according to NETA ATS, Ch. 7.3.3. Do not exceed cable manufacturer's recommended maximum test voltage.
 - 4. Perform Partial Discharge test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
 - 5. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
- B. Medium-voltage cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 26 05 13

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Copper building wire.
 - 2. Connectors and splices.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260513 "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 601 to 35 000 V.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product, including construction, diameter, ampacity and bending radius.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.03 INFORMATIONAL SUBMITTALS

- A. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency.

PART 2 - PRODUCTS

2.01 COPPER BUILDING WIRE

- A. Description: Flexible, insulated, and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers:
 - 1. General Cable
 - 2. Superior Essex Inc.
 - 3. Southwire Company
 - 4. Northern Cables
 - 5. Allied Wire & Cable
 - 6. Cerro Wire

7. AFC Cable Systems
8. Encore Wire Corporation
9. Approved Equal

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

2.02 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers:

1. General Cable
2. Superior Essex Inc.
3. Southwire Company
4. Allied Wire & Cable
5. Northern Cables
6. Cerro Wire
7. AFC Cable Systems
8. Encore Wire Corporation
9. Approved Equal

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: One or Two hole with standard or long barrels as appropriate.
3. Termination: Compression.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

- C. ASD Output Circuits Cable: Extra-flexible stranded for all sizes.
- D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.
- E. PV Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway
- B. Exposed Feeders, use only where indicated on drawings: Type THHN/THWN-2, single conductors in raceway or Type XHHW/XHHW-2, single conductors in raceway
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway or Type XHHW/XHHW-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway or Metal-clad cable, Type MC.

3.03 INSTALLATION, GENERAL

- A. All branch circuit conductors shall be #12AWG or larger, unless otherwise specified on the drawings.
- B. All conductors on drawings are sized for Copper.
- C. Except as otherwise specifically noted, all wiring throughout the building, including each of the systems specified, shall be enclosed in raceways and boxes.
- D. Unless specifically noted on drawings, wire sizes have not been derated. Where multiple circuits are installed in one conduit, appropriate deration of wire size in accordance with 310.15 must be accounted for.
- E. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- F. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- G. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- H. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

- I. Pull all conductors into raceway at same time.
- J. Use suitable wire pulling lubricant for building wire #4 AWG and larger.
- K. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- L. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Clean conductor surfaces before installing lugs and connectors.
- D. Use split bolt connectors, insulation piercing connectors or U.L. approved insulated connectors for copper conductor splices and taps, #6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- E. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, #8 AWG and smaller.
- F. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- G. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch (150 mm) of slack.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.07 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Through-Penetration Firestop Systems."

3.08 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and all conductors over #8AWG for compliance with requirements.
 - a. Insulation Resistance test:
 - 1) Applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable.
 - 2) Take readings after 1 minute and until the reading is constant for 15 seconds.
 - 3) Minimum insulation-resistance values shall not be less than 25 Megohms for 300 volt rated cable and 100 Megohms for 600 volt rated cable.
 - 2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
 - 3. Inspect all wire and cable for:
 - a. Physical damage and proper connection.
 - b. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
 - c. Verify continuity of each branch circuit conductor.
 - d. Verify proper operation of each circuit.

- B. Cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Grounding and bonding conductors.
 - 2. Grounding and bonding clamps.
 - 3. Grounding and bonding bushings.
 - 4. Grounding and bonding hubs.
 - 5. Grounding and bonding connectors.
 - 6. Intersystem bonding bridge grounding connector.
 - 7. Grounding and bonding busbars.
 - 8. Signal reference grids.
 - 9. Grounding (earthing) electrodes.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.02 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of product indicated.
- B. Shop Drawings: Plans showing dimensioned locations of grounding features described in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Rod electrodes.
 - 3. Ring electrodes.
 - 4. Grounding arrangements and connections for separately derived systems.
- C. Field Quality-Control Submittals:
 - 1. Field quality-control reports including overall resistance to ground and at each electrode.

1.03 CLOSEOUT SUBMITTALS

- A. Manufacturer's Instructions: Include Instructions for protection, examination, preparation, and installation of exothermic connectors.
- B. Operation and Maintenance Data:
 - 1. In addition to items specified in Section 260010 "Supplemental Requirements for Electrical," include the following:

- a. Plans showing locations of grounding features described in "Field Quality Control" Article, including the following:
 - 1) Test wells.
 - 2) Rod electrodes.
 - 3) Ring electrodes.
 - 4) Grounding arrangements and connections for separately derived systems.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING CONDUCTORS

- A. Equipment Grounding Conductor:
 - 1. General Characteristics: 600 V, THHN/THWN-2 copper wire or cable, green color, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. ASTM - Bare Copper Grounding and Bonding Conductor:
 - 1. Erico, Eritech, Caltrain, Harger, or approved equal
 - 2. Referenced Standards: Complying with one or more of the following:
 - a. Soft or Annealed Copper Wire: ASTM B3
 - b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
 - c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
 - d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.02 GROUNDING AND BONDING CLAMPS

- A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar.
- B. Source Limitations: Obtain products from single manufacturer.
- C. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Listing Criteria:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
- D. UL KDER and KDSH - Hex-Fitting-Type Pipe and Rod Grounding and Bonding Clamp:
 - 1. Thomas and Betts/Blackburn, or approved equal.
 - 2. General Characteristics:
 - a. Two pieces with zinc-plated bolts.
 - b. Clamp Material: Silicon bronze.
 - c. Listed for outdoor use.

- E. UL KDER and KDSH - U-Bolt-Type Pipe and Rod Grounding and Bonding Clamp:
 - 1. Thomas and Betts/Blackburn, or approved equal.
 - 2. General Characteristics:
 - a. Clamp Material: Brass.
 - b. Listed for outdoor use.
- F. UL KDER and KDSH - Strap-Type Pipe and Rod Grounding and Bonding Clamp:
 - 1. Thomas and Betts/Blackburn, or approved equal.
 - 2. General Characteristics:
 - a. Clamp Material: Copper or Tinned copper.
 - b. Listed for outdoor use.
- G. UL KDER - Beam Grounding and Bonding Clamp:
 - 1. Thomas and Betts/Blackburn, or approved equal.
 - 2. General Characteristics: Mechanical-type, terminal, ground wire access from four directions; with dual, tin-plated or silicon bronze bolts.
- H. UL KDER - Exothermically Welded Connection:
 - 1. Erico, Cadweld, or approved equal.
 - 2. General Characteristics: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- I. UL KDER - Raised-Floor Signal Reference Grid Clamp:
 - 1. Thomas and Betts/Blackburn, or approved equal.
 - 2. General Characteristics: Mechanical-type, stamped-steel terminal with hex head screw.

2.03 GROUNDING AND BONDING BUSHINGS

- A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.
- B. Source Limitations: Obtain products from single manufacturer.
- C. Performance Criteria:
 - 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Listing Criteria:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
- D. UL KDER - Bonding Bushing:
 - 1. Bridgeport, Eaton, or approved equal.
 - 2. General Characteristics: Threaded bushing with insulated throat.
- E. UL KDER - Grounding Bushing:
 - 1. Bridgeport, Eaton, or approved equal.

2. General Characteristics: Threaded bushing with insulated throat and mechanical-type wire terminal.

2.04 GROUNDING AND BONDING HUBS

- A. Description: Hubs with certified grounding or bonding locknut.
- B. Source Limitations: Obtain products from single manufacturer.
- C. Performance Criteria:
 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 2. Listing Criteria:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
- D. UL KDER - Grounding and Bonding Hub:
 1. Bridgeport, Eaton, or approved equal.
 2. General Characteristics: Insulated, gasketed, watertight hub with mechanical-type wire terminal.

2.05 GROUNDING AND BONDING CONNECTORS

- A. Source Limitations: Obtain products from single manufacturer.
- B. Performance Criteria:
 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 2. Listing Criteria:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
 - b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
- C. UL KDER - Pressure-Type Grounding and Bonding Busbar Cable Connector:
 1. Thomas and Betts/Blackburn, or approved equal.
 2. General Characteristics: Copper or copper alloy, for compression bonding of one or more conductor directly to copper busbar. Listed for direct burial.
- D. UL KDER - Lay-In Lug Mechanical-Type Grounding and Bonding Busbar Terminal:
 1. Thomas and Betts/Blackburn, or approved equal.
 2. General Characteristics: Mechanical-type, copper rated for direct burial.
- E. UL KDER - Crimped Lug Pressure-Type Grounding and Bonding Busbar Terminal:
 1. Thomas and Betts/Blackburn, or approved equal.

2. General Characteristics: Cast silicon bronze, solderless compression-type wire terminals; with long barrel and two holes spaced on 5/8 or 1 inch (16 or 25 mm) centers for two-bolt connection to busbar.

2.06 INTERSYSTEM BONDING BRIDGE GROUNDING CONNECTORS

- A. Description: Devices that provide means for connecting communications systems grounding and bonding conductors at service equipment or at disconnecting means for buildings or structures.
- B. Performance Criteria:
 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 2. Listing Criteria:
 - a. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.
- C. UL KDSH - One-Piece Intersystem Bonding Bridge Grounding Connector:
 1. Eritch, Southwire, or approved equal.
 2. General Characteristics: Zinc-alloy one-piece construction; six terminating points; gangable.
- D. UL KDSH - Two-Piece Intersystem Bonding Bridge Grounding Connector:
 1. Eritch, Southwire, or approved equal.
 2. General Characteristics: Copper body and polycarbonate cover; four terminating points.

2.07 GROUNDING (EARTHING) ELECTRODES

- A. Description: Grounding electrodes include rod electrodes, ring electrodes, metal underground water pipes, metal building frames, concrete-encased electrodes, and pipe and plate electrodes.
- B. Source Limitations: Obtain products from single manufacturer.
- C. Performance Criteria:
 1. Regulatory Requirements:
 - a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 2. Listing Criteria:
 - a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
- D. UL KDER - Rod Electrode:
 1. Erico, Eritech, or approved equal.
 2. General Characteristics: Copper-clad steel; 3/4 inch by 10 ft (19 mm by 3 m).
- E. UL KDER - Plate Electrode:
 1. Erico, Eritech, or approved equal.

2. General Characteristics: 1/4 inch (6 mm) thick, hot-dip galvanized.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.
- B. Inspect test results of grounding system measured at point of electrical service equipment connection.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of electrical service equipment only after unsatisfactory conditions have been corrected.
- E. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 SELECTION OF BUSBARS

- A. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 1. Install bus horizontally, on insulated spacers 2 inch (50 mm) minimum from wall, 6 inch (150 mm) above finished floor unless otherwise indicated.
 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

3.03 SELECTION OF GROUNDING AND BONDING CONDUCTORS

- A. Conductors: Install solid conductor for 8 AWG and smaller, and stranded conductors for 6 AWG and larger unless otherwise indicated.
- B. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.
- C. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch (6 mm) in diameter.
- D. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.
- E. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch (41 mm) wide and 1/16 inch (1.6 mm) thick.
- F. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch (41 mm) wide and 1/16 inch (1.6 mm) thick.
- G. Underground Grounding Conductors: Install bare copper conductor, 4/0 AWG minimum.

1. Bury at least 30 inch (750 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inch (300 mm) above duct bank when indicated as part of duct-bank installation.

3.04 SELECTION OF CONNECTORS

- A. Conductor Terminations and Connections:
 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 4. Connections to Structural Steel: Welded connectors.

3.05 INSTALLATION

- A. Comply with manufacturer's published instructions.
- B. Special Techniques:
 1. Conductors:
 - a. Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
 2. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - b. Make connections with clean, bare metal at points of contact.
 - c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
 - d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
 - f. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1) Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate adjacent parts.
 - 2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3) Use exothermic-welded connectors for outdoor locations; if disconnect-type connection is required, use bolted clamp.
 - g. Grounding and Bonding for Piping:
 - 1) Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use bolted clamp connector or bolt lug-type connector to pipe flange by using one of lug bolts of flange. Where

- dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- 2) Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with bolted connector.
 - 3) Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- h. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
 - i. Grounding for Steel Building Structure: Install driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft (18 m) apart.
3. Electrodes:
 - a. Ground Rods: Drive rods until tops are 2 inch (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1) Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2) Use exothermic welds for below-grade connections.
 - b. For grounding electrode system, install at least four rods spaced at least one-rod length from each other and located at least same distance from other grounding electrodes, and connect to service grounding electrode conductor.
 - c. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and must be at least 12 inch (300 mm) deep, with cover.
 - 1) Install at least one test well for each service unless otherwise indicated. Install at ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
 - d. Concrete-Encased Electrode (Ufer Ground):
 - 1) Fabricate in accordance with NFPA 70; use minimum of 20 ft (6 m) of bare copper conductor not smaller than 4 AWG.
 - a) If concrete foundation is less than 20 ft (6 m) long, coil excess conductor within base of foundation.
 - b) Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
 - 2) Fabricate in accordance with NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 ft (6.0 m) long. If reinforcing is in multiple pieces, connect together by usual steel tie wires or exothermic welding to create required length.
 4. Grounding at Service:
 - a. Equipment grounding conductors and grounding electrode conductors must be connected to ground bus. Install main bonding jumper between neutral and ground buses.
 5. Grounding Separately Derived Systems:
 6. Grounding Underground Distribution System Components:
 - a. Duct-Bank Grounding Conductor: Bury 12 inch (300 mm) above duct bank when indicated as part of duct-bank installation.
 - b. Comply with IEEE C2 grounding requirements.

- c. Grounding Manholes and Handholes: Install driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inch (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inch (50 mm) above to 6 inch (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.
 - d. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields in accordance with manufacturer's published instructions with splicing and termination kits.
 - e. Pad-Mounted Transformers and Switches: Install four ground rods and ring electrode around pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install bare copper conductor not less than 4/0 for ring electrode and for taps to equipment grounding terminals. Bury ring electrode not less than 6 inch (150 mm) from foundation. Do not connect ring to ground rod in pad hand hole.
7. Equipment Grounding:
- a. Install insulated equipment grounding conductors with feeders and branch circuits.
 - b. Provide separate, insulated 600V conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
 - c. Equipment grounding conductors shall be continuous where possible. Where splices are required, provide approved compression connectors in an approved pattern. Insulate connectors to equivalent thickness of conductors.
 - d. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1) Feeders and branch circuits.
 - 2) Lighting circuits.
 - 3) Receptacle circuits.
 - 4) Single-phase motor and appliance branch circuits.
 - 5) Three-phase motor and appliance branch circuits.
 - 6) Flexible raceway runs.
 - 7) Armored and metal-clad cable runs.
 - 8) Water Entrance: Install ground wire from water entrance to main entrance switchboard. Provide additional ground wire from main service to building structural steel and 20-50 feet of ½" minimum re-bar or 4/0 copper conductor in concrete footing, as required by NEC. Enclose wire in PVC-40 where exposed.
 - 9) Metal siding not attached to grounded structure: Bond to ground.
 - 10) Transformer secondaries: provide grounding system for neutrals of dry type transformer secondaries as indicated and required.
 - e. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

- f. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.06 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed by Architect and/or University.
- B. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.
 - 3. Test completed grounding system at service disconnect enclosure grounding terminal. Make tests at ground rods before conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method in accordance with IEEE Std 81.
 - c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.
 - 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to record of tests and observations. Include number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Nonconforming Work:
 - 1. Grounding system will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective components and retest.
- D. Collect, assemble, and submit test and inspection reports.
 - 1. Report measured ground resistances that exceed the following values:
 - a. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 Ω .

3.07 PROTECTION

- A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 26 05 26

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Support, anchorage, and attachment components.
 - 2. Fabricated metal equipment support assemblies.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.02 ACTION SUBMITTALS

- A. Product Data:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Saddles.
 - i. Brackets.
 - 2. Include rated capacities and furnished specialties and accessories.
 - 3. Hangers. Include product data for components.
 - 4. Slotted support systems.
 - 5. Equipment supports.
 - 6. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.03 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch (10 mm) diameter holes at a maximum of 8 inch (200 mm) on center in at least one surface.
 - 1. Flexstrut, Unistrut or approved equal.
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Material for Channel, Fittings, and Accessories: Galvanized steel
 - 4. Channel Width: Selected for applicable load criteria.
 - 5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Aluminum Slotted Support Systems: Extruded-aluminum channels and angles with minimum 13/32 inch (10 mm) diameter holes at a maximum of 8 inch (200 mm) on center in at least one surface.
 - 1. Flexstrut, Unistrut or approved equal.
 - 2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 3. Channel Material: 6063-T5 aluminum alloy.
 - 4. Fittings and Accessories Material: 5052-H32 aluminum alloy.
 - 5. Channel Width: Selected for applicable load criteria.
 - 6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 2. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325 (Grade A325M).
 3. Toggle Bolts: steel springhead type.
 4. Hanger Rods: Threaded steel.
- G. Medium cable supports – Underground Devices or equal. Manhole cable supports shall be non-metallic for use in manholes.

PART 3 - EXECUTION

3.01 SELECTION

- A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:
1. NECA NEIS 101
- B. Comply with requirements in Section 078413 "Through-Penetration Firestop Systems." for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes as specified in Section 260533 "Raceway and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERM as required by NFPA 70. Minimum rod size must be 1/4 inch (6 mm) in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.02 INSTALLATION OF SUPPORTS

- A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT IMC ERM as may be supported by openings through structure members, in accordance with NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus 200 lb (90 kg).

- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
 2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 3. To Existing Concrete: Expansion anchor fasteners.
 4. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 5. To Light Steel: Sheet metal screws.
 6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.03 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inch (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000 psi (20.7 MPa), 28-day compressive-strength concrete.
- C. Anchor equipment to concrete base as follows:
1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.04 PAINTING

- A. Touchup:
1. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 26 05 29

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Type EMT-S raceways and elbows.
2. Type FMT raceways.
3. Type PVC raceways and fittings.
4. Type RTRC for medium voltage underground cable.
5. Fittings for conduit, tubing, and cable.
6. Threaded metal joint compound.
7. Solvent cements.
8. Surface metal raceways and fittings.
9. Wireways and auxiliary gutters.
10. Metallic outlet boxes, device boxes, rings, and covers.
11. Termination boxes.
12. Junction boxes, pull boxes, and miscellaneous enclosures.
13. Cover plates for device boxes.

B. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
2. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, manholes, and underground utility construction.

1.02 ACTION SUBMITTALS

A. Product Data: For the following:

1. Wireways and auxiliary gutters.
2. Surface metal raceways.
3. Surface nonmetallic raceways.
4. Cabinets, cutout boxes, and miscellaneous enclosures.
5. Expansion Fittings.
6. Fire-stop seals and fillers.
7. Boxes larger than 12x12x6 inches
8. Boxes with hinged covers

B. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures."

1.03 INFORMATIONAL SUBMITTALS

A. Manufacturers' Instructions:

1. For Type RTRC.

1.04 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 Section “Project Record Documents”
- B. Accurately record actual locations and mounting heights of outlets if not as shown on Drawings, plus pull and junction boxes larger than 12”x12”x6” and boxes used for panel feeders.
- C. Accurately record routing of all underground and other conduits 2” and larger.

1.05 PROJECT CONDITIONS

- A. Verify field measurements are as shown on Drawings.
- B. Verify locations of boxes and outlets in work areas prior to rough in.
- C. Verify routing and termination locations of conduit prior to rough-in.
- D. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose. Generally, pull boxes are not shown on Drawings. Provide as required.
- E. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to meet project conditions.
- F. Where conduit routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.06 COORDINATION

- A. Locate outlets so that they are readily accessible and do not interfere with other work.
- B. Provide access panels where required.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 01.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

PART 2 - PRODUCTS

2.01 CONDUIT REQUIREMENTS

- A. Except as otherwise specifically noted, all wiring throughout the building, including each of the systems specified, shall be enclosed in minimum size 3/4 inch conduit.
- B. Underground Installations:
 - 1. 600volts and below: More than Five Feet from Foundation Wall: Use RTRC nonmetallic conduit (encased in concrete where indicated).
 - 2. Medium voltage (above 1000volts) use RTRC nonmetallic conduit.
 - 3. 600volts and below: Within five feet from foundation wall: Use intermediate metal conduit, plastic coated steel conduit.
 - 4. 600volts and below: In or Under Slab on Grade:
 - a. Use intermediate metal conduit, plastic coated steel conduit, PVC-80 nonmetallic conduit.
 - b. Rise through slab in rigid galvanized steel conduit.
 - c. Conduit larger than 3/4" shall run below slab.
 - 5. 600volts and below: Minimum Size: 3/4 inch.
 - 6. 600volts and below: Under paved areas: concrete encased RTRC nonmetallic conduit.
 - 7. Conduits for Medium voltage cables: RTRC nonmetallic conduit.
 - 8. Communications (telephone, data, catv) underground conduits: PVC-80 nonmetallic conduit (concrete encased where indicated).
- C. 600volts and below: Outdoor Locations, Above Grade: Use aluminum conduit, intermediate metal conduit.
- D. 600volts and below: In Slab Above Grade:
 - 1. Use rigid galvanized steel conduit, intermediate metal conduit, electrical metallic tubing with water tight connectors.
 - 2. Maximum Size Conduit in Slab: 3/4 inch.
 - 3. Rise through slab in rigid galvanized steel conduit.
- E. 600volts and below: Interior Wet and Damp Locations: Use aluminum conduit, intermediate metal conduit.
- F. 600volts and below: Dry Locations:
 - 1. Concealed: Use aluminum conduit, intermediate metal conduit, electrical metallic tubing.
 - 2. Concealed/ Accessible: Use aluminum conduit, intermediate metal conduit, electrical metallic tubing.
 - 3. Exposed: Use aluminum conduit, intermediate metal conduit, electrical metallic tubing.
 - a. Exposed conduit: Not allowed in finished areas except as specifically noted.
- G. 600volts and below: Panel Feeders: Use aluminum conduit, intermediate metal conduit, and electrical metallic tubing, in accordance with locations herein specified.
- H. 600volts and below: Temperature Control: Use aluminum conduit, intermediate metal conduit, and electrical metallic tubing in accordance with locations herein specified.

- I. 600volts and below: Couplings and connectors for electrical metallic tubing up to 2" shall be steel set screw or compression type. Set-screw connection shall be used for all tubing sizes with a minimum of four set-screws for coupling and two set-screws for connectors and fittings for sizes 1-1/4" and larger.
- J. 600volts and below: Couplings and connectors for rigid and intermediate metal conduit shall be threaded.
- K. 600volts and below: Termination for all conduit and tubing shall have insulated bushings or insulated throat connectors in accordance with code requirements.
- L. 600volts and below: Permanent Connection to Motors: Dry locations, use flexible metal conduit. Damp or wet locations, use flexible liquidtight Type UA conduit with approved liquidtight fittings. Maximum length two feet (2').
- M. Telecommunications cabling - Outside Plant Innerduct: Non-Metallic Corrugated Flexible Raceway designed for use within a conduit. Duct shall maintain flexibility at low temperatures and shall contain pre-installed pull string.
 - 1. Carlon Optic-Gard/PE or equal for sizes 1" and 1.25"ID.
 - 2. Carlon corrugated P&C Flex PVC for sizes 1.5" to 4"ID designed for direct burial but installed in conduits where shown.
- N. Telecommunications cabling - Inside Plant Innerduct: Premises Non-Metallic Corrugated Flexible Raceway designed for use within and without a conduit. Duct shall contain pre-installed pull string.
 - 1. Carlon Plenum-Gard or equal for sizes 3/4" to 2"ID. Use where plenum cable is required and where indicated.
 - 2. Carlon Riser-Gard or equal for sizes 3/4" to 2"ID. Use where riser cable is required and where indicated.

2.02 TYPE EMT-S RACEWAYS AND ELBOWS (for 600volts and below).

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 797 and UL Category Control Number FJMX.
- B. Steel Electrical Metal Tubing (EMT-S) and Elbows:
 - 1. Material: Steel.
 - 2. Options:
 - a. Exterior Coating: Zinc
 - b. Interior Coating: Zinc
 - c. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - d. Colors: As indicated on Drawings.

2.03 TYPE RTRC RACEWAYS AND FITTINGS (for medium voltage 4.160kv thru 35kv).

- A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 2420.
3. Manufacturers: Champion fiberglass or equal by Atkore.
4. Manufacturing:
 - a. The conduit shall be fiberglass conduit, also known as Reinforced Thermosetting Resin Conduit (RTRC), manufactured using the single circuit filament winding process. Multi circuit windings are not allowed. The conduit shall have a winding angle as close as possible to 54.75 degrees. Winding mandrels shall be straight and true so as to produce a non-tapered conduit. Tapering is allowed at the belled end.
 - b. The resin system shall be epoxy based, with no fillers, using an anhydride curing agent. The fiberglass shall consist of continuous E-glass Grade "A" roving. All additives for increasing flame spread and lowering smoke density shall be halogen free, i.e. not contain chlorine or bromine.
 - c. Carbon black shall be used as ultra violet inhibitor to protect the conduit and fittings during storage and exposure to the outdoors. Conduit and elbows shall be black in color.
 - d. Curing shall be done using an oven and shall take place in two steps. The first curing zone shall bring the conduit slowly to the gel temperature. The second zone shall post-cure the conduit at no less than 350° F. The pipe has to be properly cured so that when measuring the glass transition temperature with a differential calorimeter the difference between the first measurement and the second shall not exceed 5° F.
 - e. The internal conduit and elbow walls shall be smooth and all fibers embedded in the epoxy.
 - f. All elbows shall meet the nominal radius + or – 2 o. The wall thickness shall meet tolerance as shown below and the "Out of Rounds" as shown in NEMA TC 14.
 - g. All elbows shall have either straight ends or deep socket PVC couplings. All conduits and elbows shall be durably and legibly marked in accordance to NEMA TC 14. In addition the following information shall be included: NEMA TC 14 UL 2420 BG (Below Ground) Manufacturer and Reseller (if the conduit was modified or bent other than by the manufacturer) Date of Manufacturing of conduit and elbows Elbows shall be marked with the angle and radius Special customer markings (per request)
 - h. Fittings and Accessories Fiberglass conduit fittings, elbows, and accessories shall be manufactured using one of two manufacturing procedures. The first method shall use the same process, methods, and components as used to manufacture the fiberglass conduit. The second method shall use the compression molding process, Sheet Molding Compound (SMC), for the manufacture of the finished component. The SMC material shall be a vinyl ester resin with +30% reinforcement of glass. The glass fibers should be approximately 1" in length. The SMC material shall be fire resistant to UL 2515 specifications and shall be halogen free. Plastic duct plugs shall be manufactured from PVC.

2.04 TYPE FMT RACEWAYS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 1652 and UL Category Control Number ILJW.

3. Utilize FMC for permanent connections to motors.
- B. Steel Flexible Metallic Tubing (FMT):
1. Hubbell, or approved equal
 2. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Colors: As indicated on Drawings.

2.05 TYPE PVC RACEWAYS AND FITTINGS

- A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 2. General Characteristics: UL 651 and UL Category Control Number DZYR.
- B. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:
1. Carlon or approved equal
 2. Dimensional Specifications: Schedule 80.
 3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
 - b. Markings: For use with maximum 90 deg C wire.
- C. Type A Rigid PVC Concrete-Encased Conduit (PVC-A) and Fittings:
1. Carlon or approved equal
 2. Dimensional Specifications: Type A.
 3. Options:
 - a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
- D. Type EB Rigid PVC Concrete-Encased Underground Conduit (PVC-EB) and Fittings:
1. Carlon or approved equal
 2. Dimensional Specifications: Type EB.
 3. Options:
 - a. Minimum Trade Size: Metric designator 53 (trade size 2), Metric designator 78 (trade size 3), Metric designator 103 (trade size 4).

2.06 FITTINGS FOR CONDUIT, TUBING, AND CABLE

- A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- B. Fittings for Type EMT Raceways:
1. General Characteristics: UL 514B and UL Category Control Number FKAV.
 2. Options:
 - a. Material: Steel.
 - b. Coupling Method: Compression coupling, Raintight compression coupling with distinctive color gland nut.
 - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.

- d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.
 - C. Fittings for Type FMC Raceways:
 - 1. General Characteristics: UL 514B and UL Category Control Number ILNR.
 - D. Fittings for Type LFMC and Type LFNC Raceways:
 - 1. General Characteristics: UL 514B and UL Category Control Number DXAS.
- 2.07 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT
- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 2419 and UL Category Control Number FOIZ.
- 2.08 SOLVENT CEMENTS
- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL Category Control Number DWTT.
 - B. Solvent Cements for Type PVC Raceways and Fittings:
 - 1. Carlon, Grainer, or approved equal.
- 2.09 RTRC Joining systems:
- A. Joining System A. Conduit Subjected to Changes in Ambient Temperature The conduit shall be supplied with a bonded coupling or an integral wound bell on one end and a machined spigot on the other end. A two part adhesive, epoxy resin system, designed to permanently bond fittings and joints of conduit shall be properly mixed and applied to the spigot end before joining the conduits together. The adhesive shall be available for use in three different ambient temperatures, 70°F, 40°F and 20°F. The adhesive shall be supplied from the same manufacturer of conduit and fittings in order not to void the listing by UL.
 - B. Constant Ambient Temperature – Gasketed Joining System The conduit shall be supplied with a gasketed joining system which can be used for concrete encasement as well as direct burial installations. This gasketed conduit shall consist of a three-ribbed gasket made from water resistant rubber material. The gasket shall be fit into a permanent groove in the belled end of the conduit. Retainer rings etc. are not permitted and shall not be used in order to create the gasket groove.
 - C. Constant Ambient Temperature – Interference Joining System The conduit shall be supplied with an interference joining system which can be used for concrete encasement (only). The interference joining system consists of an integral bell and spigot. The spigot end has a buttress type male thread for easy installation into the belled end female mating threads. The tapered

buttress threads make the joining system easy to assemble while providing a high pull-out strength of 1,000 lbs. The joining system is concrete tight but not water tight.

2.10 WIREWAYS AND AUXILIARY GUTTERS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 870 and UL Category Control Number ZOYX.
- B. Metal Wireways and Auxiliary Gutters:
 - 1. General Electric, Square D., Siemens or approved equal.
 - 2. Additional Characteristics:
 - a. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
 - b. Finish: Manufacturer's standard enamel finish.
 - 3. Options:
 - a. Degree of Protection: Type 1 unless otherwise indicated.
 - b. Wireway Covers: Hinged type unless otherwise indicated.

2.11 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 514A and UL Category Control Number QCIT.
 - 3. Covers for flush floor devices and poke-through fittings shall meet UL scrub water standards for installation in carpet and tile floors.
- B. Metallic Outlet Boxes:
 - 1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
 - 2. Options:
 - a. Material: Sheet steel.
 - b. Sheet Metal Depth: Minimum 2 1/8 inch (50 mm).
 - c. Cast-Metal Depth: Minimum 2.4 inch (60.3 mm).
- C. Metallic Conduit Bodies:
 - 1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point.
- D. Metallic Device Boxes:
 - 1. Description: Box with provisions for mounting wiring device directly to box.
 - 2. Options:
 - a. Material: Sheet steel.

- b. Sheet Metal Depth: minimum 2 1/8 inch (54 mm).
 - c. Cast-Metal Depth: minimum 2.4 inch (60.3 mm).
- E. Metallic Concrete Boxes and Covers:
 - 1. Description: Box intended for use in poured concrete.

2.12 TERMINATION BOXES

- A. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.
- B. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 1773 and UL Category Control Number XCKT.
- C. Termination Boxes and Termination Bases for Installation on Line Side of Service Equipment:
 - 1. Additional Characteristics: Listed and labeled for installation on line side of service equipment.
- D. Termination Boxes and Termination Bases for Installation on Load Side of Service Equipment:
 - 1. Additional Characteristics: Listed and labeled for installation on load side of service equipment.

2.13 JUNCTION BOXES, PULL BOXES, AND MISCELLANEOUS ENCLOSURES

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics:
 - a. Non-Environmental Characteristics: UL 50.
 - b. Environmental Characteristics: UL 50E.
- B. Indoor Sheet Metal Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Hubbell, or approved equal
 - 3. Additional Characteristics: UL Category Control Number BGUZ.
 - 4. Options:
 - a. Degree of Protection: Type 1
- C. Indoor Cast-Metal Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Hubbell, or approved equal
 - 3. Additional Characteristics: UL Category Control Number BGUZ.
 - 4. Options:
 - a. Degree of Protection: Type 1

2.14 HOODS FOR OUTLET BOXES

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics:
 - a. Reference Standards:
 - 1) UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - 2) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
 - b. Mounts to box using fasteners different from wiring device.
- B. Retractable or Reattachable Hoods for Outlet Boxes:
 - 1. Options:
 - a. Provide clear, weatherproof, "while-in-use" cover.

PART 3 - EXECUTION

3.01 SELECTION OF RACEWAYS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.
- B. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
 - 1. IMC: Provide threaded type fittings unless otherwise indicated.

3.02 SELECTION OF BOXES AND ENCLOSURES

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

3.03 INSTALLATION OF RACEWAYS

- A. Installation Standards:
 - 1. Except as otherwise specifically noted, all wiring throughout the building, including each of the systems specified, shall be enclosed in minimum ¾" conduit.
 - 2. Install exposed only where specifically indicated.
 - 3. Arrange supports to prevent misalignment during wiring installation.
 - 4. Route conduit parallel and perpendicular to walls.
 - 5. Do not cross conduits in slab.
 - 6. Route conduit in and under slab from point-to-point.
 - a. Install only where specifically indicated or required.
 - b. Obtain approval from the Architect before installation.
 - 7. Maintain adequate clearance between conduit and piping.

8. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
9. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
10. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.
11. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
12. Use sleeves when passing through floors and walls.
13. When serving roof top equipment, conduit shall enter within the weather-proof curbing. Maintain watertight roofing system.
14. Ground and bond conduit under provisions of Division 26 Section "GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS."
15. Identify conduit under provisions of Division 26 Section "IDENTIFICATION FOR ELECTRICAL SYSTEMS."
16. Group Related Conduits:
 - a. Support using conduit rack of Power-Strut or approved equal.
 - b. Parallel runs shall be neatly clustered with all bends and offsets of uniform pattern.
 - c. Provide space on each for 25 percent additional conduit.
17. Substantially support conduits with approved clips or hangers spaced not to exceed ten feet (10') on centers except 1/2" rigid conduit and 1/2" and 3/4" electrical metallic tubing shall have supports spaced not to exceed six feet (6').
18. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
19. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
20. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
21. Comply with NECA NEIS 101 for installation of steel raceways.
22. Comply with NECA NEIS 102 for installation of aluminum raceways.
23. Comply with NECA NEIS 111 for installation of nonmetallic raceways.
24. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
25. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
26. Raceway Terminations at Locations Subject to Moisture or Vibration:
 - a. Provide insulating bushings or insulated throat connectors in accordance with code requirements to protect conductors, including conductors smaller than No. 4 AWG. install insulated throat metal grounding bushings on service conduits.

B. General Requirements for Installation of Raceways:

1. Complete raceway installation before starting conductor installation.
2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft (0.6 m) above finished floor.

3. Install no more than equivalent of three 90-degree bends in conduit run except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted. Support within 12 inch (300 mm) of changes in direction.
4. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
6. Support conduit within 12 inch (300 mm) of enclosures to which attached.
7. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.
8. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes, before burying in trench.
9. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
 - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - b. Where an underground service raceway enters a building or structure.
 - c. Conduit extending from interior to exterior of building.
 - d. Conduit extending into pressurized duct and equipment.
 - e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - f. Where otherwise required by NFPA 70.
10. Do not install raceways or electrical items on "explosion-relief" walls or rotating equipment.
11. Do not install conduits within 2 inch (50 mm) of the bottom side of a metal deck roof.
12. Keep raceways at least 6 inch (150 mm) away from parallel runs of flues and steam, hot-water pipes, or any surface exceeding a surface temperature of 104°F. Install horizontal raceway runs above water and steam piping.
13. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
14. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb (90 kg) tensile strength. Leave at least 12 inch (300 mm) of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

C. Expansion-Joint Fittings:

1. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F (17 deg C) and that have straight-run length that exceeds 25 ft (7.6 m). Install in runs of aboveground EMT conduit that are located where environmental temperature change may exceed 100 deg F (55 deg C) and that have straight-run length that exceeds 100 ft (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for the following locations:

- a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
- 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
 - 4. Install expansion fittings at locations where conduits cross building or structure expansion joints.
 - 5. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

3.04 INSTALLATION OF BOXES AND ENCLOSURES

- A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
- B. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
 - 1. Except where specifically noted, boxes on finished surfaces shall be flush mounted with finished cover plate.
 - 2. Consult Architect prior to installing in finished areas.
 - 3. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- D. In Non-accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panels or from removable recessed luminaires such that they are accessible.
- E. In accessible Ceiling Areas: Install outlet and junction boxes such that they are accessible from ceiling access panels or from removable recessed luminaires.
- F. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- G. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
- H. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

- I. Locate boxes so that cover or plate will not span different building finishes.
- J. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
- K. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
- L. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- M. Set metal floor boxes level and flush with finished floor surface.
- N. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- O. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
- Q. Use 4" square box with plaster ring for single device outlets.
- R. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- S. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

3.05 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Through-Penetration Firestop Systems."

3.06 FIELD QUALITY CONTROL

- A. No wire shall be installed until work which might cause damage to wires or conduits has been completed.
- B. Conduits shall be thoroughly cleaned of water or other foreign matter before wire is installed.

3.07 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.08 CLEANING

- A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION 26 05 33

This Page Left Intentionally Blank

SECTION 26 05 43
UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Type RTRC raceways and fittings.
 - 2. Type PVC raceways and fittings.
 - 3. Fittings for conduit, tubing, and cable.
 - 4. Electrically conductive corrosion-resistant compounds for threaded conduit.
 - 5. Solvent cements.
 - 6. Duct accessories.
 - 7. Duct sealing.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 013100 "Project Management and Coordination" for preinstallation conference procedures.
 - 3. Section 260519 "Low-Voltage for Electrical Power Conductors and Cables" for nonmetallic underground conduit with conductors (Type NUCC).

1.02 DEFINITIONS

- A. Duct: A single raceway or multiple raceways, installed singly or as components of a duct bank.
- B. Duct Bank: Two or more ducts installed in parallel, direct buried or with additional casing materials such as concrete.
- C. Handhole: An underground chamber containing electrical cables, sized such that personnel are not required to enter in order to access the cables.
- D. Manhole: An underground chamber containing electrical cables and equipment, sized to provide access with working space clearances.
- E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.03 ACTION SUBMITTALS

- A. Product Data:
 - 1. Type RTRC raceways and fittings.
 - 2. Type PVC raceways and fittings.
 - 3. Fittings for conduit, tubing, and cable.

4. Electrically conductive corrosion-resistant compounds for threaded conduit.
5. Solvent cements.
6. Duct accessories.
7. Duct sealing.

B. Shop Drawings:

1. Electric Utility Duct Banks and Structures:
 - a. Include plans, elevations, sections, and details, including attachments to other Work.
 - b. Indicate locations of private property boundaries and utility easements.

C. Field quality-control reports.

1.04 INFORMATIONAL SUBMITTALS

A. Manufacturers' published instructions.

B. Field Reports:

1. Factory Test Reports: For handholes and boxes.
2. Manufacturer's field reports for field quality-control support.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts: Furnish to Owner spare parts necessary for repairing or adding more cables to manholes or handholes that are packaged with protective covering for storage and identified with labels describing contents.

1. Cable-Support Stanchions, Arms, and Associated Fasteners: Five percent of quantity of each item installed.
2. Insulators: Five percent of quantity of each item installed.

PART 2 - PRODUCTS

2.01 TYPE RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 651A and UL CCN EAZX.
3. For detailed requirements for specifying the following raceway types and associated fittings, see Specification 260533 – Raceway and Boxes for Electrical Systems:

2.02 TYPE RTRC RACEWAYS AND FITTINGS (for medium voltage 4.160kv thru 35kv).

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

2. General Characteristics: UL 2420.
3. Manufacturers: Champion fiberglass or equal by Atkore.
4. Manufacturing:
 - a. The conduit shall be fiberglass conduit, also known as Reinforced Thermosetting Resin Conduit (RTRC), manufactured using the single circuit filament winding process. Multi circuit windings are not allowed. The conduit shall have a winding angle as close as possible to 54.75 degrees. Winding mandrels shall be straight and true so as to produce a non-tapered conduit. Tapering is allowed at the belled end.
 - b. The resin system shall be epoxy based, with no fillers, using an anhydride curing agent. The fiberglass shall consist of continuous E-glass Grade "A" roving. All additives for increasing flame spread and lowering smoke density shall be halogen free, i.e. not contain chlorine or bromine.
 - c. Carbon black shall be used as ultra violet inhibitor to protect the conduit and fittings during storage and exposure to the outdoors. Conduit and elbows shall be black in color.
 - d. Curing shall be done using an oven and shall take place in two steps. The first curing zone shall bring the conduit slowly to the gel temperature. The second zone shall post-cure the conduit at no less than 350° F. The pipe has to be properly cured so that when measuring the glass transition temperature with a differential calorimeter the difference between the first measurement and the second shall not exceed 5° F.
 - e. The internal conduit and elbow walls shall be smooth and all fibers embedded in the epoxy.
 - f. All elbows shall meet the nominal radius + or – 2 o. The wall thickness shall meet tolerance as shown below and the "Out of Rounds" as shown in NEMA TC 14.
 - g. All elbows shall have either straight ends or deep socket PVC couplings. All conduits and elbows shall be durably and legibly marked in accordance to NEMA TC 14. In addition the following information shall be included: NEMA TC 14 UL 2420 BG (Below Ground) Manufacturer and Reseller (if the conduit was modified or bent other than by the manufacturer) Date of Manufacturing of conduit and elbows Elbows shall be marked with the angle and radius Special customer markings (per request)
 - h. Fittings and Accessories Fiberglass conduit fittings, elbows, and accessories shall be manufactured using one of two manufacturing procedures. The first method shall use the same process, methods, and components as used to manufacture the fiberglass conduit. The second method shall use the compression molding process, Sheet Molding Compound (SMC), for the manufacture of the finished component. The SMC material shall be a vinyl ester resin with +30% reinforcement of glass. The glass fibers should be approximately 1" in length. The SMC material shall be fire resistant to UL 2515 specifications and shall be halogen free. Plastic duct plugs shall be manufactured from PVC.

2.03 TYPE PVC RACEWAYS AND FITTINGS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 651 and UL CCN DZYR.
3. For detailed requirements for specifying the following raceway types and associated fittings, see Specification 260533 – Raceway and Boxes for Electrical Systems:

- a. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings
- b. Type A Rigid PVC Concrete-Encased Conduit (PVC-A) and Fittings
- c. Type EB Rigid PVC Concrete-Encased Underground Conduit (PVC-EB) and Fittings
- d. Type RTRC-BG Raceways and Fittings

2.04 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting pour.
- B. Underground-Line Warning Tape: In accordance with Section 260553 "Identification for Electrical Systems."

2.05 DUCT SEALING

- A. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Compound must be capable of withstanding temperature of 300 deg F (150 deg C) without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals. Duct sealing compound must be removable without damaging ducts or cables.
- B. Inflatable Duct-Sealing System: Wraparound inflatable bladder that seals ducts that are empty or containing conductors against air and water infiltration. System is suitable for use in steel, plastic, or concrete ducts and penetrations.

2.06 SOURCE QUALITY CONTROL

- A. Product Data: Prepare and submit catalog cuts and performance data illustrating size, physical appearance, and other characteristics of product.
 - 1. Duct-bank materials, including spacers and miscellaneous components.
 - 2. Ducts, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 - 3. Underground-line warning tape.
- B. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in field. Notify

Architect if there is conflict between areas of excavation and existing structures or archaeological sites to remain.

- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.
- C. Clear and grub vegetation to be removed, and protect vegetation to remain in accordance with Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication in accordance with Section 311000 "Site Clearing."

3.02 SELECTION OF UNDERGROUND DUCTS

- A. Duct for Electrical Cables More Than 600 V: RTRC, concrete or flowable fill encased unless otherwise indicated.
- B. Duct for Electrical Feeders 600 V and Less: RTRC unless otherwise permitted, concrete or flowable fill encased unless otherwise indicated.
- C. Underground Ducts Crossing Paved Paths Driveways: RTRC, encased in reinforced concrete.
- D. Stub-ups: Concrete encased, RTRC.

3.03 INSTALLATION OF DUCTS AND DUCT BANKS

- A. Reference Standards:
 - 1. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA TCB 2 for installation of underground ducts and duct banks.
 - 2. Consult Architect for resolution of conflicting requirements.
- B. Special Techniques:
 - 1. Where indicated on Drawings, install duct, spacers, and accessories into duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
 - 2. Steel raceway, bends, and fittings in single duct run or duct bank must be of same type.
 - 3. Slope: Pitch duct minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from high point between two manholes to drain in both directions.
 - 4. Expansion and Deflection Fittings: Install expansion and deflection fitting in each duct in area of disturbed earth adjacent to manhole or handhole.
 - 5. Install expansion fitting near center of straight line duct with calculated expansion of more than 3/4 inch (19 mm).
 - 6. Curves and Bends:
 - a. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with minimum radius of 48 inch (1200 mm), both horizontally and vertically, at other locations unless otherwise indicated.

- b. Field bending must be in accordance with NFPA 70 minimum radii requirements, except bends over 45 degrees must be made with minimum radius of 48 inch (1200 mm) . Use only equipment specifically designed for material and size involved. Use PVC heating bender for bending PVC conduit.
 - c. Duct must have maximum of 180 degrees of bends between pull points.
- 7. Joints: Use solvent-cemented joints in nonmetallic duct and fittings and make watertight in accordance with manufacturer's published instructions. Stagger couplings so those of adjacent duct do not lie in same plane. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch (75 mm) of concrete for minimum of 12 inch (300 mm) on each side of coupling.
 - a. Install insulated grounding bushings on steel raceway terminations that are less than 12 inch (300 mm) below grade or floor level and do not terminate in hubs.
- 8. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing duct will not be subject to environmental temperatures above 104 deg F (40 deg C). Where environmental temperatures are calculated to rise above 104 deg F (40 deg C), and anywhere duct crosses above underground steam line, install insulation blankets listed for direct burial to isolate duct bank from steam line to maintain maximum environmental temperature of 104 deg F (40 deg C).
- 9. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inch (250 mm) o.c. for 5 inch (125 mm) duct, and vary proportionately for other duct sizes.
 - a. Begin change from regular spacing to end-bell spacing 10 ft (3 m) from end bell, without reducing duct slope and without forming trap in line.
 - b. Grout end bells into structure walls from both sides to provide watertight entrances.
- 10. Building Wall Penetrations: Make transition from underground duct to steel raceway at least 10 ft (3 m) outside building wall, without reducing duct line slope away from building and without forming trap in line. Use fittings manufactured for transition to steel raceway type installed. Install steel raceway penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- 11. Install manufactured steel raceway elbows for stub-ups at poles unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 - a. Couple steel elbows to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch (75 mm) of concrete for minimum of 12 inch (300 mm) on each side of coupling.
- 12. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15 psig (1.03 MPa) hydrostatic pressure.
- 13. Pulling Cord: Install 200 lbf (1000 N) test nylon cord in empty ducts.
 - a. Elbows:
 - 1) Use manufactured steel elbows for stub-ups, at building entrances, and at changes of direction in duct run.
 - b. Stub-ups to Outdoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch (1500 mm) from edge of equipment base.
 - 1) Stub-ups must terminate in coupling installed flush with be minimum 4 inch (100 mm) above finished floor and minimum 3 inch (75 mm) from conduit side to edge of slab.

- c. Stub-ups to Indoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch (1500 mm) from edge of wall. Install insulated grounding bushings on terminations at equipment.
 - 1) Stub-ups must terminate in coupling minimum 4 inch (100 mm) above finished floor and no less than 3 inch (75 mm) from conduit side to edge of slab.
- 14. Underground-Line Warning Tape: Bury nonconducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inch (300 mm) above concrete-encased duct and duct banks and approximately 12 inch (300 mm) below grade. Align tape parallel to and within 3 inch (75 mm) of centerline of duct bank. Provide additional warning tape for each 12 inch (300 mm) increment of duct-bank width over nominal 18 inch (450 mm). Space additional tapes 12 inch (300 mm) apart, horizontally across width of ducts.
- 15. Ground ducts and duct banks in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

3.04 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
 - 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide minimum 12 inch (300 mm) long mandrel equal to duct size minus 1/4 inch (6 mm). If obstructions are indicated, remove obstructions and retest.
 - 3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Nonconforming Work:
 - 1. Underground ducts, raceways, and structures will be considered defective if they do not pass tests and inspections.
 - 2. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.05 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump, and building interiors affected by Work.
 - 1. Sweep floor, removing dirt and debris.
 - 2. Remove foreign material.

END OF SECTION 26 05 43

SECTION 26 05 44
SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Round sleeves.
 - 2. Rectangular sleeves.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.
 - 6. Pourable sealants.
 - 7. Foam sealants.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 078413 "Through-Penetration Firestop Systems." for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.01 ROUND SLEEVES

- A. Steel Wall Sleeves:
 - 1. General Characteristics: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.
- B. Cast-Iron Wall Sleeves:
 - 1. General Characteristics: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.
- C. Round, Galvanized-Steel, Sheet Metal Sleeves:
 - 1. General Characteristics: Galvanized-steel sheet; thickness not less than 0.0239 inch (0.6 mm); round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.02 RECTANGULAR SLEEVES

A. Rectangular, Galvanized-Steel, Sheet Metal Sleeves:

1. General Characteristics:
 - a. Material: Galvanized sheet steel.
 - b. Minimum Metal Thickness:
 - 1) For sleeve cross-section rectangle perimeter less than 50 inch (1270 mm) and with no side larger than 16 inch (400 mm), thickness must be 0.052 inch (1.3 mm).
 - 2) For sleeve cross-section rectangle perimeter not less than 50 inch (1270 mm) or with one or more sides larger than 16 inch (400 mm), thickness must be 0.138 inch (3.5 mm).

2.03 SLEEVE-SEAL SYSTEMS

A. Metraflex, Roxtec, or approved equal.

B. General Characteristics: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.

C. Options:

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.04 SLEEVE-SEAL FITTINGS

A. Metraflex, Garlock, or approved equal.

B. General Characteristics: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit must have plastic or rubber waterstop collar with center opening to match piping OD.

2.05 GROUT

A. General Characteristics: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4 inch (6.4 mm) annular clear space between sleeve and raceway or cable, unless sleeve-seal system is to be installed
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for wall assemblies.
- C. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve-seal systems. Size sleeves to allow for 1 inch (25 mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- D. Underground, Exterior-Wall and Floor Penetrations:
 - 1. Install steel pipe sleeves. Size sleeves to allow for 1 inch (25 mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Grout sleeve into wall or floor opening.

3.02 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

- A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.
- B. Install conduits and cable with no crossings within the sleeve.
- C. Fill opening around conduits and cables with concrete without leaving voids.
- D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.03 INSTALLATION OF SLEEVE-SEAL SYSTEMS

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 26 05 44

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Labels.
 - 2. Bands and tubes.
 - 3. Tapes and stencils.
 - 4. Tags.
 - 5. Signs.
 - 6. Cable ties.
 - 7. Miscellaneous identification products.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.02 ACTION SUBMITTALS

- A. Product Data:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with 29 CFR 1910.144 for color identification of hazards; 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs and tags; and the following:
- C. Signs, labels, and tags required for personnel safety must comply with the following standards:
 - 1. Safety Colors: NEMA Z535.1.
 - 2. Facility Safety Signs: NEMA Z535.2.
 - 3. Safety Symbols: NEMA Z535.3.
 - 4. Product Safety Signs and Labels: NEMA Z535.4.
 - 5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.
- D. Comply with NFPA 70E requirements for arc-flash warning labels.

- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, must comply with UL 969.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 1000 V or Less:
 - 1. Black letters on orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 1000 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
 - 1. Color must be factory applied or field applied for sizes larger than 8 AWG if authorities having jurisdiction permit.
 - 2. Colors for 208Y/120 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White
 - 3. Colors for 240 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Neutral: White
 - 4. Colors for 480Y/277 V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - d. Neutral: Gray
 - 5. Colors for 4160Y/2400 V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White
 - 6. Color for Equipment Grounds: Green.
 - 7. Colors for Isolated Grounds: Green with two or more yellow stripes.
- C. Raceways and Cables Carrying Circuits at More Than 1000 V:
 - 1. Black letters on orange field.
 - 2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."
- D. Warning Label Colors:
 - 1. Identify system voltage with black letters on orange background.
- E. Warning labels and signs must include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 3 FEET MINIMUM."
 3. Multiple Equipment Voltages: "DANGER – MULTIPLE VOLTAGE SOURCES. ISOLATE ALL SOURCES BEFORE SERVICING"
 4. Arc Flash Hazard: "WARNING – ARC FLASH AND SHOCK HAZARD. APPROPRIATE PPE AND TOOLS REQUIRED WHEN WORKING ON THIS EQUIPMENT."
- F. Equipment Identification Labels:
1. Black letters on white field.

2.03 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends. Minimum ¼ inch black letters on white background.
- B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action. Minimum ¼ inch black letters on white background.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3 mil (0.08 mm) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
 1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over legend. Labels sized such that clear shield overlaps entire printed legend. Minimum ¼ inch black letters on white background.
 2. Marker for Labels:
 - a. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Polyester or Vinyl, thermal, transfer-printed, 3 mil (0.08 mm) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 1. Minimum Nominal Size:
 - a. 1-1/2 by 6 inch (37 by 150 mm) for raceway and conductors.
 - b. 3-1/2 by 5 inch (76 by 127 mm) for equipment.
 - c. As required by authorities having jurisdiction.

2.04 BANDS AND TUBES

Utilize bands and tubes only where conductors are not available in colors indicated, due to size, prewired cable, or other reason: Install identifying bands ¾" wide of appropriate colors as noted in this specification within six inches (6") and twelve inches (12") of each end and at a maximum of five foot (5') intervals along wireways, at back of panelboards, and wherever conductors are accessible.

- A. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inch (50 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.
- B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at maximum of 200 deg F (93 deg C). Comply with UL 224.

2.05 TAPES AND STENCILS

Use tape labels only for identification of individual wall switches, receptacles, and control device stations.

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mil (0.08 mm) thick by 1 to 2 inch (25 to 50 mm) wide; compounded for outdoor use.
- C. Floor Marking Tape: 2 inch (50 mm) wide, 5 mil (0.125 mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
- D. Underground-Line Warning Tape:
 - 1. Tape:
 - a. Recommended by manufacturer for method of installation and suitable to identify and locate underground electrical lines.
 - b. Printing on tape must be permanent and may not be damaged by burial operations.
 - c. Tape material and ink must be chemically inert and not be subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 2. Color and Printing:
 - a. Comply with APWA Uniform Color Code using NEMA Z535.1 safety colors.
 - b. Inscriptions for Red Tapes: "CAUTION BURIED ELECTRIC LINE BELOW"
- E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height must be 2 inch (25 mm) .

2.06 TAGS

- A. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch (0.38 mm) thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
 - a. Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
 - b. Medium and high voltage cables tags shall be 1.5" x5" with ¼" hole in each corner for cable ties to wrap around cable. Color of tag shall based upon phase (paragraph 2.02 B.) with white lettering.

2.07 SIGNS

- A. Baked-Enamel Signs:
 - 1. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4 inch (6.4 mm) grommets in corners for mounting.
 - 3. Nominal Size: 7 by 10 inch (180 by 250 mm).
- B. Metal-Backed Butyrate Signs:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396 inch (1 mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
 - 2. 1/4 inch (6.4 mm) grommets in corners for mounting.
 - 3. Nominal Size: 10 by 14 inch (250 by 360 mm).
- C. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Engraved legend.
 - 2. Thickness:
 - a. For signs up to 20 sq. inch (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
 - b. For signs larger than 20 sq. inch (129 sq. cm), 1/8 inch (3.2 mm) thick.
 - c. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.08 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C) in accordance with ASTM D638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black, except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength at 73 deg F (23 deg C) in accordance with ASTM D638: 12,000 psi (82.7 MPa).
 - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 - 4. Color: Black.

2.09 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.02 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install nonmetallic tags on all medium and high voltage cables.
- C. Install nonmetallic tags on all low voltage cables (1000volts and below).
- D. Nonmetallic Preprinted Tags:
 - 1. Place at every termination in location with high visibility and accessibility.
 - 2. Place in every manhole location at the source side conduit entry, location shall be visible and accessible.
 - 3. Secure using general-purpose cable ties.
 - 4. Use nonmetallic tags for medium and high voltage cables.
- E. Install identifying devices before installing acoustical ceilings and similar concealment.
- F. Verify identity of item before installing identification products.
- G. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- H. Apply identification devices to surfaces that require finish after completing finish work.
- I. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- J. All circuit conductors of the same color shall be connected to the same ungrounded feeder conductor throughout the installation.
- K. Conductors of different system voltage shall not enter the same raceway, box, gutter, or other types of enclosures unless specifically noted on drawings or by equipment manufacturer. If required, utilize alternate wire color coding for neutrals noted in this specification.
- L. Power and lighting circuits in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection: Provide wire markers on each conductor and Identify with branch circuit or feeder number.

- M. For system control wires at control panel and load connection, provide wire markers on each conductor and identify with number as indicated on manufacturer's schematic and interconnection diagrams or manufacturer's shop drawings.
- N. System Identification for Raceways and Cables under 1000 V: Identification must completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- O. System Identification for Raceways and Cables over 1000 V: Identification must completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- P. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- Q. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from floor.
- R. Accessible Fittings for Raceways: Identify cover of junction and pull box of the following systems with wiring system legend and system voltage. System legends must be as follows:
 - 1. "POWER."
- S. Vinyl Wraparound Labels:
 - 1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.
 - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.
- T. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.
- U. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.
- V. Self-Adhesive Labels:
 - 1. Install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide single line of text with 1/2 inch (13 mm) high letters on 1-1/2 inch (38 mm) high label; where two lines of text are required, use labels 2 inch (50 mm) high.
- W. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.
- X. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.
- Y. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.
- Z. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- AA. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- BB. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's instructions.
- CC. Underground Line Warning Tape:
1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inch (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in common trench or concrete envelope exceeds 16 inch (400 mm) overall.
 2. Limit use of underground-line warning tape to direct-buried cables.
 3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- DD. Baked-Enamel Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
 2. Unless otherwise indicated, provide single line of text with 1/2 inch (13 mm) high letters on minimum 1-1/2 inch (38 mm) high sign; where two lines of text are required, use signs minimum 2 inch (50 mm) high.
- EE. Metal-Backed Butyrate Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
 2. Unless otherwise indicated, provide single line of text with 1/2 inch (13 mm) high letters on 1-1/2 inch (38 mm) high sign; where two lines of text are required, use labels 2 inch (50 mm) high.
- FF. Laminated Acrylic or Melamine Plastic Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.
 2. Unless otherwise indicated, provide single line of text with 1/2 inch (13 mm) high letters on 1-1/2 inch (38 mm) high sign; where two lines of text are required, use labels 2 inch (50 mm) high.
- GG. Cable Ties: General purpose, for attaching tags, except as listed below:
1. Outdoors: UV-stabilized nylon.
 2. In Spaces Handling Environmental Air: Plenum rated.

3.03 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

- C. Concealed Raceways, Duct Banks, More Than 1000 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3 inch (75 mm) high, black letters on 20 inch (500 mm) centers.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, and at 10 ft (3 m) maximum intervals.
- D. Accessible Raceways and Metal-Clad Cables, 1000 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120V to Ground: Identify with self-adhesive raceway labels or vinyl tape applied in bands.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft (15 m) maximum intervals in straight runs, and at 25 ft (7.6 m) maximum intervals in congested areas.
- E. Accessible Fittings for Raceways and Cables within Buildings: Identify cover of junction and pull box of the following systems with self-adhesive labels containing wiring system legend and system voltage. System legends must be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
 - 3. "UPS."
- F. Power-Circuit Conductor Identification, 1000 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify phase.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft (15 m) maximum intervals in straight runs, and at 25 ft (7.6 m) maximum intervals in congested areas.
- G. Power-Circuit Conductor Identification, More Than 1000 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and separate tag with circuit designation.
- H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with conductor or cable designation, origin, and destination.
- I. Control-Circuit Conductor Termination Identification: For identification at terminations, provide heat-shrink preprinted tubes or self-adhesive labels with conductor designation.
- J. Conductors to Be Extended in Future: Attach marker tape to conductors and list source.
- K. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- L. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- M. Concealed Raceways and Duct Banks, More Than 1000 V, within Buildings: Apply floor marking tape to the following finished surfaces:
 - 1. Floor surface directly above conduits running beneath and within 12 inch (300 mm) of floor that is in contact with earth or is framed above unexcavated space.

2. Wall surfaces directly external to raceways concealed within wall.
 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in building, or concealed above suspended ceilings.
- N. Workspace Indication: Apply floor marking tape or tape and stencil to finished surfaces. Show working clearances in direction of access to live parts. Workspace must comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- O. Instructional Signs: Self-adhesive labels, including color code for grounded and ungrounded conductors.
- P. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels, Baked-enamel warning signs, or Metal-backed, butyrate warning signs.
1. Apply to exterior of door, cover, or other access.
 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- Q. Arc Flash Warning Labeling: Self-adhesive labels.
- R. Operating Instruction Signs: Self-adhesive labels, Baked-enamel warning signs, or Metal-backed, butyrate warning signs.
- S. Equipment Identification Labels:
1. Indoor Equipment: Self-adhesive labels, Baked-enamel warning signs, or Metal-backed, butyrate warning signs.
 2. Outdoor Equipment: Laminated acrylic or melamine sign or Stenciled legend 4 inch (100 mm) high.
 3. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in location provided by panelboard manufacturer. Panelboard identification must be in form of self-adhesive, engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Medium voltage Switchgear.
 - d. Switchboards.
 - e. Oil filled transformers
 - f. Dry type Transformers: Label that includes tag designation indicated on Drawings for transformer, feeder, and panelboards or equipment supplied by secondary.
 - g. Emergency system boxes and enclosures.
 - h. Motor-control centers.
 - i. Enclosed switches.
 - j. Enclosed circuit breakers.

END OF SECTION 26 05 53

SECTION 26 05 73.13
SHORT-CIRCUIT STUDIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Computer-based, fault-current study to determine minimum interrupting capacity of circuit protective devices.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260573.16 "Coordination Studies" for overcurrent protective device coordination studies.
 - 3. Section 260573.19 "Arc-Flash Hazard Analysis" for arc-flash studies.

1.02 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items must remain functional throughout construction period.
- B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
- D. SCCR: Short-circuit current rating.
- E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- F. Single-Line Diagram: See "One-Line Diagram."

1.03 ACTION SUBMITTALS

- A. Product Data:
 - 1. Power system analysis software shall be SKM for all studies.
- B. Short-Circuit Study Report:
 - 1. Submit the following after approval of system protective devices submittals. Submittals must be in digital form and in the native SKM format.

- a. Short-circuit study input data, including completed computer program input data sheets.
- b. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
- c. Revised one-line diagram, reflecting field investigation results and results of short-circuit study.
- d. Submit native SKM calculation files.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.05 QUALITY ASSURANCE

- A. Study must be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms must comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.

PART 2 - PRODUCTS

2.01 POWER SYSTEM ANALYSIS SOFTWARE

- A. SKM, no substitutions.
- B. Comply with IEEE 399 and IEEE 551.
- C. Analytical features of power systems analysis software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- D. Computer software program must be capable of plotting and diagramming time-current-characteristic curves as part of its output.
- E. Computer program must be designed to perform short-circuit studies or have function, component, or add-on module designed to perform short-circuit studies.
- F. Computer program must be developed under supervision of licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

2.02 SHORT-CIRCUIT STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, and lengths.
 - 3. Transformer kVA and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
 - 6. Derating factors and environmental conditions.
 - 7. Any revisions to electrical equipment required by study.
- D. Comments and recommendations for system improvements or revisions in written document, separate from one-line diagram.
- E. Protective Device Evaluation:
 - 1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
 - 2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
 - 3. For 600 V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 - 4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
 - 5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
- F. Short-Circuit Study Input Data:
 - 1. One-line diagram of system being studied.
 - 2. Power sources available.
 - 3. Manufacturer, model, and interrupting rating of protective devices.
 - 4. Conductors.
 - 5. Transformer data.
- G. Short-Circuit Study Output Reports:
 - 1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. Equivalent impedance.
 - 2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.

- b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. Calculated asymmetrical fault currents:
 - 1) Based on fault-point X/R ratio.
 - 2) Based on calculated symmetrical value multiplied by 1.6.
 - 3) Based on calculated symmetrical value multiplied by 2.7.
- 3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.

PART 3 - EXECUTION

3.01 POWER SYSTEM DATA

- A. Obtain data necessary for conduct of study.
 - 1. Verify completeness of data supplied on one-line diagram. Call discrepancies to Architect's attention.
 - 2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
 - 3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers in accordance with NFPA 70E.
 - 4. Complete study without Owner input or involvement.
- B. Gather and tabulate required input data to support short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to amount of detail that is required to be acquired in field. Field data gathering must be by, or under supervision of, qualified electrical professional engineer. Data include, but are not limited to, the following:
 - 1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Obtain electrical power utility impedance at service.
 - 3. Power sources and ties.
 - 4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
 - 5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.

6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Motor horsepower and NEMA MG 1 code letter designation.
9. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
10. Derating factors.

3.02 SHORT-CIRCUIT STUDY

- A. Perform study following general study procedures contained in IEEE 399.
- B. Calculate short-circuit currents according to IEEE 551.
- C. Base study on device characteristics supplied by device manufacturer.
- D. Extent of electrical power system to be studied is the new equipment i.e. 4-way solid dielectric switchgear, transformer oil filled, transformer dry type, main panelboard.
 1. Exclude equipment supplied by single transformer smaller than 75 kVA.
- E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- F. Include ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement to address asymmetrical requirements of interrupting equipment.
- G. Calculate short-circuit momentary and interrupting duties for three-phase bolted fault and single line-to-ground fault at each equipment indicated on one-line diagram.
 1. For grounded systems, provide bolted line-to-ground fault-current study for areas as defined for three-phase bolted fault short-circuit study.
- H. Include in report identification of protective device applied outside its capacity.

END OF SECTION 26 05 73.13

This Page Left Intentionally Blank

SECTION 26 05 73.16
COORDINATION STUDIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260573.13 "Short-Circuit Studies" for fault-current studies.
 - 3. Section 260573.19 "Arc-Flash Hazard Analysis" for arc-flash studies.

1.02 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. Existing to remain items must remain functional throughout construction period.
- B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of electric circuit or system of circuits and the component devices or parts used therein.
- C. Protective Device: A device that senses when abnormal current flow exists and then removes the affected portion of the circuit from the system.
- D. SCCR: Short-circuit current rating.
- E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- F. Single-Line Diagram: See "One-Line Diagram."

1.03 ACTION SUBMITTALS

- A. Product Data:
 - 1. Power system analysis software shall be SKM no substitutions.
- B. Coordination Study Report:
 - 1. Submit the following after approval of system protective devices submittals. Submittals must be in digital form.

- a. Coordination-study input data, including completed computer program input data sheets.
- b. Study and equipment evaluation reports.
- c. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
- d. Revised one-line diagram, reflecting field investigation results and results of coordination study.
- e. Submit native SKM calculation files.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.05 QUALITY ASSURANCE

- A. Studies must be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms must comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.

PART 2 - PRODUCTS

2.01 POWER SYSTEM ANALYSIS SOFTWARE

- A. SKM no substitutions.
- B. Comply with IEEE 242 and IEEE 399.
- C. Analytical features of device coordination study computer software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- D. Computer software program must be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program must report device settings and ratings of overcurrent protective devices and must demonstrate selective coordination by computer-generated, time-current coordination plots.
 - 1. Optional Features:
 - a. Arcing faults.
 - b. Simultaneous faults.
 - c. Explicit negative sequence.
 - d. Mutual coupling in zero sequence.

- E. Computer program must be designed to perform coordination studies or have function, component, or add-on module designed to perform coordination studies.
- F. Computer program must be developed under supervision of licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

2.02 COORDINATION STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, and lengths.
 - 3. Transformer kVA and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, and panelboard designations.
 - 6. Revisions to electrical equipment required by study.
 - 7. Study Input Data: As described in "Power System Data" Article.
 - a. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
- D. Protective Device Coordination Study:
 - 1. Report recommended settings of protective devices, ready to be applied in field. Use manufacturer's data sheets for recording recommended setting of overcurrent protective devices when available.
 - a. Phase and Ground Relays:
 - 1) Device tag.
 - 2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
 - 3) Recommendations on improved relaying systems, if applicable.
 - b. Circuit Breakers:
 - 1) Adjustable pickups and time delays (long time, short time, and ground).
 - 2) Adjustable time-current characteristic.
 - 3) Adjustable instantaneous pickup.
 - 4) Recommendations on improved trip systems, if applicable.
 - c. Fuses: Show current rating, voltage, and class.
- E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for switching schemes and for emergency periods where power source is local generation. Show the following information:
 - 1. Device tag and title, one-line diagram with legend identifying portion of system covered.
 - 2. Terminate device characteristic curves at point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

3. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:
 - a. Power utility's overcurrent protective device.
 - b. Medium-voltage equipment overcurrent relays.
 - c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
 - d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
 - e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
 - f. Cables and conductors damage curves.
 - g. Ground-fault protective devices.
 - h. Motor-starting characteristics and motor damage points.
 - i. Generator short-circuit decrement curve and generator damage point.
 - j. Largest feeder circuit breaker in each motor-control center and panelboard.
5. Maintain selectivity for tripping currents caused by overloads.
6. Provide adequate time margins between device characteristics such that selective operation is achieved.
7. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.
 1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.02 POWER SYSTEM DATA

- A. Obtain data necessary for conduct of overcurrent protective device study.
 1. Verify completeness of data supplied in one-line diagram on Drawings. Call discrepancies to Architect's attention.
 2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
 3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers must be in accordance with NFPA 70E.
- B. Gather and tabulate required input data to support coordination study. List below is guide. Comply with recommendations in IEEE 551 for amount of detail required to be acquired in field. Field data gathering must be by, or under supervision of, qualified electrical professional engineer. Data include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at service.
3. Power sources and ties.
4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).
17. Data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
 - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
 - d. Generator thermal-damage curve.
 - e. Ratings, types, and settings of utility company's overcurrent protective devices.
 - f. Special overcurrent protective device settings or types stipulated by utility company.
 - g. Time-current-characteristic curves of devices indicated to be coordinated.
 - h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
 - i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
 - j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
 - k. Identify series-rated interrupting devices for condition where available fault current is greater than interrupting rating of downstream equipment. Obtain device

data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.03 COORDINATION STUDY

- A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.
- B. Comply with IEEE 399 for general study procedures.
- C. Base study on device characteristics supplied by device manufacturer.
- D. Extent of electrical power system to be studied is full extents of existing system and new system shown on Drawings.
- E. Begin analysis at service, extending down to system overcurrent protective devices as follows:
 - 1. To normal system low-voltage load buses where fault current is 5 kA or less.
- F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- G. Transformer Primary Overcurrent Protective Devices:
 - 1. Device must not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 - 2. Device settings must protect transformers according to IEEE C57.12.00, for fault currents.
- H. Motor Protection:
 - 1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
 - 2. Select protection for motors served at voltages more than 600 V according to IEEE 620.
- I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands maximum short-circuit current for time equivalent to tripping time of primary relay protection or total clearing time of fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
- J. Generator Protection: Select protection according to manufacturer's instructions and to IEEE 242.
- K. Include ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.

- L. Calculate short-circuit momentary and interrupting duties for three-phase bolted fault and single line-to-ground fault at each equipment indicated on one-line diagram.
 - 1. For grounded systems, provide bolted line-to-ground fault-current study for areas as defined for three-phase bolted fault short-circuit study.
- M. Protective Device Evaluation:
 - 1. Evaluate equipment and protective devices and compare to short-circuit ratings.
 - 2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
 - 3. Include in report identification of protective device applied outside its capacity.

3.04 LOAD-FLOW AND VOLTAGE-DROP STUDY

- A. Perform load-flow and voltage-drop study to determine steady-state loading profile of system. Analyze power system performance two times as follows:
 - 1. Determine load flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
 - 2. Determine load flow and voltage drop based on 80 percent of design capacity of load buses.
 - 3. Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.05 MOTOR-STARTING STUDY

- A. Perform motor-starting study to analyze transient effect of system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze effects of motor starting on power system stability.
- B. Prepare motor-starting study report, noting light flicker for limits proposed by IEEE 141, and voltage sags so as not to affect operation of other utilization equipment on system supplying motor.

3.06 FIELD ADJUSTING

- A. Adjust relay and protective device settings according to recommended settings provided by coordination study. Field adjustments must be completed by engineering service division of equipment manufacturer under "Startup and Acceptance Testing" contract portion.
- B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.
- C. Testing and adjusting must be by qualified low-voltage electrical testing and inspecting agency.
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for adjustable overcurrent protective devices.

END OF SECTION 260573.16

SECTION 26 05 73.19
ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Computer-based, arc-flash study to determine arc-flash hazard distance and incident energy to which personnel could be exposed during work on or near electrical equipment.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260573.13 "Short-Circuit Studies" for fault-current studies.
 - 3. Section 260573.16 "Coordination Studies" for overcurrent protective device coordination studies.

1.02 DEFINITIONS

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- D. p.u.: Per unit. The reference unit, established as a calculating convenience, for expressing all power system electrical parameters on a common reference base.
- E. SCCR: Short-circuit current rating.
- F. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- G. Single-Line Diagram: See "One-Line Diagram."

1.03 ACTION SUBMITTALS

- A. Product Data:
 - 1. Power system analysis software SKM no substitutions.
- B. Study Submittals:

1. Submit the following after approval of system protective devices submittals. Submittals must be in digital form:
 - a. Arc-flash study input data, including completed computer program input data sheets.
 - b. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
 - c. Revised one-line diagram, reflecting field investigation results and results of arc-flash study.
 - d. Submit native SKM calculation files.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.05 QUALITY ASSURANCE

- A. Study must be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms must comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.

PART 2 - PRODUCTS

2.01 COMPUTER SOFTWARE

- A. SKM, no substitutions.
- B. Comply with IEEE 1584 and NFPA 70E.
- C. Analytical features of device coordination study computer software program must have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- D. Computer program must be designed to perform arc-flash analysis or have function, component, or add-on module designed to perform arc-flash analysis.
- E. Computer program must be developed under supervision of licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

2.02 ARC-FLASH STUDY REPORT CONTENT

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, and lengths.
 - 3. Transformer kVA and voltage ratings, including derating factors and environmental conditions.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
- F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."
- G. Arc-Flash Study Output Reports:
 - 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in report:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on total basis.
- H. Incident Energy and Flash Protection Boundary Calculations:
 - 1. Arcing fault magnitude.
 - 2. Protective device clearing time.
 - 3. Duration of arc.
 - 4. Arc-flash boundary.
 - 5. Restricted approach boundary.
 - 6. Limited approach boundary.
 - 7. Working distance.
 - 8. Incident energy.
 - 9. Hazard risk category.
 - 10. Recommendations for arc-flash energy reduction.
- I. Fault study input data, case descriptions, and fault-current calculations including definition of terms and guide for interpretation of computer printout.

2.03 ARC-FLASH WARNING LABELS

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce 3.5 by 5 inch (76 by 127 mm) self-adhesive equipment label for each work location included in analysis.
- B. Label must have orange header with wording, "WARNING, ARC-FLASH HAZARD," and must include the following information taken directly from arc-flash hazard analysis:
 - 1. Location designation.
 - 2. Nominal voltage.
 - 3. Protection boundaries.
 - a. Arc-flash boundary.
 - b. Restricted approach boundary.
 - c. Limited approach boundary.
 - 4. Arc flash PPE category.
 - 5. Required minimum arc rating of PPE in Cal/cm squared.
 - 6. Available incident energy.
 - 7. Working distance.
 - 8. Engineering report number, revision number, and issue date.
- C. Labels must be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.02 ARC-FLASH HAZARD ANALYSIS

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. Preparatory Studies: Perform Short-Circuit and Protective Device Coordination studies prior to starting Arc-Flash Hazard Analysis.
 - 1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
 - 2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."
- C. Calculate maximum and minimum contributions of fault-current size.
 - 1. Maximum calculation must assume maximum contribution from utility and must assume motors to be operating under full-load conditions.
 - 2. Calculate arc-flash energy at 85 percent of maximum short-circuit current in accordance with IEEE 1584 recommendations.

- D. Calculate arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.
- E. Include medium- and low-voltage equipment locations, except equipment fed from transformers smaller than 75 kVA.
- F. Calculate limited, restricted, and prohibited approach boundaries for each location.
- G. Incident energy calculations must consider accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations must take into account changing current contributions, as sources are interrupted or decremented with time. Fault contribution from motors and generators must be decremented as follows:
 - 1. Fault contribution from induction motors must not be considered beyond three to five cycles.
 - 2. Fault contribution from synchronous motors and generators must be decayed to match actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 p.u. to 3 p.u. after 10 cycles).
- H. Arc-flash energy must generally be reported for maximum of line or load side of circuit breaker. However, arc-flash computation must be performed and reported for both line and load side of circuit breaker as follows:
 - 1. When circuit breaker is in separate enclosure.
 - 2. When line terminals of circuit breaker are separate from work location.
- I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.03 POWER SYSTEM DATA

- A. Obtain data necessary for conduct of arc-flash hazard analysis.
 - 1. Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.
 - 2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
 - 3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.
- B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to amount of detail that is required to be acquired in field. Field data gathering must be under direct supervision and control of engineer in charge of performing study, and must be by, or under supervision of, qualified electrical professional engineer. Data include, but are not limited to, the following:
 - 1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 - 2. Obtain electrical power utility impedance or available short circuit current at service.
 - 3. Power sources and ties.

4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

3.04 LABELING

- A. Apply one arc-flash label on front cover of each section of equipment for each equipment included in study. Base arc-flash label data on highest values calculated at each location.
- B. Each piece of equipment listed below must have arc-flash label applied to it:
 1. Switchboards.
 2. Panelboards.
 3. Motor-control centers.
 4. Low voltage transformers.
 5. Safety switches.
 6. Control panels.
- C. Note on record Drawings location of equipment where personnel could be exposed to arc-flash hazard during their work.
 1. Indicate arc-flash energy.
 2. Indicate protection level required.

3.05 APPLICATION OF WARNING LABELS

- A. Install arc-flash warning labels under direct supervision and control of qualified electrical professional engineer.

END OF SECTION 26 05 73.19

SECTION 26 09 13
ELECTRICAL POWER MONITORING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Power meters.
 - 2. Raceways and boxes.
 - 3. Wires and cables.
 - 4. Coordination with the owners I.T. department for meter networking.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.02 DEFINITIONS

- A. Active Power: The average power consumed by a unit. Also known as "real power."
- B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.
- C. Apparent (Phasor) Power: " $S = VI$ " where "S" is the apparent power, "V" is the RMS value of the voltage, and "I" is the RMS value of the current.
- D. Firmware: Software (programs or data) that has been written onto read-only memory (ROM). Firmware is a combination of software and hardware. Storage media with ROMs that have data or programs recorded on them are firmware.
- E. KY Pulse: A method of measuring consumption of electricity that is based on a relay operating like a SPST switch.
- F. KYZ Pulse: A method of measuring consumption of electricity based on a relay operating like a SPDT switch.
- G. L-G: Line to ground.
- H. L-L: Line to line.
- I. L-N: Line to neutral.
- J. MODBUS TCP/IP: An open protocol for exchange of process data.
- K. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

- L. N-G: Neutral to ground.
- M. Power Factor: The ratio of active power to apparent power, sometimes expressed in percentage.

1.03 ACTION SUBMITTALS

- A. Product Data:
 - 1. Power meters.
 - 2. Raceways and boxes.
 - 3. Wires and cables.
- B. Shop Drawings: For power monitoring and control equipment.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, method of field assembly, components, and location and size of each field connection.
 - a. Attach copies of approved Product Data submittals for products (such as switchboards, switchgear, and motor-control centers) that describe the following:
 - 1) Location of the meters and gateways, and routing of the connecting wiring.
 - 2) Details of power monitoring and control features to illustrate coordination among related equipment and power monitoring and control.
 - 3. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
 - 4. Network naming and numbering scheme.
 - 5. Include diagrams for power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.

1.04 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.05 COORDINATION

- A. Coordinate features of distribution equipment and power monitoring and control components to form an integrated interconnection of compatible components.
 - 1. Match components and interconnections for optimum performance of specified functions.
- B. Coordinate Work of this Section with those in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Microprocessor-based monitoring and control of electrical power distribution system(s) that includes the following:
 - 1. Electrical meters that monitor, control, and connect to the data transmission network.
 - 2. LAN: High-speed, multi-access, open, nonproprietary, industry-standard communication protocols.
 - 3. Include with web access, with its operating system and application software, connected to data transmission network.
- B. The electrical power monitoring shall be Internet based.
 - 1. System software must be based on server thin-client architecture, designed around open standards of internet technology.
 - 2. Intent of thin-client architecture is to provide operators complete access to power monitoring and control system via an Internet browser. No special software other than an Internet browser must be required to access graphics, point displays, and trends; to configure trends, points, and controllers; and to edit programming.
 - 3. Internet access must be password protected.
- C. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with UL 61010-1 and marked for intended location and application.

2.02 PERFORMANCE REQUIREMENTS

- A. Addressable Devices: Transmitters and receivers must communicate unique device identification and status reports to monitoring and control clients.
 - 1. Hardwired Monitoring Points: Electrical power demand (kilowatts), electrical power consumption (kilowatt-hours).
 - 2. ASHRAE 135 (BACnet) communication interface

2.03 POWER METERS

- A. Electro Industries Gauge Tech Shark meter, ENCSHK250-60-10-V4-D2-INP100S-RS1S-X.
- B. Description: Separately mounted, modular, permanently installed, solid-state, digital I/O instrument for power monitoring and control; complying with UL 61010-1.
 - 1. Capable of metering four-wire wye, three-wire wye, three-wire delta, and single-phase power systems.
- C. Comply with IEC 60529 degree of protection code of IP51 for the front of the meter, and code of IP30 for the body.
- D. Overvoltage: Comply with UL 61010-1 overvoltage withstand rating for CAT III.
- E. Accuracy:
 - 1. Comply with ANSI C12.20, Class 0.5.

2. Neutral Current Measurement: Not more than 0.65 percent.
 3. Power: 0.6 percent.
 4. Power Factor: 0.5 percent.
 5. Active Energy: 0.6 percent.
 6. Reactive Energy: 2.5 percent.
 7. Frequency: 0.05 percent.
 8. THD: 1.0 percent.
 9. Waveform Sampling: 32 per cycle.
- F. Data Link:
1. MODBUS TIA-485 RTU protocol, 2 wire connection.
 - a. Provide for firmware and software updates through the communications port.
- G. Meter Physical Characteristics:
1. Display: Backlit LCD with antiglare and scratch-resistant lens.
 2. Display of Metered Values: One screen to show at least four lines of user-selected values on one screen at the same time. Provide graphical representation of user-selected values. The screen selections available at the display must include the following:
 - a. Meters, including those listed under the following:
 - 1) Measurements.
 - 2) THD.
 - 3) Energy.
 - 4) Demand.
 - 5) Minimum and maximum values.
 - 6) Power demand.
- H. Sampling Rate: Continuously sample and record voltage and current at a rate not less than 32 samples per cycle simultaneously on voltage and current channels of the meter.
- I. Meters:
1. Measurements: Instantaneous, in real time, RMS to the 15th harmonic.
 - a. Voltage: L-L each phase, L-N each phase, and three-phase average.
 - b. Current: Each phase, three-phase average, and neutral.
 - c. Unbalanced current, L-L V(ac) and L-N V(ac).
 - d. Active Power (+/- kW): Each phase and three-phase total.
 - e. Reactive Power (+/- kVAR): Each phase and three-phase total.
 - f. Apparent Power (+/- kVA): Each phase and three-phase total.
 - g. Displacement Power Factor: Each phase and three-phase total.
 - h. Distortion Power Factor: Each phase and three-phase total.
 - i. Frequency.
 2. THD from measurements simultaneously from the same cycle, through 15th harmonic.
 - a. Voltage THD: L-L each phase, L-N each phase, and three-phase average.
 - b. Current THD: Each phase and three-phase average.
 - c. Total demand distortion.
 3. Energy: Accumulated, indicate whether in-flow or out-flow, net and absolute values. Store the values in instrument's nonvolatile memory.
 - a. Active kWh.
 - b. Reactive kVARh.
 - c. Apparent kVAh.
 4. Demand: Present, last, predicted, peak.
 - a. Three-phase average current.

- b. Three-phase total active power (kW).
 - c. Reactive power (kVAR).
 - d. Apparent power (kVA).
- 5. Minimum and Maximum Values:
 - a. L-L and L-N voltages.
 - b. Current in each phase.
 - c. Power factor.
 - d. Active power total.
 - e. Reactive power total.
 - f. Apparent power total.
 - g. THD L-L and L-N voltages.
 - h. THD current in each phase.
 - i. Frequency.
- J. Power Demand, User Selectable:
 - 1. Thermal Demand: Sliding window updated every second for the present demand and at end of the interval for the last interval. Adjustable window that can be set in 1-minute intervals, from 1 to 60 minutes.
 - 2. Block Interval with Optional Subintervals: Adjustable for 1-minute intervals, from 1 to 60 minutes. User-defined parameters for the following block intervals:
 - a. Sliding block that calculates demand every second, with intervals less than 15 minutes, and every 15 seconds with an interval between 15 and 60 minutes.
 - b. Fixed block that calculates demand at end of the interval.
 - c. Rolling block subinterval that calculates demand at end of each subinterval and displays it at end of the interval.
 - 3. Demand Calculation Initiated by a Synchronization Signal:
 - a. Signal is a communication signal. Calculation must be configurable as either a block or rolling block calculation.
 - b. Provide for synchronizing the demand with the internal of this instrument.
- K. Data Recording: Store the listed values in instrument's nonvolatile memory, indicate which of the three phases relates to the value. Attach a date and time stamp to the peak values and the alarms.
 - 1. Minimum and maximum of real-time RMS measurement.
 - 2. Energy.
 - 3. Demand values.
 - 4. Alarms, store the last 40 events.
- L. Alarms: Transmit a digital output and show on display when alarmed. Provide for no fewer than 15 metered items. Each alarm must be user configured, by using the following options:
 - 1. Date and time stamp.
 - 2. Enable-disable (default) or enable.
 - 3. Pickup magnitude.
 - 4. Pickup time delay.
 - 5. Dropout magnitude.
 - 6. Dropout time delay.
 - 7. Alarm type.
 - 8. Alarm label.

- M. Output Signals: Provide two mechanical relays, rated not less than 250 V(ac), 2 A resistive, and rated for 200,000 cycles or more. The relays must be user configurable in one of the following listed modes:
 - 1. Normal contact closure where the contacts change state for as long as the signal exists.
 - 2. Latched mode when the contacts change state when a pickup signal is received and are held until a dropout signal is received.
 - 3. Timed mode when the contacts change state when a pickup signal is received and are held for a preprogrammed duration.
- N. Meter Face:
 - 1. Display: Backlit LCD display, with antiglare and scratch-resistant lens.
 - 2. Display of Metered Values: One screen to show at least three user-selected values on one screen at the same time.
 - 3. Provide for the reset of metered peak values.
- O. Capacities and Characteristics:
 - 1. Power Supply: 120 V(ac), 60 Hz.
 - 2. Circuit Connections:
 - a. Voltage: Measurements autoranging, 60 to 400 V(ac) L-N. Connect directly to low-voltage (600 V and less) without using voltage transformers. Meter impedance must be 2 megohm L-L or greater. Overload Tolerance: 1500 V(ac), RMS, continuously.
 - b. Current: Connect to instrument grade current transformer with a metering range of 5 mA to 6 A. Overcurrent tolerance of the instrument must be 10 A continuous, 50 A for 10 seconds once per hour, and 120 A for one second per hour.
 - c. Frequency: 45 to 65 Hz.
 - d. Time: Input from a GPS receiver to synchronize the internal clock of the instrument and to time-synchronize this instrument with the network to a deviation of not greater than 1 ms.

2.04 RACEWAYS AND BOXES

- A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceways for electrical power wiring and NFPA 70 Class 1 remote-control and signaling circuits.
- B. Comply with requirements in Section 270000 "Communications" for control wiring, TIA-232 cable, and NFPA 70 Class 2 remote-control and signaling circuits.

2.05 WIRES AND CABLES

- A. Electrical Power Wiring: Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 - 1. Copper conductors are Type THHN/THWN-2.
- B. TIA-232 Cable:
 - 1. PVC-Jacketed, TIA-232 Cable: Paired, two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, and individual aluminum foil-polyester tape

shielded pairs with 100 percent shield coverage; PVC jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.

- a. Type CM.
 - b. Flame Resistance: UL 1581, vertical tray.
2. Plenum-Type, TIA-232 Cable: Paired, two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; plastic jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - a. Type CMP.
 - b. Flame Resistance: NFPA 262, flame test.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF POWER MONITORING AND CONTROL SYSTEMS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- C. Wiring and Cabling Installation:
 1. Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power wiring.
- D. Raceways Installation:
 1. Comply with Section 260533 "Raceways and boxes for Electrical Systems" for electrical power wiring and NFPA 70 Class 1 remote-control and signaling circuits.
 2. Comply with Section 270000 "Communications" for control wiring, TIA-232 cable, and NFPA 70 Class 2 remote-control and signaling circuits.
- E. Identification Installation:
 1. Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power wiring.
 2. Comply with Section 270000 "Communications" for identification products and cable management system requirements for twisted pair cable, TIA-485 cable, control-voltage cable, and TIA-232 cable.
 3. Comply with Section 270000 "Communications" for identification products and cable management system requirements for optical-fiber cable.

3.03 NETWORK NAMING AND NUMBERING

- A. Coordinate with Owner and provide unique naming and addressing for networks and devices.

3.04 GROUNDING

- A. For data communication wiring, comply with BICSI N1.
- B. For control-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.05 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed by university and/or Architect.
- B. Tests and Inspections:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Visually inspect balanced twisted pair cabling and optical-fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
 - 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of components.
 - 4. Test balanced twisted pair cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.
 - a. Test instruments must meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
 - 5. Power Monitoring and Control System Tests.
 - a. Test Analog Signals:
 - 1) Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
 - 2) Check analog current signals using a precision current meter at zero, 50, and 100 percent.
 - 3) Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.
 - b. Test Digital Signals:
 - 1) Check digital signals using a jumper wire.
 - 2) Check digital signals using an ohmmeter to test for contact making or breaking.
 - c. I/O Control Loop Tests:

- 1) Test every I/O point to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.
- 2) Test every I/O point throughout its full operating range.
- 3) Test every control loop to verify that operation is stable and accurate.
- 4) Adjust control loop proportional, integral, and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
- 5) Test and adjust every control loop for proper operation according to sequence of operation.
- 6) Test software and hardware interlocks for proper operation.
- 7) Operate each analog point at the following:
 - a) Upper quarter of range.
 - b) Lower quarter of range.
 - c) At midpoint of range.
- 8) Exercise each binary point.
- 9) For every I/O point in the system, read and record each value at workstation, at controller, and at field instrument simultaneously. Value displayed at workstation and at field instrument must match.
- 10) Prepare and submit a report documenting results for each I/O point in the system, and include in each I/O point a description of corrective measures and adjustments made to achieve desired results.

C. Nonconforming Work:

1. Wiring and cabling will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.06 FINAL REVIEW

- A. Submit written request to Architect and University when the power monitoring and control system is ready for final review. Written request must state the following:
 1. The system has been thoroughly inspected for compliance with Contract Documents and found to be in full compliance.
 2. The system has been calibrated, adjusted, and tested and found to comply with requirements of operational stability, accuracy, speed, and other performance requirements indicated.
 3. The system monitoring and control of electrical distribution systems results in operation according to sequences of operation indicated.
 4. The system is complete and ready for final review.
- B. Review by Architect and/or University will be made after receipt of written request. A field report must be issued to document observations and deficiencies.
- C. Take prompt action to remedy deficiencies indicated in field report and submit a second written request when deficiencies have been corrected. Repeat process until no deficiencies are reported.
- D. Final review must include a demonstration to parties participating in final review.

3.07 TRAINING

- A. Attendee Training Manuals:
 - 1. Provide each attendee with a color hard copy of training materials and visual presentations.
 - 2. Hard-copy materials must be organized in a three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
 - 3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes a DVD or flash drive with PDF copy of hard-copy materials.
- B. On-Site Training:
 - 1. Instructor must provide training materials, projector, and other audiovisual equipment used in training.
 - 2. Provide as much of training located on-site as deemed feasible and practical by Owner.
 - 3. On-site training must include regular walk-through tours, as required, to observe each unique product type installed with hands-on review of operation, calibration, and service requirements.
- C. At Completion of Training: Staff familiar with the system installed are capable of demonstrating operation of the system during final review.

END OF SECTION 26 09 13

SECTION 26 12 19
PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. The installation of the Owner furnished Pad-mounted, liquid-filled, medium-voltage distribution transformers, with primary and secondary bushings within or without air-terminal enclosures.
 - 2. Secondary lugs.
- B. Coordination of delivery, unloading, storing, setting and installation of Transformer.
- C. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.02 DEFINITIONS

- A. Bushing: An insulating structure including a central conductor, or providing a central passage for a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purpose of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.
- B. Bushing Elbow: An insulated device used to connect insulated conductors to separable insulated connectors on dead-front, pad-mounted transformers and to provide a fully insulated connection. This is also called an "elbow connector."
- C. Bushing Insert: That component of a separable insulated connector that is inserted into a bushing well to complete a dead-front, load break or nonload break, separable insulated connector (bushing).
- D. Bushing Well: A component of a separable insulated connector, either permanently welded or clamped to an enclosure wall or barrier, having a cavity that receives a replaceable component (bushing insert) to complete the separable insulated connector (bushing).
- E. Elbow Connector: See "bushing elbow" above.

1.03 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of product.

- a. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. For pad-mounted, liquid-filled, medium-voltage transformers.
 - a. Include plans and elevations showing major components and features.
 - 1) Include plan view and cross section of equipment base, showing clearances, required workspace, and locations of penetrations for grounding and conduits.
 - b. Include details of equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connections.
 - c. Include list of materials.
 - d. Include nameplate data.
 - e. Manufacturer's published time-current curves of transformer line-side fuses, with transformer damage curve, inrush curve, and thru fault current indicated.
- C. Field Quality-Control Submittals:
 - 1. Field quality-control reports.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For transformers, signed by product manufacturer.
- B. Source quality-control reports.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- B. Comply with IEEE C2.
- C. Comply with IEEE C57.12.00.

2.02 PERFORMANCE REQUIREMENTS

- A. Windings Material: Copper.
- B. Surge Arresters: Comply with IEEE C62.11, Distribution Class; metal-oxide-varistor type, fully shielded, separable-elbow type, suitable for plugging into inserts provided in line-side section of transformer. Connected in each phase of incoming circuit and ahead of disconnecting device.
- C. Winding Connections: Connection of windings and terminal markings must comply with IEEE C57.12.70.

- D. Efficiency: Shall meet current DOE standards and shall Comply with 10 CFR 431, Subpart K.
- E. Insulation: Transformer kVA rating must be as follows: Average winding temperature rise above 30 deg C ambient temperature must not exceed 65 deg C and 80 deg C hottest-spot temperature rise at rated kVA when tested in accordance with IEEE C57.12.90, using combination of connections and taps that give highest average winding temperature rise.
- F. Tap Changer: External handle, for de-energized operation.
- G. Tank: Sealed, with welded-on cover.
- H. Enclosure Integrity: Comply with IEEE C57.12.28 for pad-mounted enclosures that contain energized electrical equipment in excess of 600 V that may be exposed to public.
- I. Mounting: Integral skid mounting frame, suitable to allow skidding or rolling of transformer in any direction, and with provision for anchoring frame to pad.
- J. Insulating Liquids:
 - 1. Less-Flammable Liquids:
 - a. Non -PCB oil-filled using ABB BIOTEMP (trademark), FR3 (trademark), or equivalent fluid.
- K. Sound level must comply with NEMA TR 1 requirements.
- L. Corrosion Protection:
 - 1. Transformer coating system must be factory applied, complying with requirements of IEEE C57.12.28, in Munsell 7.0GY3.29/1.5green paint finish.

2.03 THREE-PHASE TRANSFORMERS

- A. WEG.
- B. Description:
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
 - 2. Comply with IEEE C57.12.26.
- C. Compartment Construction:
 - 1. Double-Compartment Construction: Individual compartments for line- and load-side sections, formed by steel isolating barriers that extend full height and depth of compartments, with hinged, lift-off doors and three-point latching, with stop in open position and provision for padlocking.
- D. Primary Fusing: Designed and rated to provide thermal protection of transformer by sensing overcurrent and high liquid temperature.
 - 1. 60 kV BIL min. current-limiting fuses, conforming to requirements of IEEE C37.47.
 - 2. Interrupting Rating: 50 000 A(rms sym) at system voltage.
 - 3. Fuse Assembly: flapper side wall mount Bay-o-net fuse assemblies and drip trays with dual sensing Bay-O-Net fuse links in series with partial range current limiting fuses.

Liquid-immersed, expulsion fuses in series with liquid-immersed, partial-range, current-limiting fuses. Bayonet fuse must sense both high currents and high oil temperature to provide thermal protection to transformer. Connect current-limiting fuses ahead of radial-feed load-break switch.

4. Provide bayonet fuse assembly with oil retention valve and external drip shield inside housing to eliminate or minimize oil spills. Valve must close when fuse holder is removed and external drip shield is installed.
5. Provide conspicuously displayed warning adjacent to bayonet fuse(s), cautioning against removing or inserting fuses unless transformer has been de-energized and tank pressure has been released.

E. Line-Side Section: Dead-front design, radial feed.

1. To connect primary cable, use separable insulated connectors; coordinated with and complying with requirements of Section 260513 "Medium-Voltage Cables." Bushings must be one-piece units, with ampere and BIL ratings same as connectors.
2. Bushing inserts:
 - a. Conform to requirements of IEEE 386.
 - b. Rated at 200 A, with voltage class matching connectors. Provide parking stand near bushing wells. Parking stands must be equipped with insulated standoff bushings for parking of energized load-break elbow connectors on parking stands.
 - c. Provide insulated protective caps for insulating and sealing out moisture from unused bushing inserts and insulated standoff bushings.
3. Access to liquid-immersed fuses.
4. Dead-front surge arresters.
5. Tap-changer operator.
6. Load-Break Switch:
 - a. Radial-feed, liquid-immersed type with voltage class and BIL matching that of separable connectors, with continuous current rating and load-break rating of 200 A, and make-and-latch rating of 12 kA(rms sym).
7. Ground pad.

F. Load-Side Section:

1. Bushings with spade terminals drilled for terminating number of conductors indicated on Drawings, and lugs that comply with requirements of Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
2. Metering: Coordinated with and complying with requirements of Section 260913 "Electrical Power Monitoring." Install meter, providing mounting space, brackets, and cable and conduit routing as well as the following:
 - a. Sensors.
 - b. BAS interface.
 - c. Kilowatt-hour meter.
 - d. Kilowatt-hour demand meter.

G. Capacities and Characteristics:

1. Power Rating: 1000 kVA.
2. Voltage Ratings: dual rated 12.47/4.16KV - 480Y/277 V.
3. Taps: (4) @ 2.5% above normal and 2 @ 2.5% below normal.
4. Transformer BIL (kv): comply with IEEE C57.12.26 requirements 60kV BIL min.
5. Minimum Tested Impedance (Percent) at 85 deg C: 5.75.
6. KNAN type self-cooled.
7. Comply with FM Global Class No. 3990.

8. Comply with UL listing requirements for combination classification and listing for transformer and less-flammable insulating liquid.
9. Comply with ANSI, NEMA, IEEE STANDARDS AND NEC specifications.
10. Comply with current DOE efficiency standards.

H. Transformer Accessories:

1. Drain and filter connection. One inch drain valve with sampling device in external sampler box secured with a penta-head bolt, with provisions for a padlock.
2. Filling and top filter press connections.
3. Pressure-vacuum gauge, Dial-type analog thermometer with alarm contacts, Magnetic liquid level indicator with high and low alarm contacts. All gauges are to be located outside the secondary terminal compartment in a separate enclosure secured with a penta-head bolt, with provision for a padlock.
4. Automatically resetting pressure-relief device. Device flow must be as recommended by manufacturer. With alarm contacts and manual bleeder.
5. Stainless steel ground connection pads.
6. Machine-engraved nameplate, made of anodized aluminum or stainless steel.
7. Sudden pressure relay for remote alarm or trip when intern
8. Transformer shall include flapper side wall mount Bay-O-Net fuse assemblies and drip trays with dual sensing Bay-O-Net fuse links in series with partial range current limiting fuses.
9. Sudden pressure relay for remote alarm or trip when internal transformer pressure rises at field-set rate. Provide with seal-in delay.
10. Tank ground pads (1 in HV, 1 in LV) with two transformer ground connectors Greaves GLT-20 or equal.

2.04 CONTROL NETWORK

- A. Controllers: Support serial MS/TP and Ethernet IP communications, and able to communicate directly via RS-485 serial networks and Ethernet 10Base-T networks as native device.

2.05 WARNING LABELS AND SIGNS

- A. Comply with requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."
1. High-Voltage Warning Label: Provide self-adhesive warning signs on outside of line-side compartment door(s). Sign legend must be "DANGER HIGH VOLTAGE" printed in two lines of nominal 2 inch (50 mm) high letters. Word "DANGER" must be in white letters on red background and words "HIGH VOLTAGE" must be in black letters on white background.
 2. Arc Flash Warning Label: Provide self-adhesive warning signs on outside of line-side compartment door(s), warning of potential electrical arc flash hazards and appropriate personal protective equipment required.

2.06 SOURCE QUALITY CONTROL

- A. Factory Tests and Inspections: Perform the following tests and inspections, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having

jurisdiction, before delivering to site. Affix label with name and date of qualified electrical testing laboratory's certification of system compliance on control units.

1. Resistance.
2. Turns ratio, polarity, and phase relation.
3. Transformer no-load losses and excitation current at 100 percent of ratings.
4. Transformer impedance voltage and load loss.
5. Operation of devices.
6. Lightning impulse.
7. Low frequency.
8. Leak.
9. Perform Tests:
 - a. Transformer no-load losses and excitation current at 110 percent of ratings.
 - b. Insulation power factor.
 - c. Applied potential, except that this test is not required for single-phase transformers or for three-phase Y-Y-connected transformers.
 - d. Induced potential.
 - e. Resistance measurements of windings on rated voltage connection and at tap extreme connections.
 - f. Ratios on rated voltage connection and at tap extreme connections.
 - g. Polarity and phase relation on rated voltage connection.
 - h. No-load loss at rated voltage on rated voltage connection.
 - i. Exciting current at rated voltage on rated voltage connection.
 - j. Impedance.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine pad-mounted, liquid-filled, medium-voltage transformers upon delivery.
 1. Upon delivery of transformers and prior to unloading, inspect equipment for damage that may have occurred during shipment or storage.
 2. Verify that tie rods and chains are undamaged and tight, and that blocking and bracing is tight. Verify that there is no evidence of load shifting in transit, and that readings from transportation shock recorders, if equipped, are within manufacturer's recommendations.
 3. Verify that there is no indication of external damage and no dents or scratches in doors and sill, tank walls, radiators and fins, or termination provisions.
 4. Verify that there is no evidence of insulating-liquid leakage on transformer surfaces, at weld seams, on line- or load-side bushing parts, and at transformer base.
 5. Verify that there is positive pressure or vacuum on tank. Check pressure gauge; it is required to read other than zero.
 6. Compare transformers and accessories received with bill of materials to verify that shipment is complete. Verify that transformers and accessories conform with manufacturer's quotation and shop drawings. If shipment is incomplete or does not comply with Project requirements, notify manufacturer in writing immediately.
 7. Verify presence of polychlorinated biphenyl content labeling.
 8. Unload transformers carefully, observing packing label warnings and handling instructions.

9. Open termination compartment doors and inspect components for damage or displaced parts, loose or broken connections, cracked or chipped insulators, bent mounting flanges, dirt or foreign material, and water or moisture.

B. Handling:

1. Handle transformers carefully, in accordance with manufacturer recommendations, to avoid damage to enclosure, termination compartments, base, frame, tank, and internal components. Do not subject transformers to impact, jolting, jarring, or rough handling.
2. Protect transformer termination compartments against entrance of dust, rain, and snow.
3. Transport transformers upright, to avoid internal stresses on core and coil mounting assembly and to prevent trapping air in windings. Do not tilt or tip transformers.
4. Verify that transformer weights are within rated capacity of handling equipment.
5. Use only manufacturer-recommended points for lifting, jacking, and pulling. Use lifting lugs when lifting transformers.
6. Use jacks only at corners of tank base plate.
7. Use nylon straps of same length to balance and distribute weight when handling transformers with crane.
8. Use spreaders or lifting beam to obtain vertical lift and to protect transformer from straps bearing against enclosure. Lifting cable pull angles may not be greater than 15 degrees from vertical.
9. Exercise care not to damage tank base structure when handling transformer using skids or rollers. Use skids to distribute stresses over tank base when using rollers under large transformers.

C. Storage:

1. Store transformers in accordance with manufacturer's recommendations.
2. Transformers may be stored outdoors. If possible, store transformers at final installation locations on concrete pads. If dry concrete surfaces are unavailable, use pallets of adequate strength to protect transformers from direct contact with ground. Ensure transformer is level.
3. Ensure that transformer storage location is clean and protected from severe conditions. Protect transformers from dirt, water, contamination, and physical damage. Do not store transformers in presence of corrosive or explosive gases. Protect transformers from weather when stored for more than three months.
4. Store transformers with compartment doors closed.
5. Regularly inspect transformers while in storage and maintain documentation of storage conditions, noting discrepancies or adverse conditions. Verify that effective pressure seal is maintained using pressure gauges. Visually check for insulating-liquid leaks and rust spots.

- D. Examine areas and space conditions for compliance with requirements for pad-mounted, liquid-filled, medium-voltage transformers and other conditions affecting performance of the Work.

E. Examine roughing-in of conduits and grounding systems to verify the following:

1. Wiring entries comply with layout requirements.
2. Entries are within conduit-entry tolerances specified by manufacturer, and no feeders will cross section barriers to reach load or line lugs.

- F. Examine concrete bases for suitable conditions for transformer installation.

G. Pre-Installation Checks:

1. Verify removal of shipping bracing after placement.
 2. Remove sample of insulating liquid in accordance with ASTM D923. Insulating-liquid values must comply with NETA ATS, Table 100.4. Sample must be tested for the following:
 - a. Dielectric Breakdown Voltage: ASTM D877 or ASTM D1816.
 - b. Acid Neutralization Number: ASTM D974.
 - c. Interfacial Tension: ASTM D971.
 - d. Color: ASTM D1500.
 - e. Visual Condition: ASTM D1524.
- H. Verify that ground connections are in place and that requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 Ω at transformer location.
- I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install transformers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 260529 "Hangers and Supports for Electrical Systems."
- B. Transformer must be installed level and plumb and must tilt less than 1.5 degrees while energized.
- C. Maintain minimum clearances and workspace at equipment in accordance with manufacturer's published instructions and IEEE C2.

3.03 CONNECTIONS

- A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
 1. For counterpoise, use tinned bare copper cable not smaller than 4/0 AWG, buried not less than 30 inch (765 mm) below grade interconnecting grounding electrodes. Bond surge arrester and neutrals directly to transformer enclosure and then to grounding electrode system with bare copper conductors, sized as shown. Keep lead lengths as short as practicable, with no kinks or sharp bends.
 2. Equipment connections may not be smaller than 4 AWG.
 3. Make joints in grounding conductors and loops by exothermic weld or compression connector.
 4. Terminate grounding and bonding conductors on common equipment grounding terminal on transformer enclosure.
 5. Complete transformer tank grounding and lightning arrester connections prior to making other electrical connections.
- B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 1. Maintain air clearances between energized live parts and between live parts and ground for exposed connections in accordance with manufacturer recommendations.

2. Bundle associated phase, neutral, and equipment grounding conductors together within transformer enclosure. Arrange conductors such that there is not excessive strain that could cause loose connections. Allow adequate slack for expansion and contraction of conductors.
- C. Terminate medium-voltage cables in incoming section of transformers in accordance with Section 260513 "Medium-Voltage Cables."

3.04 SIGNS AND LABELS

- A. Comply with installation requirements for labels and signs specified in Section 260553 "Identification for Electrical Systems."
- B. Install warning signs as required to comply with 29 CFR 1910.269.

3.05 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed by Architect and/or University.
- B. Tests and Inspections:
 1. General Field-Testing Requirements:
 - a. Comply with provisions of "Testing and Test Methods" Chapter in NFPA 70B.
 - b. Perform visual and mechanical inspections and electrical tests. Certify compliance with test parameters.
 - c. After installing transformer but before primary is energized, verify that grounding system at transformer is tested at specified value or less.
 - d. After installing transformer and after electrical circuitry has been energized, test for compliance with requirements.
 - e. Visual and Mechanical Inspection:
 - 1) Verify equipment nameplate data complies with Contract Documents.
 - 2) Inspect bolted electrical connections for high resistance using one of the following two methods:
 - a) Use low-resistance ohmmeter to compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
 - b) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS, Table 100.12.
 2. Medium-Voltage Surge Arrester Field Tests:
 - a. Visual and Mechanical Inspection:
 - 1) Inspect physical and mechanical condition.
 - 2) Verify arresters are clean.
 - 3) Verify that ground leads on devices are individually attached to ground bus or ground electrode.
 - b. Electrical Test:

- 1) Perform insulation-resistance test on arresters, phase terminal-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.1. Replace units that fail to comply with recommended minimum insulation resistance listed in that table.
- 2) Perform watts-loss test. Evaluate watts-loss values by comparison with similar units and test equipment manufacturer's published data.
3. Liquid-Filled Transformer Field Tests:
 - a. Visual and Mechanical Inspection:
 - 1) Test dew point of tank gases if applicable.
 - 2) Inspect anchorage, alignment, and grounding.
 - 3) Verify bushings are clean.
 - 4) Verify that alarm, control, and trip settings on temperature and level indicators are set and operate within manufacturer's recommended settings.
 - 5) Verify that liquid level in tanks is within manufacturer's published tolerances.
 - 6) Perform specific inspections and mechanical tests recommended by manufacturer.
 - 7) Verify presence of transformer surge arresters and that their ratings are as specified.
 - 8) Verify that as-left tap connections are as specified.
 - b. Electrical Tests:
 - 1) Perform insulation-resistance tests winding-to-winding and windings-to-ground. Apply voltage in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index; value of index may not be less than 1.0.
 - 2) Perform power-factor or dissipation-factor tests on windings in accordance with test equipment manufacturer's published data. Maximum winding insulation power-factor/dissipation-factor values must be in accordance with manufacturer's published data. In absence of manufacturer's published data, comply with NETA ATS, Table 100.3.
 - 3) Measure core insulation resistance at 500 V(dc) if core is insulated and core ground strap is removable. Core insulation-resistance values may not be less than 1 M Ω at 500 V(dc).
 - 4) Perform Field Tests:
 - a) Perform turns-ratio tests at tap positions. Turns-ratio test results may not deviate by more than one-half percent from either adjacent coils or calculated ratio. If test fails, replace transformer.
 - b) Perform excitation-current test on each phase. Typical excitation-current test data pattern for three-legged core transformer is two similar current readings and one lower current reading. Investigate and correct if test shows different pattern.
 - c) Measure resistance of windings at tap connections, and record temperature-corrected winding-resistance values in Operations and Maintenance Manual.
 - d) Perform applied-voltage test on line- and load-side windings-to-ground. Comply with IEEE C57.12.91, Sections 10.2 and 10.9. This test is not required for single-phase transformers and for three-phase wye-wye-connected transformers.

- 5) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- 6) Remove sample of insulating liquid in accordance with ASTM D923, and perform dissolved-gas analysis in accordance with IEEE C57.104 or ASTM D3612.

C. Nonconforming Work:

1. Equipment and devices will be considered defective if they do not pass tests and inspections.
2. Remove and replace malfunctioning units and retest.

D. Prepare test and inspection reports. Record as-left set points of adjustable devices.

3.06 FOLLOW-UP SERVICE

A. Voltage Monitoring and Adjusting: After Substantial Completion, if requested by Owner, but not more than six months after Final Acceptance, perform the following voltage monitoring:

1. During period of normal load cycles as evaluated by Owner, perform seven days of three-phase voltage recording at outgoing section of transformers. Use voltmeters with calibration traceable to National Institute of Science and Technology standards and with chart speed of not less than 1 inch (25 mm) per hour. Voltage unbalance greater than 1 percent between phases, or deviation of phase voltage from nominal value by more than plus or minus 5 percent during test period, is unacceptable.
2. Corrective Action: If test results are unacceptable, perform the following corrective action, as appropriate:
 - a. Adjust transformer taps.
 - b. Prepare written request for voltage adjustment by electric utility.
3. Retests: Repeat monitoring, after corrective action is performed, until satisfactory results are obtained.
4. Report:
 - a. Prepare written report covering monitoring performed and corrective action taken.

- B. Infrared Inspection: Perform survey during periods of maximum possible loading. Remove necessary covers prior to inspection.
1. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of transformer's electrical power connections.
 2. Instrument: Inspect distribution systems with imaging equipment capable of detecting minimum temperature difference of 1 deg C at 30 deg C.
 3. Record of Infrared Inspection: Prepare certified report that identifies testing technician and equipment used, and lists results as follows:
 - a. Description of equipment to be tested.
 - b. Discrepancies.
 - c. Temperature difference between area of concern and reference area.
 - d. Probable cause of temperature difference.
 - e. Areas inspected. Identify inaccessible and unobservable areas and equipment.
 - f. Identify load conditions at time of inspection.
 - g. Provide photographs and thermograms of deficient area.
 4. Act on inspection results in accordance with recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.

END OF SECTION 26 12 19

SECTION 26 22 13
LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Distribution, dry-type transformers with nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.
- B. Related Requirements:
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.02 ACTION SUBMITTALS

- A. Product Data:
 - 1. For each type of product.
 - a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
 - b. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.
- B. Shop Drawings:
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connections.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Field Quality-Control Submittals:
 - 1. Field quality-control reports.

1.03 INFORMATIONAL SUBMITTALS

- A. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:
 - 1. Transformer temporary heating, working clearances, anchoring, torque values, and insulation-resistance testing.
- B. Source quality-control reports.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: On receipt, inspect for and note shipping damage to packaging and transformer.
 - 1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.
- B. Storage: Store in warm, dry, and temperature-stable location in original shipping packaging.
- C. Temporary Heating: Apply temporary heat in accordance with manufacturer's published instructions within enclosure of ventilated-type units, throughout periods during which equipment is not energized and when transformer is not in space that is continuously under normal control of temperature and humidity.
- D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Cutler-Hammer, General Electric, Square D, Hevi-Duty, ITE-Siemens, Hammond Power Solutions, Inc., or approved equal.
- B. Source Limitations: Obtain each type of transformer from single source from single manufacturer.

2.02 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60 Hz service.
- B. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- C. Transformers Rated 15 kVA and Larger:
 - 1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
 - 2. Marked as compliant with DOE 2016 efficiency levels by qualified electrical testing laboratory recognized by authorities having jurisdiction.

2.03 DISTRIBUTION TRANSFORMERS

- A. Comply with NFPA 70 and UL listing appropriate to size and type.
- B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
 - 1. One leg per phase.
 - 2. Grounded to enclosure.
- C. Coils: Continuous windings except for taps.

1. Coil Material: Copper.
 2. Internal Coil Connections: Brazed or pressure type.
 3. Terminal Connections: Welded or Bolted.
- D. Enclosure: Ventilated.
1. Core and coil must be encapsulated within resin compound to seal out moisture and air.
 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
 3. Wiring Compartment: Sized for conduit entry and wiring installation.
 4. Environmental Protection:
 - a. Indoor: UL 50E, Type 2
 5. Finish Color: Gray weather-resistant enamel.
- E. Taps for Transformers 3 kVA and Smaller: None.
- F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- H. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with maximum of 115 deg C rise above 40 deg C ambient temperature.
- I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with maximum of 115 deg C rise above 40 deg C ambient temperature.
- J. Grounding: Provide ground-bar kit or ground bar installed on inside of transformer enclosure.
1. Unit must comply with requirements of DOE 2016 efficiency levels when tested in accordance with NEMA TP 2 with K-factor equal to one.
- K. Electrostatic Shielding: Windings must have independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 2. Include special terminal for grounding shield.
- L. Low-Sound-Level Requirements: Maximum sound levels when factory tested in accordance with IEEE C57.12.91, as follows:
1. 9.00 kVA and Less: 40 dB(A-weighted)
 2. 9.01 to 30.00 kVA: 45 dB(A-weighted)
 3. 30.01 to 50.00 kVA: 45 dB(A-weighted)
 4. 50.01 to 150.00 kVA: 50 dB(A-weighted)
 5. 150.01 to 300.00 kVA: 55 dB(A-weighted)
 6. 300.01 to 500.00 kVA: 60 dB(A-weighted)
 7. 500.01 to 700.00 kVA: 62 dB(A-weighted)
 8. 700.01 to 1000.00 kVA: 64 dB(A-weighted)

2.04 IDENTIFICATION

- A. Nameplates:

1. Engraved, laminated-acrylic or melamine plastic signs for distribution transformers, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.05 IMPEDANCE RANGE

A. Levels as Follows:

KVA	Impedance (%)
15	4.0 - 5.2
30	3.0 - 5.9
45	3.0 - 3.2
75	3.0 - 4.2
112.5	3.5 - 5.4
150	4.5 - 5.0
225	6.25 - 6.5
300	3.1 - 4.1

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for transformers.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's published instructions.
- A. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed. Set transformer plumb and level. Ventilated transformers located against walls shall be located sufficient distance from wall for proper ventilation. Coordinate with manufacturer's recommendations and Code requirements.
- C. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance must be 5 Ω at location of transformer.
- D. Environment: Enclosures must be rated for environment in which they are located. Covers for UL 50E, Type 4X enclosures may not cause accessibility problems.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Set floor mounted transformers plumb and level. Ventilated transformers located against walls shall be located sufficient distance from wall for proper ventilation. Coordinate with manufacturer's recommendations and Code requirements.
- B. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.
- C. Use flexible conduit, 2 ft minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure. See manufacturer's drawings for allowable locations.
- D. Secondary neutral of transformer shall be grounded to building steel and to grounding conductor from source and as required by NEC. Neutral conductor shall terminate on isolated neutral bus and grounding conductor shall terminate on ground bus in panel served.
- E. Install cable lugs to transformer studs so that lug protrusion is facing away from front cover to maximize the distance from the lug to the cover.
- F. Provide primary disconnecting means per NEC. If not within sight of transformer, shall be lockable and transformer shall be labeled with location.
- G. Construct concrete bases and anchor floor-mounted transformers in accordance with manufacturer's published instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."
 - 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- H. Secure transformer to concrete base in accordance with manufacturer's published instructions.
- I. Secure covers to enclosure and tighten bolts to manufacturer-recommended torques to reduce noise generation.
- J. Remove shipping bolts, blocking, and wedges.

3.03 CONNECTIONS

- A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- D. Provide flexible connections at conduit and conductor terminations and supports to eliminate sound and vibration transmission to building structure.

3.04 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed by Architect and/or the University.
- B. Tests and Inspections:
 - 1. Small (Up to 167 kVA Single-Phase or 500 kVA Three-Phase) Dry-Type Transformer Field Tests:
 - a. Visual and Mechanical Inspection.
 - 1) Inspect physical and mechanical condition.
 - 2) Inspect anchorage, alignment, and grounding.
 - 3) Verify that resilient mounts are free and that shipping brackets have been removed.
 - 4) Verify that unit is clean.
 - 5) Perform specific inspections and mechanical tests recommended by manufacturer.
 - 6) Verify that as-left tap connections are as specified.
 - 7) Verify presence of surge arresters and that their ratings are as specified.
 - b. Electrical Tests:
 - 1) Measure resistance at windings, taps, and bolted connections.
 - 2) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
 - 2. Large (Larger Than 167 kVA Single Phase or 500 kVA Three Phase) Dry-Type Transformer Field Tests:
 - a. Visual and Mechanical Inspection:
 - 1) Inspect physical and mechanical condition.
 - 2) Inspect anchorage, alignment, and grounding.
 - 3) Verify that resilient mounts are free and that shipping brackets have been removed.
 - 4) Verify that unit is clean.
 - 5) Perform specific inspections and mechanical tests recommended by manufacturer.
 - 6) Verify that as-left tap connections are as specified.
 - 7) Verify presence of surge arresters and that their ratings are as specified.
 - b. Electrical Tests:
 - 1) Measure resistance at windings, taps, and bolted connections.
 - 2) Perform applied voltage test on line- and load-side windings to ground. See IEEE C57.12.91, Sections 10.2 and 10.9.
 - 3) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- C. Test Labeling: On completion of satisfactory testing of units, attach dated and signed "Satisfactory Test" label to tested components.
- D. Nonconforming Work:
 - 1. Transformer will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace units that do not pass tests or inspections and retest as specified above.
- E. Assemble and submit test and inspection reports.

3.05 ADJUSTING

- A. Record transformer secondary voltage at unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare written report recording output voltages and tap settings.

3.06 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.07 MAINTENANCE

- A. Infrared Scanning: Two months after Substantial Completion, perform infrared scan of transformer connections.
 - 1. Use infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - 2. Perform two follow-up infrared scans of transformers, one at four months and another at 11 months after Substantial Completion.
 - 3. Prepare certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial actions taken, and scanning observations after remedial action.

END OF SECTION 26 22 13

This Page Left Intentionally Blank

SECTION 26 24 13 SWITCHBOARDS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Switchboards.
 - 2. Surge protection devices.
 - 3. Disconnecting and overcurrent protective devices.
 - 4. Instrumentation.
 - 5. Control power.
 - 6. Accessory components and features.
- B. Related Requirements
 - 1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.
 - 2. Section 260573.19 "Arc-Flash Hazard Analysis" for arc-flash analysis and arc-flash label requirements.

1.02 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.03 ACTION SUBMITTALS

- A. Product Data:
 - 1. Switchboards.
 - 2. Overcurrent protective devices.
 - 3. Surge protection devices.
 - 4. Ground-fault protection devices.
 - 5. Accessories.
 - 6. Other components.
 - 7. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
- B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than UL 50E, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Detail utility company's metering provisions with indication of approval by utility company.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.
8. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Field Quality-Control Submittals:

1. Field Quality-Control Reports:
 - a. Test procedures used.
 - b. Test results that comply with requirements.
 - c. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.04 INFORMATIONAL SUBMITTALS

- A. Manufacturers' Published Instructions: Record copy of official installation and testing instructions issued to Installer by manufacturer for the following:
 1. Handling, storing, and providing temporary heat.
 2. Mounting accessories and anchoring devices.
 3. Testing and adjusting overcurrent protective devices.
- B. Sample warranties.

1.05 CLOSEOUT SUBMITTALS

- A. Warranty documentation.

1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Spare Parts: Furnish to Owner spare parts, for repairing switchboards, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:
 1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type but no fewer than two of each size and type.
 2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 3. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.

4. Indicating Lights: Equal to 10 percent of quantity installed for each size and type but no less than one of each size and type.
- B. Special Tools: Furnish to Owner proprietary equipment, keys, and software required to operate, maintain, repair, adjust, or implement future changes to switchboards, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:
1. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.
 2. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.
- 1.07 DELIVERY, STORAGE, AND HANDLING
- A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. Handle and prepare switchboards for installation in accordance with NEMA PB 2.1.
- 1.08 WARRANTY
- A. Installer warrants that fabricated and installed switchboard perform in accordance with specified requirements and agrees to repair or replace components that fail to perform as specified within warranty period.

PART 2 - PRODUCTS

2.01 SWITCHBOARDS

- A. Square D. (I-Line), or approved equal
- B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- E. Comply with NEMA PB 2.
- F. Comply with NFPA 70.
- G. Comply with UL 891.

- H. Front-Connected, Front-Accessible Switchboards:
 - 1. Main Devices: Panel mounted.
 - 2. Branch Devices: Panel mounted.
 - 3. Sections front and rear aligned.
- I. Nominal System Voltage: 480Y/277 V
- J. Main-Bus Continuous: 1200 A.
- K. Indoor Enclosures: Steel, UL 50E, Type 1.
- L. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over rust-inhibiting primer on treated metal surface.
- M. Service Entrance Rating: Switchboards intended for use as service entrance equipment may contain one service disconnecting means with overcurrent protection, neutral bus with disconnecting link, grounding electrode conductor terminal, and main bonding jumper.
- N. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- O. Buses and Connections: Three phase, four wire unless otherwise indicated.
 - 1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from front of switchboard.
 - 2. Phase- and Neutral-Bus Material:
 - a. Hard-drawn copper of 98 percent conductivity, silver-plated or Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
 - 3. Copper feeder circuit-breaker line connections or Tin-plated aluminum feeder circuit-breaker line connections.
 - 4. Ground Bus: 1/4 by 2 inch (6 by 50 mm-) OR Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.
 - 5. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
 - 6. Disconnect Links:
 - a. Isolate neutral bus from incoming neutral conductors.
 - b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.
 - 7. Neutral Buses: 100 percent of ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
- P. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.
- Q. Bus-Bar Insulation: Factory-applied, flame-retardant, tap
- R. e wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

2.02 SURGE PROTECTION DEVICES

- A. Schneider Electric, or approved equal.
- B. SPDs: Listed and labeled in accordance with UL 1449, Type 2.
- C. Features and Accessories:
 - 1. Indicator light display for protection status.
 - 2. Form-C contacts rated at 5 A and 250 V(ac), one normally open and one normally closed, for remote monitoring of protection status. Contacts must reverse on failure of surge diversion module or on opening of current-limiting device. Coordinate with building power monitoring and control system.
 - 3. Surge counter.
- D. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating per phase may not be less than 200 kA. Peak surge current rating must be arithmetic sum of ratings of individual MOVs in each mode.
- E. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, three-phase, four-wire circuits may not exceed the following:
 - 1. Line to Neutral: 1200 V for 480Y/277 V.
 - 2. Line to Ground: 1200 V for 480Y/277 V.
 - 3. Line to Line: 2000 V for 480Y/277 V.
- F. SCCR: Equal or exceed 100 kA.
- G. Nominal Rating: 20 kA.

2.03 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Main circuit breaker (branch mounted) Electronic trip circuit breaker with RMS sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long and short time adjustments.
 - d. Ground-fault pickup level, time delay, and I squared t response.
 - e. Anti-single phase protection
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Branch Circuit breaker Electronic trip circuit breaker with RMS sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long and short time adjustments.

2.04 INSTRUMENTATION

- A. Instrument Transformers: NEMA EI 21.1, and the following:
 - 1. Potential Transformers: NEMA EI 21.1; 120 V, 60 Hz, tapped secondary; disconnecting type with integral fuse mountings. Burden and accuracy must be consistent with connected metering and relay devices.
 - 2. Current Transformers: NEMA EI 21.1; 5 A, 60 Hz, secondary; wound bar type; double secondary winding and secondary shorting device. Burden and accuracy must be consistent with connected metering and relay devices.
 - 3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
 - 4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
 - 1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
 - a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
 - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
 - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
 - d. Megawatts: Plus or minus 1 percent.
 - e. Megavars: Plus or minus 1 percent.
 - f. Power Factor: Plus or minus 1 percent.
 - g. Frequency: Plus or minus 0.1 percent.
 - h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
 - i. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
 - j. Contact devices to operate remote impulse-totalizing demand meter.
 - 2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
 - 3. Ratchets to prevent reverse rotation.
 - 4. Removable meter with drawout test plug.
 - 5. Semiflush mounted case with matching cover.
 - 6. Appropriate multiplier tag.
- C. Manufacturer: Electro Industries Gauge Tech, Nexus or equal

2.05 CONTROL POWER

- A. Control Circuits:
 - 1. 120 V(ac), supplied from remote branch circuit.

2.06 ACCESSORY COMPONENTS AND FEATURES

- A. Mounting Accessories: For anchors, mounting channels, bolts, washers, and other mounting accessories, comply with requirements in manufacturer's instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Receive, inspect, handle, and store switchboards in accordance with NEMA PB 2.1.
 - 1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's published instructions.
 - 2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
 - 3. Protect from moisture, dust, dirt, and debris during storage and installation.
 - 4. Install temporary heating during storage in accordance with manufacturer's published instructions.
- B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.
- C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect performance of equipment.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with manufacturer's published instructions.
- B. Reference Standards:
 - 1. Switchboards and Accessories: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA PB 2.1.
 - 2. Consult Architect for resolution of conflicting requirements.
 - 3. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.
 - 4. Operating Instructions: Frame and mount printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
 - 5. Install filler plates in unused spaces of panel-mounted sections.
 - 6. Install overcurrent protective devices, surge protection devices, and instrumentation.
 - a. Set field-adjustable switches and circuit-breaker trip ranges.
 - 7. Install spare-fuse cabinet.

3.03 CONNECTIONS

- A. Bond conduits entering underneath switchboard to equipment ground bus with bonding conductor sized in accordance with NFPA 70.
- B. Support and secure conductors within switchboard in accordance with NFPA 70.
- C. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3.04 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Switchboard Nameplates: Label each switchboard compartment with nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Service Equipment Label: Labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

3.05 FIELD QUALITY CONTROL

- A. Field tests and inspections shall be witnessed by Architect and /or University.
- B. Tests and Inspections:
 - 1. Acceptance Testing:
 - a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
 - b. Test continuity of each circuit.
 - 2. Test ground-fault protection of equipment for service equipment in accordance with NFPA 70.
 - a. Overcurrent devices installed in a circuit breaker rated or adjustable to 1200A or higher must meet the additional requirements for RELT (Reduced Energy Let Through) testing and documentation noted in NEC Section 240.87.
 - b. GFCI circuit breakers rated 1000A or more shall be tested in accordance with NEC 230.95 (C).
 - 3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 5. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.
 6. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each. Test voltage shall be 1000 volts, and minimum acceptable value for insulation resistance ins 2 megohms.
 7. Perform the following infrared scan tests and inspections, and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Nonconforming Work:
1. Switchboard will be considered defective if it does not pass tests and inspections.
 2. Remove and replace defective units and retest.
- D. Collect, assemble, and submit test and inspection reports, including certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.06 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Touch-up scratched or marred surfaces to match original finish.
- C. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573.16 "Coordination Studies."

3.07 PROTECTION

- A. Temporary Heating: Apply temporary heat, to maintain temperature in accordance with manufacturer's published instructions, until switchboard is ready to be energized and placed into service.

END OF SECTION 26 24 13

This Page Left Intentionally Blank

APPENDIX B

SECTION 27 00 00
COMMUNICATIONS

TABLE OF CONTENTS

PART 1 GENERAL	1
1.01 Description	2
1.02 Definitions	2
1.03 References	3
PART 2 OUTSIDE PLANT (OSP)	32.01 OSP – Duct System
	3
2.02 Manholes and Hand holes	3
2.03 Trenching, Back-Filling and Restoration of Grounds	4
2.04 Cable Identification and Labeling	4
2.05 OSP Cable Sizing	5
2.06 Cable Type, Splices and Protection	5
2.07 Administrative and Academic Building OSP Data Fiber Sizing	5
2.08 OSP – Video Cable Specifications	5
PART 3 INSIDE PLANT (ISP)	63.01 Configuration and Specifications for ISP
	5
3.02 Cable Routing	6
3.03 Cat 6 Requirements AND Parts	6
3.04 Distribution Frame Requirements	7
3.05 Cable Support and Rack Products	8
3.06 Cable Networks Identification and Labeling	10
3.07 Uniform Wiring Plan (UWP)	11
3.08 Voice and Data Cable Specifications for horizontal Cabling	11
3.09 Video Wiring Plan (UMP)	11
3.10 Video Riser Cables	11
3.11 Wireless Networking Requirements	11
3.12 Camera Installation	12
3.13 Outside Emergency Phones / Pole-Mounted Cameras	12
3.14 US:IT Voice and Data Cable Specifications for Jacks	12
3.15 Install Level 6 Standards	13
PART 4 TEST RECORDS AND DOCUMENTATION	144.01 Test Records for ISP/OSP
	13
4.02 Data Fiber Testing	13
4.03 Close-out Documentation	15

APPENDIX B

PART 1 GENERAL

1.01 DESCRIPTION

- A. All cabling for voice and data will be CAT6. The general building contractor shall provide Inside Plant (ISP) pathways, which may include accessible utility corridors, finished and exposed metal cable tray or ladder, enclosed conduit, duct, or raceway including pull ropes to allow the installation of cable. Junction boxes shall be provided to allow installation of termination jacks at each station. The general contractor shall provide dedicated building closets, equipment backboards, a grounding system, and an Outside Plant (OSP) conduit with pull ropes from the Building Distribution Frame (BDF) to nearest manhole.
- B. US:IT will refer to the cable, which carries Telecommunications System signals, either integrated voice/data or voice only signals, as “voice” cable, i.e. voice riser, voice station cable.
- C. ISP/OSP bid submittals shall include all costs for construction material, labor and any other items required for ISP/OSP installation.
- D. The Contractor will be responsible for implementing all ISP/OSP per the design layout and specifications in its proposal. The design of all pathways and hardware shall allow for a 50% growth in capacity. This responsibility includes installation and termination of all ISP/OSP cabling to their proper equipment.
- E. Particular consideration is to be given to the restoration of penetrated fire and smoke stop partitions and floor slabs to their original condition or to current fire code standards, whichever is greater.
- F. The Contractor shall furnish blueprints, schedules and other technical data in order to illustrate to US:IT the intended method of installation. These shall define material type, path and concealment methods, distribution cable quantities, and room or wall space requirements. This information will be submitted prior to starting any portion of work and is subject to the approval of US:IT department.

1.02 DEFINITIONS

- A. Inside Plant (ISP) is defined as intra-building distribution of cable media such as riser cable both fiber and copper coax, station cable, station jack hardware, Intra building Distribution Frame (IDF) terminals, sleeves, conduit, raceways, distribution frame hardware, etc. All other physical plant such as grounding, power, conduit, and raceway not considered OSP are part of the ISP.
- B. Outside Plant (OSP) are all facilities used to support inter-building connections, including (but not limited to) copper, fiber and coaxial cable, splices, terminators, pairs protection, grounding systems, ducts, conduits, manholes, and all related outside infrastructure. Also included are Main Distribution Frames (MDF) and Building Distribution Frames (BDF).
- C. Voice Cable – Cabling, which carries Telecommunications System signals, either integrated voice/data or voice only signals, i.e. voice riser, voice station cable.
- D. Data Cable – Cabling, which carries data communications signals, i.e. data riser, data station cable, data fiber.
- E. Video Cable – Cabling, which carries video or TV communications signals, i.e. video riser, video station cable, video coax.
- F. Contractor – Approved US:IT cabling installation contractor. The Contractor shall be Cat 6 or Cat 6A certified. Also, must have a minimum of 5 years telecommunications/data installation experience. Cabling technicians must be certified installers. No more than one helper per certified installer. Certification of technicians must be shown if requested.

APPENDIX B

1.03 REFERENCES

- A. All work shall meet all applicable codes and standards.
 - 1. National Fire Protective Assoc. (NFPA) 70.
 - 2. Building Industry Consulting Service International (BICSI) Standards.
 - 3. National Electrical Manufacturers Assoc. (NEMA) Standards.
 - 4. Electronics Industry Assoc./Telecom. Industry Assoc. (EIA/TIA).
 - 5. US:IT requirements.

PART 2 OUTSIDE PLANT (OSP)

2.01 OSP – DUCT SYSTEM

- A. The Contractor shall be prudent in the design and installation and use of all available industry techniques to fully utilize individual ducts or raceways and avoid using existing spare ducts or raceways where feasible.
- B. Each duct bank shall consist of three 4” conduits to each building. The duct bank sizing reflects the installation of video coax, data fiber, and voice cable. Contractors shall install Schedule 40 or better with industry approved fittings. One 4” three cell maxicell shall be installed in one 4” conduit.
- C. Where sharp bends or turns are required, prefabricated fittings will be used unless such bends or turns prohibit the pulling of large cables. In such cases, manholes or hand holes shall be installed.
- D. Rigid conduit will be used where ducts run under roadways. Where conduits are installed in concrete slabs or where the minimum required depth is not feasible. All 4” Rigid conduits will extend a minimum of 10’ past the outside wall and attach to ducts feeding the building.
- E. The duct systems shall be sloped to permit penetrating water to drain towards the manhole(s). The highest point of the duct array will be at the building entry point. All duct systems will be marked with the appropriate marking tape on top. There must be a minimum of 4 inches of sand above the conduits before backfilling.
- F. All unused ducts shall be provided with removable conduit plugs or equivalent for waterproofing and protection. All ducts shall be cleaned of earth and debris, and equipped with minimum 200-pound strength pull rope.
- G. All cables entering ducts shall be sealed according to industry standards and provide a watertight seal.

2.02 MANHOLES AND HAND HOLES

- A. New manholes shall be reinforced concrete construction, cast-in-place or pre-cast, and must meet industry standards for telephone manholes.
- B. The manholes/hand holes sizes shall be a minimum of 4’ x 4’ x 4’, up to a maximum of 6’ x 12’ x 7’ (see manhole/conduit drawings for manholes sizes and locations).
- C. A PVC water barrier shall be installed at each construction joint.
- D. Maximum distances between manholes and from manhole to buildings shall not be greater than 600 feet for a run containing an aggregate of a 45-degree bend and 400 feet for runs having an aggregate of a 90-degree bend.
- E. On straight sections maximum distance between manholes shall be no greater than 600 feet.
- F. Manhole lids will be permanently marked with the word “Telecom” or “Communications.”

APPENDIX B

- G. Each manhole must have an integral 7/8" inch steel ring 6" diameter as part of the manhole structure. A 12-inch circular sump hole must also be included at the lowest point in a manhole.
- H. All manhole covers must meet industry standards for vehicular traffic loads.

2.03 TRENCHING, BACK-FILLING AND RESTORATION OF GROUNDS

- A. Trenching shall be done using trenching machines or backhoes and supplemented by hand excavation where required in order to avoid utility disruption.
- B. Ducts shall be placed on top of four inches (4") of sand bedding at the bottom of each duct run. An additional four inches (4") of sand shall be placed around and between ducts. A final four inches (4") of sand shall be placed on top such that an aggregate of twelve inches (12") exists from the floor of the duct trench and the top of the last four inches (4") of sand.
- C. Below finished grade, just on top of the final layer of sand, and offset from the center of the duct bank, the Contractor shall place one (1) continuous plastic marking strip labeled "Communications."
- D. Gravel backfill shall be used in paved areas and earth shall be used in lawn area. Backfill shall be free of large stones of 3" in diameter or greater.
- E. All backfill materials shall be compacted 95%.
- F. The Contractor shall repair all the University grounds and property to their pre-construction condition using materials of same or better quality. This includes, but is not limited to, re-paving, re-seeding, walls, fences, landscaping, utilities, signs, painting, curbing, etc.
- G. Bituminous materials should be used where necessary for repairing roads, parking areas, and footpaths. The materials shall be provided in two (2) courses: two 2" binders and a 1" surface course. All existing paths and roadways of greater depth shall be repaired to match existing materials and depths.
- H. US:IT reserves the right to inspect all materials to be used in the process required in this section on trenching, backfilling, restoration of grounds, and to demand changes in type and quality in order to meet US:IT standards. Such changes will be at the Contractor's expense unless US:IT requires materials of a higher quality than originally required by this document. In all cases concerning determination of "original condition", US:IT will be the judge and have final approval.
- I. Trench depth, from the bottom of the trench to the top of finished grade will be three feet, eight inches (3' 8") under pavement, and two feet, two inches (2' 2") under finish grade.

2.04 CABLE IDENTIFICATION AND LABELING

- A. After final acceptance, Contractor will prepare and submit cable OSP drawings. These site drawings will be supplied as a digital file in standard CAD format, and the Contractor will add its distribution system and show at a minimum:
 - 1. Exact route of total outside plant including trenching routes.
 - 2. Depth of cable trench.
 - 3. Locator coordinates measurements from cable location to nearest building.
 - 4. Cable number, cable pair count, wire gauge, cable lengths, and cable types of every OSP copper, coax and fiber cable included in the system.

2.05 OSP CABLE SIZING

- A. Contractor will design an OSP that is complete.
 - 1. All OSP pairs must be terminated in approved fuse protectors per Appendix A: Standard Materials List.

APPENDIX B

2. All fiber cable shall be at least 12 single-mode (8.3 UM OS2) fibers and 12 multi-mode (62.5/125) fibers or as specified.
3. All cable shall be rated for indoor/outdoor usage in duct systems.

2.06 CABLE TYPE, SPLICES AND PROTECTION

- A. All Copper cable used in OSP shall be waterproof with moisture and heat resistant properties up to 125 degrees, Gel-Filled Core Duct/Direct Burial type, with a Metal Clad composition. All wire shall be Twisted Pair type PE89 jelly filled 24 AWG solid copper cables.
- B. All splice connections in manholes shall be placed in re-enterable waterproof closures and sealed according to manufacturer's specifications. All splices shall be made with 3M modular connectors (4000-D) and enclosed in "Preform" enclosures.
- C. All OSP will be properly grounded according to NEC Codes and BICSI Standards, and Local Codes and industry standards. All ground connections are subject to the inspection and approval of the US:IT, as well as State and Federal Inspectors.
- D. All OSP will be enclosed in conduit or raceway where appropriate, such as required by Fire Codes, exposed to steam pressure relief valves, or in public areas.
- E. If utilized, pull strings must be replaced prior to completion of project.

2.07 ADMINISTRATIVE AND ACADEMIC BUILDING OSP DATA FIBER SIZING

- A. Fiber cables shall be pulled to the BDF.
- B. All fiber cables shall be properly terminated at the BDF.
- C. In the fiber installation there will be no splices in the fiber cable, other than those at termination points.
- D. All fiber cable shall be at least 12 single-mode and 12 multi-mode 62.5/125 fibers or as specified.
- E. If utilized, pull strings must be replaced prior to completion of the project.

2.08 OSP – VIDEO CABLE SPECIFICATIONS

- A. All video cables for OSP will be Hitachi single-mode fiber.
- B. Video fibers shall terminate on SC fiber optic connectors.

2.09 OSP – FIBER INSTALLATION

- A. No splices will be allowed in OSP fiber. Any faulty cables must be replaced at Contractor's expense.
- B. All fiber cable must be installed in accordance with manufacturer recommended tensile specifications.
- C. Lubricant must be used when installing fiber cable. This lubricant must be manufacturer guaranteed to be non-destructive to the cable sheath or any portion of the inner duct.
- D. All fiber cables shall be terminated in an approved patch panel using approved connectors. All connections shall be fusion splicing onto correct connectors. Labels shall show the destination of each fiber optic strand.

APPENDIX B

- E. All fiber cable will be tested for loss and bandwidth according to the manufacturer's specifications. Tests shall be performed after all the cable has been installed, spliced and terminated.
- F. All fiber cable shall be single-mode or hybrid Hitachi/Corning Fiber containing twelve multi-mode fibers and 12 single-mode fiber rated for outside usage in duct system.

PART 3 INSIDE PLANT (ISP)

3.01 CONFIGURATION AND SPECIFICATIONS FOR ISP

- A. Where existing sleeves, riser conduit, etc., are insufficient for new riser cable, construction of new sleeves, cores, and conduit or raceway shall be proposed and included in the contractor's purchase price. A minimum of twelve inches is required between all phone/data services and any electrical circuits or other low voltage wiring (ie, fire alarms, environmental controls, door controls, etc). This is a US:IT requirement.
- B. There must be a 50% growth factor built in on all conduit runs used for Voice, Data and Video jacks. Minimum conduit for station runs will be 1" trade size conduit with proper fittings. A 1" NMT non-metallic tubing properly installed meeting all NMT requirements of NEC/BISCI and US:IT is also acceptable. There will be NO DAISY CHAINING of jacks for any reason. A pull string needs to be installed in all conduits used for ISP/OSP cabling.
- C. Open Ceiling – All conduits will be installed to the proper IDF/BDF or will be terminated near or above an installed cable tray or pathway.
- D. Suspended Ceiling – All conduits will be installed to proper IDF/BDF or stubbed above the ceiling grid. Approved cable tray will be installed in all corridors providing a continuous pathway back to the proper BDF/IDF.
- E. All old cables are to be removed as required by the NEC.

3.02 CABLE ROUTING

- A. It is mandatory that the Contractor makes use of and provides cable pathway materials between all building MDFs, BDFs or IDFs. A 50% growth factor must be provided when a job is completed. A minimum of 12 inches shall be kept between all data and electrical pathways when being designed (US:IT requirements).
- B. Such pathway materials may include:
 - 1. Finished and exposed metal cable tray, ladder, raceway, or J-Hooks.
 - 2. Enclosed conduit or wireway through walls or ceiling plenums.
 - 3. Sleeves and conduit.
 - 4. Other materials as the contractor may require.
- C. When a pathway must be created in an existing building, the following concealment methods are acceptable:
 - 1. Dry wall: fishing of hollow wall cavities.
 - 2. Plaster or Tile Wall: Electric ivory wire mold.
 - 3. Drop ceiling: Velcro every 10' and avoid lighting fixtures and all electrical conduit and raceway.
 - 4. Utility Corridors: Concealment not required; Velcro every 10' to (chases and trays) to self-supporting hangers, avoid receptacles and all electrical conduit/raceways. Clear and free conduit or riser sleeves are available for use wherever they are found and should be used first.
 - 5. Raceway shall be installed where indicated and when required to run on the surface of a wall. Raceway shall be Panduit and must be properly sized and meet the installation requirements of the manufacturer of the cable to be installed.

APPENDIX B

- D. All cable paths must meet all applicable codes, BICSI and ANSI/TIA/EIA standards.
- E. Approved Cable Tray or J-Hooks must be mounted no more than 12" above suspended ceiling, or 8' 6" in open corridors. A usable pull string is to be left in each cable tray or conduit on completion of cable installation.
- F. It should be noted that US:IT will not supply pathway materials.
- G. All raceways used for Telecom/Data shall be on the Approved Materials List (Appendix A). They shall be sized properly for use. ONLY proper fittings for raceway shall be used.
- H. Cables for voice and data shall not exceed 280' end to end.

3.03 CAT 6 REQUIREMENTS AND PARTS

- A. All data cables shall be CAT6e Hitachi part # 30212-8 or Cat 6e Plenum Hitachi part # 30183-8.
- B. All data cables will be blue, unless specified by Architect to match ceiling color.
- C. All dorm jacks shall be installed at 33" above finished floor.
- D. All E&G building jacks shall be installed 16" above finished floor.
- E. All CAT6 cable shall be installed according to the NEC code, BICSI standards and EIA/TIA standards.
- F. All CAT6 cable shall terminated on blue Panduit jacks per Appendix A: Approved Materials List. Faceplates should be electric ivory.
- G. All CAT6 cable shall be 23 AWG and 8 conductors terminated as 568-A standards allow.
- H. All raceway installed to be used for CAT6 installation must meet all BICSI standards as well as ANSI/TIA/EIA standards.
- I. Cables shall terminate in proper Siemon part #HD6-24 patch panels rated for CAT6 specs, RJ45 faceplates with 110 terminations on back.
- J. Patch cables rated for CAT6 100mb are to be supplied and installed.
- L. Velcro will be used as required to tie and support cables.

3.04 DISTRIBUTION FRAME REQUIREMENTS

- A. All data telecommunication rooms are for **INFORMATION TECHNOLOGIES USE ONLY**; any other equipment needing IT service should be located in a separate mechanical/electrical room.
- B. IDF and BDF room construction shall be included in new construction and renovation Building Design blueprints. The BDF closets shall be on the lowest floor level of the building being served. An IDF closet is required for each floor above the lowest floor in order to keep distance requirements for CAT6 wiring within specifications. All BDF/IDF closets shall be designed as shown in the diagram below. Materials for this requirement are shown in the diagram.
- C. For building re-cabling projects, Contractor will be required, prior to start of project, to submit a floor-by-floor list of where new BDFs and IDFs will be required.

APPENDIX B

- D. All BDF and IDF rooms shall be a minimum of 10' x 12' x 10', with signage indicating that the room is a data telecommunications facility. All data telecommunication rooms must have a 3' door swinging out into the hallway.
- E. BDF/IDF rooms shall be keyed to the telecommunications master key and/or configured for key card access.
- F. BDF/IDF rooms will be environmentally controlled to maintain 30-50% humidity and 65-75 degrees Fahrenheit.
- G. BDF/IDF rooms will have a switched light with 50 ft. candles available and at least two isolated duplex outlets rated for 20 amps with one NEMA 5-20P receptacle per circuit installed in the wire management of the data rack at 18" above finished floor. Convenience outlets should be located as appropriate on circuit(s) separate from the data rack.
- H. A # 4 copper ground wire, properly installed and terminated on a bus bar, will be required in all BDF rooms. A covered # 6 copper ground wire and bus bar must be installed at each IDF from main grounding frame in BDF and from racks installed at each IDF/BDF.
- I. Two 4" conduits with pull strings will be installed from BDFs to IDFs..
- J. Three 4" conduits with pull strings will be installed to BDF from OSP manholes.
- K. All conduit, coring, and equipment backboards must be supplied and installed by the general contractor.
- L. No sprinkler heads should be installed within the BDF/IDF rooms. Heat/smoke detectors should be installed where necessary for fire code compliance.
- M. One wall having a 4' x 8' x 3/4" sheet of plywood attached painted with fire retardant paint is required in the BDFs and IDFs. Plywood should be vertically mounted behind the racks installed 2' off the finished floor.
- N. The Contractor shall install a 25 pair feeder cable for voice to the BDF room from each IDF room. These cables should run in pipe chases of 4" conduits. A 12 strand/12 fiber riser cable will be run from BDF to each IDF for data feed. BICSI and NEC standards and US:IT requirements must be met. RJ11 coax shall be installed to each IDF from the BDF.
- O. All cable will be marked clearly and legibly at both ends.
- P. All cables and fiber shall be terminated on a 7' x 3" x 19" rack. All installed equipment shall meet all BICSI requirements as well as US:IT requirements. All racks shall be properly bonded to ground bar in IDF/BDF rooms.
- Q. Contractor will install wire management hardware on three (3) walls above the racks in preparation of installation of termination equipment (see diagram included in this document BDF/IDF requirements closet).
- R. Single-mode fiber will be fusion spliced to factory ceramic SC and SC/APC pigtails.
- S. Multi-mode fiber will be fusion spliced to factory ceramic SC pigtails.
- T. All fiber patch panels are to be selected from the Approved Materials List (Appendix A) and sized to accept fibers from the OSP plant as well as riser for the IDFs.

3.05 CABLE SUPPORT AND RACK PRODUCTS

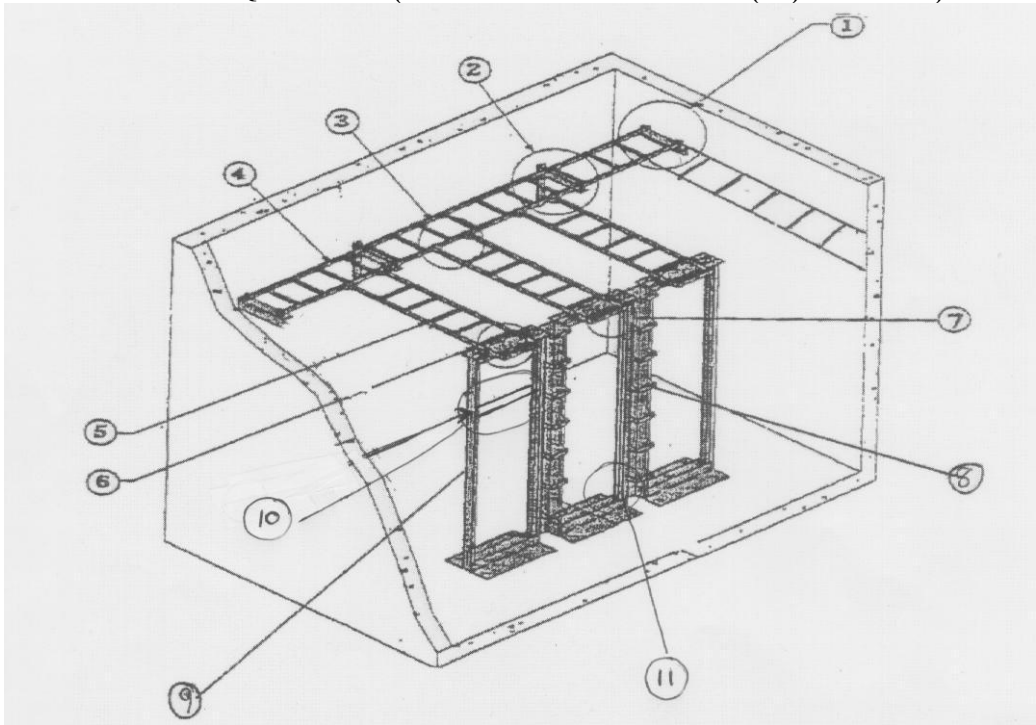
- A. All material to be installed to product specifications.

APPENDIX B

- B. All material to match cable trays installed in the building.
- C. All racking and cable tray to be grounded with # 6 green PVC ground wire.

APPENDIX B

BDF/IDF REQUIREMENTS (EXAMPLE USING B-LINE AND (SB) HARDWARE)



Item Number	Description of Item
1	End Bracket Relay Wall Bracket
2	Runway Wall Bracket
3	90 deg. Splice Bar
4	Fast Splice Bar
5	Cable Runway B-Line
6	Splice Washer Kit
7	Runway Termination Kit
8	Copper B-Line Vertical Management
9	Copper B-Line Aluminum Rack
10	Horizontal Management
11	20 AMP Dedicated Electrical Outlet

NOTE: Wire management required around each frame: top, bottom and side. This will be sized to fit each building requiring size changes to match density and count of building. All products and fittings are B-Line Cable Tray and fittings.

APPENDIX B

3.06 CABLE NETWORKS IDENTIFICATION AND LABELING

- A. Each contractor shall permanently mark all cables with permanent labels.
- B. Labels shall be waterproof materials with indelible text information and mechanical attachment or waterproof adhesive.
- C. Each required label location shall contain all fields of required information below.
- D. Required identification information shall include the following items, combined to produce a unique and non-duplicating identification for each cable. No two jacks within the cable plant shall have the same number.
 1. Each network jack should be identified using the following 6-digit format: ABCCCD, where A represents a letter, A-Z, identifying the closet for the jack; B represents the floor where the jack is installed, CCC 3-digit number identifying the drop; and D represents a letter, A-Z, identifying the jack in a faceplate/biscuit box.
 2. All jacks within a drop should be identified as A-Z, left-to-right, top-to-bottom, like reading a book. For example, a 4-jack faceplate would use the following layout:

A	B
C	D
 3. There are two special cases for jack lettering:

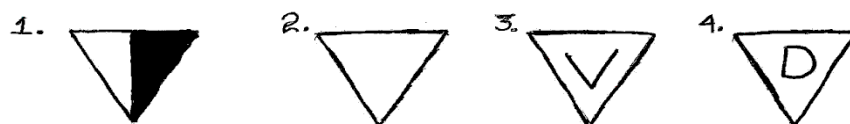
W	- Wireless Jack
V	- Dedicated voice jack.
- E. Jacks shall show termination location; floor location and BDF/IDF location as follows:
 1. Each network jack should be identified using the following 6-digit format: ABCCCD, where A represents a letter, A-Z, identifying the closet for the jack; B represents the floor where the jack is installed, CCC 3-digit number identifying the drop; and D represents a letter, A-Z, identifying the jack in a faceplate/biscuit box.
 2. All jacks within a drop should be identified as A-Z, left-to-right, top-to-bottom, like reading a book. For example, a 4-jack faceplate would use the following layout:

A	B
C	D
 3. There are two special cases for jack lettering:

W	- Wireless Jack
V	- Dedicated voice jack.
- F. The faceplate should have a label which clearly identifies the drop. In the case of the first wallbox in the example above, the label would be shown as "A1001" where A and B are assumed to be correctly ordered left-to-right, top-to-bottom. Labeling should not include punctuation, such as hyphens, periods, or number signs; and should not include spaces.
- G. When possible, installers should make an effort to have jacks terminated in numerical sequence for the patch panels based on jack numbers for new work. In installations where a significant number of wireless jacks are run (12 or more in a closet), all wireless jacks should be terminated on dedicated patch panels.
- H. Cables need to be toned, tested, and correctly labeled at the time of installation.
- I. Riser fiber cable shall be labeled to clearly indicate source/destination and fiber locations.

3.07 UNIFORM WIRING PLAN (UWP)

- A. Below are the jacks and symbols to be used by the contractor when cables and terminations are installed. Panduit jacks and equipment will be used. All jacks will be wired as 568A and meet CAT6 certification.



- B. UWP#1s – Consists of three separate cables (23 AWG), 2 blue data and 1 RG6 coax. (See symbol 1 above).

APPENDIX B

- C. UWP#2s – Consists of two separate cables (23 AWG), 2 blue data, these are the standard for all offices. (See symbol 2 above).
- D. UWP#3s – 1 blue voice cable only (23 AWG). This jack is used for alarm circuits mostly. (See symbol 3 above).
- E. UWP#4s – 1 blue data cable (23 AWG). Used where no phone will ever be needed but data transmission is required. An example would be an in-house billing system, i.e. Harco. (See symbol 4 above).

3.08 VOICE AND DATA CABLE SPECIFICATIONS FOR HORIZONTAL CABLING

- A. Cables will be 23 AWG 8 conductors Unshielded Twisted Pair (UTP).
- B. All cables will be blue category 6 four pair and comply with EIA/TIA 568A standards.

3.09 VIDEO WIRING PLAN (UMP)

- A. The contractor must install F59SSV quad shielded RG 6 type drop cables for subscriber loop locations. RG6 type subscriber drop cables are used to interconnect the TV outlet with multi-tap devices that will be installed at the BDFs or IDF.
- B. At the outlet, the contractor shall terminate the cable in the outlet connector using an F10F10S11-X straight jack. The TV outlet shall then be terminated using a 75-ohm F terminator.

3.10 VIDEO RISER CABLES

- A. Where video riser cables are required between floor types F11SSEF and single-mode fiber will be installed.
- B. Routing of video riser cables follows voice cable installation from floor to floor.

3.11 WIRELESS NETWORKING REQUIREMENTS

- A. One (1) 1” conduit run to each location for networking cables.
- B. Conduits will terminate either at BDF, IDF or above the cable trays with CAT6 data cable being installed.
- C. All ANSI/TIA and NEC codes or requirements must be met.
- D. When mounting wireless access points, contractor will follow procedures detailed in “Appendix B: Wireless AP Mounting Guidelines”

3.12 CAMERA INSTALLATION

- A. A 1” conduit will be installed from the camera location back to the cable tray or above suspended ceilings or to the BDF/IDF.
- C. A blue CAT6 data cable shall be installed and terminated in an RJ45 Panduit jack near the camera location in either a standard box with faceplate or with a surface mount “biscuit” box.
- D. Camera installation contractor shall be responsible for cabling from the data jack to the camera.
- E. Jack shall be labeled to show proper BDF or IDF location as detailed in the Labeling Section above.

APPENDIX B

3.13 OUTSIDE EMERGENCY PHONES / POLE-MOUNTED CAMERAS

- A. Two 1¼” conduits run to pedestal location, 1 for Telecom/fiber cables, and 1 for electrical circuit to be installed with ground fault interruption 20 Amp minimum 120v rated. Each to be terminated in the proper equipment rooms, i.e. electric to electric panel, IT to proper BDF room.
- B. 1¼” conduits need to be rated for outdoor use, PVC schedule 40 recommended.
- C. Symbol for location(s) is:



3.14 US:IT VOICE AND DATA CABLE SPECIFICATIONS FOR JACKS

- A. All cables are 23 AWG 8 conductors unshielded twisted pair cable.
- B. Category/Level 6 – cable must be 8 conductor and comply with EIA/TIA 568-A standards.
- G. Category/Level 6 – When requested for installation, specs will be given and approval from Telecommunications on the cable to be installed will be given.
 - 1. Characteristics:
 - a. Propagation Delay @ 10 MHZ 5.7 per/meter.
 - b. Delay Shew @ 25NS/100 meters.
 - c. Attenuation crosstalk 11.4 db @ 250 MHZ.
 - 2. Specifications:
 - a. Blue PVC jacket.
 - b. 8 Conductors 23 gauge.
 - c. DC Resistance 9.38/100 meters.
 - d. DSC Resistance unbalanced 5% maximum.
 - e. Pair to ground capacitance unbalanced maximum @ 1 KHZ 100m.
 - 3. Transmission Properties:
 - a. Freq 427.0.
 - b. Maximum attenuation @ 20 deg. Celsius 50.5.
 - c. Near end crosstalk worst pair combination 64-15log (F/00.772).
 - d. Power Sum N/A.
 - e. Worst Pair SRL 10 db.
 - f. Resistance OHMS 100 115%.
 - g. Impedance @ 250 MHZ 100 ± 15%.

3.15 INSTALL LEVEL 6 STANDARDS

- A. ANSI/TIA.E1A 568A Category 6 E (400 MHZ):
 - 1. 155 mbps ATM and 100 mpbs Ethernet.
 - 2. 4 pair 23 gauge copper.
 - 3. ISO/IEC 11801.
 - 4. Min Bend Radius .820.
 - 5. PVC Blue Jacketed.
 - 6. Cable markings starting at 0 to 1000' per box.
 - 7. Non Plenum 75N4.
- B. ETL Verified Electrical Performance:
 - 1. CAT6 STANDARDS:
 - a. Input Impedance 100 ohm ± 15 ohm 1-100 MHZ.
 - b. Capacitance 4.6 NF/100 m nominal.
 - c. DE Resistance/Unbalanced 6.66 ohms/100 m max.

APPENDIX B

- d. Propagation Delay 5.7 N/SEC/m mac at 10 MHZ.

3.16 ISP – DATA FIBER INSTALLATIONS

A. Specifications for Altos/Lst Cables:

1. Maximum attenuation: 3.5/1.0.
2. Minimum bandwidth: 120/500 850 MHZ to 1300 MHZ.
3. Gigabit Ethernet Distance Guarantee 500/1000.
4. Multi-mode/Single-mode.
5. Graded Index: 50 Gigabit Plus CL.
6. 62.5/125 micron core diameter (+/-3).
7. Maximum Tensile Loading: 600 lbf.

B. The Contractor is responsible for installation and testing of fiber. A loss of more than 2dB is not acceptable.

C. All fiber cable must be installed in accordance with manufacturer recommended tensile specifications.

D. All fiber cables shall be terminated in an approved patch panel using SC ceramic ferrule connectors. Single-mode fiber must also be properly terminated and marked using SC or SC/APC pigtails, both need to be fusion spliced. Labels shall show the destination of each data fiber optic strand.

E. All installed fiber must be tested with an Optical Time Domain Reflectometer (OTDR) to ensure cable integrity. An OTDR graph must be delivered to the University.

PART 4 TEST RECORDS AND DOCUMENTATION

4.01 TEST RECORDS FOR ISP/OSP

- A. Contractor will test each OSP pair in each cable on an end-to-end basis after terminating. Maximum allowable defective pairs will be limited to 1% of the total number of pairs and a maximum of one (1) pair per 25-pair binder group. Defective pairs over 1% will require cable repair or replacement at the Contractor's expense.
- B. ISP testing for each station cable is required with zero defective pairs acceptable.
- C. The Contractor, at no cost to the University, will replace cables rejected by the US:IT department with new cable from end to end.
- D. Records of testing will be delivered to US:IT in digital format.
- E. CAT6 and/or CAT 6A certification must be received prior to final payment.
- F. Building will not be accepted for service prior to records being received, thus no service will be provided.

4.02 DATA FIBER TESTING

- A. All fiber cable must be tested to guarantee the performance integrity of cables, bends, tensile loads and terminations or cross connects.
- B. Each fiber cable must be tested for loss and bandwidth. Tests shall be performed upon completion of installation and termination.
- C. Any cable that is found to be defective shall be repaired or replaced at the Contractor's expense.
- D. An OTDR graph must be provided for each fiber strand tested.

APPENDIX B

- E. Testing must be accomplished with an OTDR.

4.03 CLOSE-OUT DOCUMENTATION

- A. Contractor will supply in standard digital CAD format, floor plans showing the location of each data jack.
- B. Contractor will supply warranty documentation for all materials used and installation.
- C. Contractor will supply a cable schedule in a standard spreadsheet format showing each jack label associated to room and data closet.

END OF SECTION 27 00 00

APPENDIX B

University of Maine System Parts List**Cable**

Hitachi	Cat 6e Premium PVC	30212-8
Hitachi	Cat 6e Premium Plenum	30183-8
Hitachi	Cat 6 OSP Black Cable	30180-8
Hitachi	Cat 6a PVC	30222-8

Jacks, Faceplates and Panels

Panduit	MINI-COM TG6 PLUS JACK-CAT6	CJ688TGBU
Panduit	CAT 6A Module - Blue	CJ6X88TGBL
Panduit	4 Port Classic SG Faceplate Electric Ivory	CFPL4EIY
Panduit	Minicom 6 Port Design Faceplate Electric Ivory	CFPL6EIY
Panduit	10 port Double Gang Faceplate - Electric Ivory	CFPE10EI-2GY
Panduit	Wallphone Plate CAT 6	KWP6PY
Panduit	SMB for 1 or 2 Mini-Com Mods Electric Ivory	CBXJ2EI-A
Panduit	Minicom Blank Module Electric Ivory	CMBEI-X
Panduit	4 Port 106 Frame - Electric Ivory	CF1064EIY
Siemon	24P HGHDN PNL C5E T568A/B	HD5-24
Siemon	C6 24PT PNL 1RMS T568A/B	HD6-24
Siemon	CAT6A,24 PORT,1U,BLK,w/jacks	Z6A-PNL-24K
Belden	GIGABIX RACK MOUNT PANEL	AX101986
Belden	Gigabix Connector 25 Pair	AX101448
Belden	GIGABIX MOUNT,12-CONN,(EMPTY)	AX101472
Belden	Gigabix Designation Strip	AX101483
Belden	Bix Distribution Connector, 5-Pair Marking	A0266828
Panduit	5" D-Ring Cable Mgmt	CMPHH2
L-Com	Data Line Protector Indoor/Outdoor 1GB Poe 802.3At 60V	LPXT-WP-GB-POE+60V
L-Com	Data Line Protector Indoor/Outdoor 1GB Poe 802.3Bt 60V	LPXT-WP-GB-POE++60V
ITW-Links	Cat 6 Protector 110/110 16V	CAT6-LAN

Telecommunications Closet

Chatsworth	CUBE-iT PLUS Wall Cabinet; 19"W x 36"H x 30"D; Black; 18 RMU; Top Panel	12419-736
Chatsworth	Cube-iT PLUS Cabinet Extra Mounting Rails; Clear	12787-536
Allen-Tel	4U HINGED WALL BRACKET	AT55HM-7
Chatsworth	Standard two post equipment rack	55053-703
Chatsworth	Double-Sided Wide Vertical Cabling Section; 6"W x 7'H x 12.75"D; Black	11729-703
Dottie	Concrete Wedge Anchor	W12234
Chatsworth	Universal Cable Runway; 12"W x 1.5"H x 9.96"L; Black; CableCapacity - 629	10250-712
Chatsworth	3" Channel Rack-To-Runway Mounting Plate Using J-Bolts 9 to 12" W; Black	10595-712
Chatsworth	Junction-Splice Kit; 0.38"W x 1.5"H; Black	11302-701
Chatsworth	Wall Angle Support Kit 3/16"; 14"W x 2"H x 2"D; Black	11421-712
Chatsworth	Butt-Splice Kit; 0.38"W x 1.5"H x 5"L; Black	11301-701
Chatsworth	Triangular Support Bracket; Black	11312-712
Chatsworth	Chatsworth; Cable Runway Wall to Rack Kit; 12"W x 54"L; Black	11911-712
Any	6 AWG; GROUND WIRE #6--GREEN SOLID	6 AWG
Any	Burndy; Burndy - One Hole Lug for #6	KA6U
Chatsworth	TMGB Pattern Busbar; 4"W x 0.25"H x 12"L; Copper	40153-012

APPENDIX B

Surface Raceway and Pathway Material

Panduit	LD10 Low Volt 1-Piece Single Channel Raceway Electric Ivory	LD10EI8-A
Panduit	LD10 Low Volt Drop Ceiling Fitting Electric Ivory	DCF10EI-X
Panduit	LD10 Low Volt Coupler Fitting Electric Ivory	CF10EI-X
Panduit	LD10 Bend Radius Tee Fitting - Electric Ivory	TFC10EI-X
Panduit	LD10 Low Volt Outside Corner Fitting Electric Ivory	OCF10EI-X
Panduit	LD10 Low Volt Inside Corner Fitting Electric Ivory	ICF10EI-X
Panduit	LD10 Low Volt Radius Right Angle Fitting Electric Ivory	RAFC10EI-X
Panduit	LD10 Low Volt End Cap Fitting - Electric Ivory	ECF10EI-X
Panduit	Single Gang Box & Cover Electric Ivory	JBX3510EI-A
Panduit	LD10 Low Volt 1-Piece Single Channel Raceway White	LD10WH8-A
Panduit	LD10 Low Volt Drop Ceiling Fitting White	DCF10WH-X
Panduit	LD10 Low Volt Coupler Fitting White	CF10WH-X
Panduit	LD10 Bend Radius Tee Fitting - White	TFC10WH-X
Panduit	LD10 Low Volt Outside Corner Fitting White	OCF10WH-X
Panduit	LD10 Low Volt Inside Corner Fitting White	ICF10WH-X
Panduit	LD10 Low Volt Radius Right Angle Fitting White	RAFC10WH-X
Panduit	LD10 Low Volt End Cap Fitting - White	ECF10WH-X
Panduit	Single Gang Box & Cover White	JBX3510WH-A
Wiremold	STL DEVICE BOX IVORY	V5741
Wiremold	NM RACEWAY BASE 2 COMP 5400 IVORY 8' section	5400TB
Wiremold	NM WIRE CLIP 5400	5400TWC
Wiremold	NM RACEWAY COVER 5400 IVORY 8' Section	5400C
Wiremold	NM COVER CLIP 5400 IVORY	5406A
Wiremold	NM BASE CLIP 5400 IVORY	5406TB
Wiremold	NM END CAP 5400 IVORY	5410
Wiremold	NM FIBERREADY ENTRANCE END 5400 IV	5410DFO
Wiremold	NM FIBERREADY FLAT ELBOW 5400 IVORY	5411FO
Wiremold	NM TEE 5400 IVORY	5415
Wiremold	NM FIBERREADY DIV TEE FTG 5400 IV	5415FO
Wiremold	NM FIBERREADY INT. ELBOW 5400 IVORY	5417FO
Wiremold	NM EXT. ELBOW 5400 IVORY	5418
Wiremold	NM FIBERREADY EXT. ELBOW 5400 IVORY	5418FO
Wiremold	NM TRANSITION FTG 5400 IVORY	5474
B-Line	Flex Tray 6" Basket Tray	FT2X6X10
B-Line	Flex Tray 6" Basket Tray Bottom Insert	INSERT 6X118
B-Line	Flex Tray 6" Basket Tray Top Cover	6 IN COVER
B-Line	Flex Tray Trapeze support clip	TRAPEZE SUPT2
B-Line	Flex Tray 3/4" conduit connector	FTA075CC
B-Line	Double sided vertical cabling section AL	SB57166D084AL
Erico	CAT64 - NO ATTACHMENT HARDWARE	CAT64
Erico	CAT32 - NO ATTACHMENT HARDWARE	CAT32
Erico	CAT12 - NO ATTACHMENT HARDWARE	CAT12
Erico	1/2 ADJUSTABLE BEAM CLAM	BC

APPENDIX B

Erico	Metallics; 1/4-20X3/4 RH MACHSCR	JRM100
Arlington	Arlington; 1-IN NM TERMINATOR	EMT100
Any	3/4" EMT 10' sticks	ANY
Any	3/4" EMT LB Conduit Body	LB25
Any	3/4" EMT Connector	3/4EMTC
Any	3/4" EMT Coupling	3/4" EMTCP
Any	3/4" EMT 1-Hole Strap	1902
Raco	Raco; SQUARE BOX 4 -2-1/8DP 1/2+TKO	232
Raco	Raco; 4 square box reducer plate	8772
Maxcell	Maxcell; MXC4003XX; 4" 3 Cell Standard Fiber Duct	MXC4003XX

Fiber Cable and Parts

Hitachi	12F SM OS2 In/Out Tight Buffered Plenum	61459-12
Hitachi	12 Fiber I/O OM1 62.5 (OFCP)	61460-12
Hitachi	Armored - Indoor Tight Buffered SM 12 Strand Plenum	61433-12
Hitachi	Armored - Indoor Tight Buffered OM3 12 Strand Plenum	61337-12
Corning	Closet Splice Housing	CSH-05U
Corning	PRETIUM 4U RK MNT ENCL	PCH-04U
Corning	Splice Tray Bracket for PCH-04U	PC4-SPLC-12SR
Corning	PRETIUM 1U RK MNT ENCL	PCH-01U
Corning	Splice Tray Enclosure 4CCH Panels	CCS-03U
Corning	CLOSET CONN SPLICE HOUSING 2 CCH PNL	CCS-01U
Corning	Splice Tray .2-in 12F	M67-048
Corning	12 FIBER FUSION SPLICE TRAY	M67-110
Corning	SM SC Pigtailed 2m	005801R4131002M
Corning	MM 62.5 SC Pigtailed 2m	003901K3130002M
Corning	2m Fiber Pigtailed OM3/SC Connector	003901T3180002M
Corning	12F Duplex SM SC Adapter	CCH-CP12-59
Corning	PNL W/6 MM DPLX SC SLVS PB INSERT	CCH-CP12-91
Corning	CCH PNL W/6 SC MM SX	CCH-CP12-E7

OSP/ISP Copper

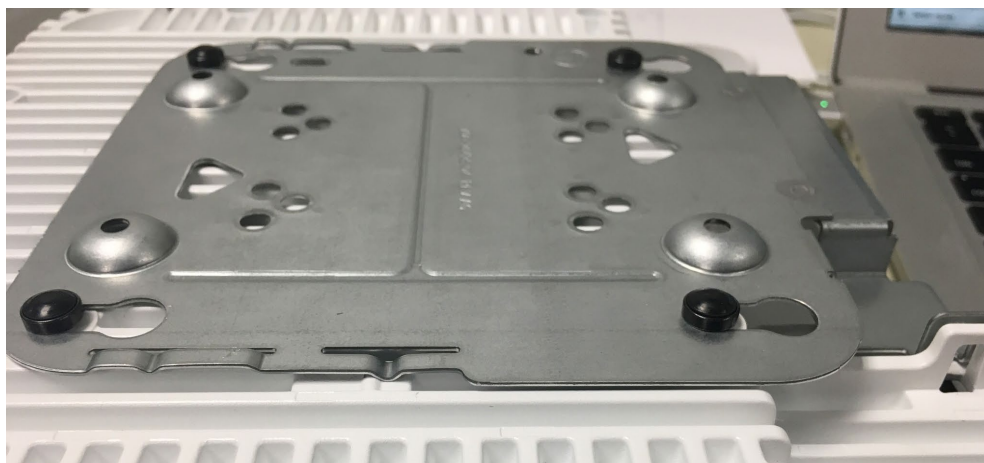
Superior E	Superior Essex; 25X24 UTP CAT3 CMR GY 500 RL	18-453-33
Superior E	50X24 UTP CAT3 CMR GY MSTR	18-599-33
General C	General Cable; OSP 25 Pair Cat3	DB25P24AL89GCC
Circa	CIRCA; 25 PR-110 IN/OUT-WITH COVER	1880ECA1-25
Circa	CIRCA; 100 PR-110 IN/OUT-WITH COVER	1880ECA1-100
Circa	CIRCA; 350V 5 PIN - 3B1 SERIES	3B1E-350V



Wireless AP Mounting Guidelines

1. General Guidelines

- 1.1. AP mounts should be 8' from floor to the bottom of the mounting bracket, but can go as high as 15ft or as low as 7ft if necessary.
- 1.2. For rooms with soffits, the AP must be below the soffit level.
- 1.3. For ceilings with exposed pipes, beams, HVAC units or light fixtures, the AP must be below these elements.
- 1.4. If preparing to run a jack to a location within 3ft of an HVAC duct or a light fixture that hangs below the ceiling, contact Networkmaine before installation.
- 1.5. AP should be mounted horizontally in all cases such that the LED faces the floor.
- 1.6. Ensure that all four AP feet are in the bracket securely as depicted below.



- 1.7. Use a plastic zip tie through the lock hasp on the back of the AP to prevent AP from being accidentally knocked off the bracket.
- 1.8. If some anomaly prevents installation at the intended location, or if the contractor has any general questions, please contact Networkmaine using the contact information at the end of this document before installation as the deployment plan may need to be modified.

2. Ceiling Mounting (Preferred)

- 2.1. Ensure that the suspended ceiling grid is correctly anchored and fastened before installing grid clips or mounting brackets. Grid rails used for AP mounting must not be free-floating.
- 2.2. If working with standard or recessed t-rail ceiling grid, use either Cisco AP bracket model AIR-AP-BRACKET-1 or AIR-AP-BRACKET-2 and recessed ceiling grid clip AIR-AP-T-RAIL-R.
- 2.3. For generic hard ceilings or ceilings with exposed beams or pipe work, use 4-square electrical boxes and screw the universal AP mounting bracket (AIR-AP-BRACKET-2) to the 4-square box.
- 2.4. In the case of exposed beam ceilings, or open ceilings with pipes, 4-square boxes should be mounted to the bottom of the beam or pipe. Alternatively, a right-angle bracket (Oberon 1011-00) may be attached to the beam such that the AP is hanging below the beam

3. Wall Mounting

- 3.1. Use appropriate strength fasteners. For example, toggle bolts if mounting a right-angle bracket into drywall.
- 3.2. Right-angle in most cases (Oberon 1011-00); for Gyms use Oberon part 1020-RAB.
- 3.3. If using Oberon part 1011-00 and Cisco AP 3802I, screw Cisco mounting bracket (AIR-AP-BRACKET-2) to the bottom such that the locking mechanism is facing the wall.
- 3.4. If using Oberon part 1011-00 and Cisco AP 3702I or earlier, use the ceiling rail adapter included with the angle bracket to emulate suspended ceiling mounting.
- 3.5. For in-place replacement of an old AP (rip-replace) which was surface mounted, you can surface mount the universal AP mounting bracket (AIR-AP-BRACKET-2).

APPENDIX B

Hardware Images



AIR-AP-BRACKET-1
AP Bracket: Low-Profile



AIR-AP-BRACKET-2
AP Bracket: Universal



AIR-AP-T-RAIL-R
Ceiling Grid Clip (Recessed)



AIR-AP-T-RAIL-F
Ceiling Grid Clip (Flush)



Oberon 1011-00

APPENDIX B

Contact Information

Mail:

Networkmaine

5752 Neville Hall

Computing Center

Orono, ME 04469-5752

Phone:207-581-3587

Email: support@maine.edu

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Protecting existing vegetation to remain.
 - 2. Removing existing vegetation.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above- and below-grade site improvements.
 - 6. Disconnecting, capping or sealing, and abandoning site utilities in place, or removing site utilities, where directed.
 - 7. Temporary erosion- and sedimentation-control measures.
 - 8. Removal of existing building foundations, footings and slabs after the framed structure has been removed; and below-grade utility structures.
- B. Related Sections in other Divisions:
 - 1. "SITE EROSION CONTROL NOTES" plan for temporary erosion and sedimentation control procedures.

1.03 DEFINITIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch (25 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined as a circle around each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 MATERIAL OWNERSHIP

- A. Cleared materials shall become Contractor's property and shall be removed from Project site, except for stripped topsoil and other materials that are indicated to be stockpiled, salvaged, or otherwise remain the Owner's property.

1.05 SUBMITTALS

- A. Product Data: For each type of product.
- B. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs or video.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.06 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

1.07 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where directed.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
 - 1. Pre-mark the boundaries of your planned excavation with white paint, flags or stakes, so utility crews know where to mark their lines.
 - 2. Call Dig Safe, at either 811 or 1-888-DIGSAFE, at least 72 business hours - but no more than 30 calendar days - before starting work. Don't assume someone else will make the call.
 - 3. If blasting, notify Dig Safe at least 24 business hours in advance.
 - 4. Wait 72 business hours for lines to be located and marked with color-coded paint, flags or stakes. Note the color of the marks and the type of utilities they indicate. Transfer these marks to the As-Built drawings.
 - 5. Contact the landowner and other non-member utilities (water, sewer, gas, etc.), for them to mark the locations of their underground facilities. Transfer these marks to the As-Built drawings.

6. Re-notify Dig Safe and the non-member utilities if the digging, drilling or blasting does not occur within 30 calendar days, or if the marks are lost due to weather conditions, site work activity or any other reason.
 7. Hand dig within 18 inches in any direction of any underground line until the line is exposed. Mechanical methods may be used for initial site penetration, such as removal of pavement or rock.
 8. Dig Safe requirements are in addition to town, city and/or state DOT street opening permit requirements.
 9. For complete Dig Safe requirements, visit their website.
 10. If you damage, dislocate or disturb any underground utility line, immediately notify the affected utility. If damage creates safety concerns, call the fire department and take immediate steps to safeguard health and property.
 11. Any time an underground line is damaged or disturbed, or if lines are improperly marked, you must call Dig Safe.
- D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
- E. The following practices are prohibited within plant or tree protection zones:
1. Storage of construction materials, debris, or excavated material.
 2. Parking vehicles or equipment.
 3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- F. Do not direct vehicle or equipment exhaust towards plant or tree protection zones.
- G. Prohibit heat sources, flames, ignition sources, and smoking within or near plant or tree protection zones.
- H. Soil Stripping, Handling, and Stockpiling: Perform when the topsoil is dry or slightly moist.
- I. Restore surfaces disturbed during construction, including stockpile and storage areas, to their pre-construction condition, or better. Leave vegetated areas smooth and finished with loam, seed, and erosion control mulch and mesh. Restore damaged paved areas with new pavement to the existing thickness.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Erosion and sedimentation control materials and methods are described on drawing entitled, 'Site Erosion Control Notes'.
- B. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving".

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.
- C. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #79, Alkyd Anticorrosive Metal Primer or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.
 1. Use coating with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction. The Contractor shall conduct his operations in conformity with all Federal and State permit requirements concerning water, air, or noise pollution, or the disposal of contaminated or hazardous materials. Erosion control measures shown on the Plans are minimum only and are not intended to be complete. Satisfy the current requirements of the regulatory agencies. Comply with materials and procedures listed on the 'SITE EROSION CONTROL NOTES' plan, for temporary erosion and sedimentation control.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross plant or tree protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.03 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site
- B. Where excavation for new construction is required within tree protection zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 1. Cover exposed roots with burlap and water regularly.

2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 3. Coat cut faces of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 4. Backfill with soil as soon as possible.
- C. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

3.04 EXISTING UTILITIES

- A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed, or abandoned in place.
1. Arrange with utility companies to shut off indicated utilities.
 2. Owner will arrange to shut off indicated utilities within his control, when requested by Contractor.
- B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Architect not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's or Owner's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

3.05 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 3. Recycle wood and wood debris either on-site or off-site, and do not bury or burn wood material. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches (450 mm) below exposed subgrade.
 4. Use only hand methods for grubbing within protection zones.
 5. Chip removed tree branches and recycle the material either on-site or off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

- A. Strip topsoil beneath areas receiving new construction, to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, stones and other objects more than 2 inches (50 mm) in diameter; trash, debris, weeds, roots, stumps, and other waste materials.

- B. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover with temporary seed and mulch to prevent windblown dust and erosion.
 - 1. Do not stockpile topsoil within protection zones.
 - 2. Dispose of surplus topsoil in same manner specified for surplus soil. Surplus topsoil is that which exceeds quantity required for reuse.

3.07 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, foundations, retaining walls, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 - 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.08 BUILDING, STRUCTURE, AND UTILITY BELOW-GRADE COMPONENTS

- A. Below-Grade Construction: Demolish foundation walls, below grade utilities and other construction extending below-grade.
 - 1. Remove below-grade construction, including basements, foundation walls, footings, and utility structures completely. Crush material and use for fill in compliance with Division 31 Section "Earth Moving" or remove from site and transport to recycling facilities.
 - 2. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations and utility removals with satisfactory soil materials according to backfill requirements in Division 31 Section "Earth Moving."
 - 3. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.09 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 31 20 00
EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
1. Preparing subgrades and finish grades. Cutting, filling, and providing additional materials required.
 2. Excavating, filling, and backfilling to grade.
 3. Excavating and backfilling for buildings and structures.
 4. Excavating and backfilling for buried structures, tanks, pipes, wires, and conduits inside or outside of buildings.
 5. Gravel and structural fill under buildings and structures.
 6. Subbase and base course for roadways, drives, walks, and hardscapes.
 7. Crushed stone drainage fill, including drains and soil-gas stone inside buildings.
 8. Stone riprap.
 9. Insulation board.
- B. Related Sections in Other Divisions:
1. Divisions 23 and 26 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

1.03 UNIT PRICES

- A. Unit prices for additional earth moving are referenced in Division 01 Section "Unit Prices."
- B. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
1. Excavation which measures 6'-0" or less in width, regardless of length, shall be classified as 'trench' excavation.
 2. Excavation which does not meet the requirements for 'trench' excavation shall be classified as 'open' (bulk) excavation.
 3. Where a trench 6'-0" or less in width is excavated lower than a floor subgrade, that is being excavated as 'open', the 'trench' shall be measured only below the floor subgrade. The upper portion of the excavation shall be measured as 'open'.
 4. The owner will take credit for excavation and/or fill omitted through changes from the Plans and/or Specifications at the unit price stated.
 5. 24 inches outside of concrete forms other than at footings.
 6. 12 inches outside of concrete forms at footings.
 7. 6 inches outside of minimum required dimensions of concrete cast against grade.

8. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
9. 12 inches beneath bottom of concrete slabs-on-grade.
10. 8 inches beneath pipe in trenches, and the greater of 30 inches wider than pipe or 36 inches wide.

1.04 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Gravel layer placed between the subbase course and finish pavement.
- C. Bedding Course: Gravel layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Crushed Stone(Drainage Fill): Crushed stone backfill to facilitate stormwater flow; that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
 2. Open(bulk) Excavation: Excavation more than 6 feet (3 m) in width.
 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Foundation Backfill: Clean course free-draining granular borrow adjacent to building foundation walls.
- I. Granular Borrow: Fill and backfill required beneath the building structural fill, and fill required beneath pavement subbase course.
- J. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 2 cu. yd. (1.5 cu. m) for bulk excavation, footing, trench, and pit excavation, that cannot be removed by rock excavating equipment, without systematic drilling, ram hammering, or blasting, when permitted. Fragmented "weathered" rock which can be removed by excavation equipment with "ripper" teeth will be considered earth.
- K. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- L. Structural Fill: Granular soil course placed beneath the building slabs and structural components.
- M. Subbase Course: Gravel layer placed between the subgrade and base course beneath pavement.
- N. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- O. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:
 - 1. Geotextiles.
 - 2. Insulation board.
 - 3. Warning tapes.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each soil material proposed for fill and backfill as follows:
 - 1. Classification according to ASTM D 2487; with particle gradation test results.
 - 2. Laboratory compaction curve according to ASTM D 1557.
- C. Seismic survey report from seismic survey agency.
- D. Pre-excavation Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.07 QUALITY ASSURANCE

- A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
 - 1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
 - 2. Seismographic monitoring during blasting operations.
- B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
 - 1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
 - 2. Seismographic monitoring during blasting operations.

- C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.
- D. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination".

1.08 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect or Owner, and then only after arranging to provide temporary utility services according to requirements outlined in Section 311000.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before earth moving operations, as outlined in Section 311000.
- D. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, and plant-protection measures are in place, as detailed on the "SITE EROSION CONTROL NOTES" plan, and as outlined in Section 311000.
- E. Restore surfaces disturbed during construction, including stockpile and storage areas, to their pre-construction condition, or better. Leave vegetated areas smooth and finished with loam, seed, and erosion control mulch and mesh. Restore damaged paved areas with new pavement to the existing thickness.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or a combination of these groups, free of rock or gravel larger than 6 inches (150 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 or a combination of these groups. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a 6-inch (150-mm)

sieve, 35-80 percent passing a 1/2-inch (12-mm) sieve, 25-65 percent passing a 1/4-inch (6-mm) sieve, 0-30 percent passing a No. 40 (0.425-mm) sieve, and not more than 7 percent passing a No. 200 (0.075-mm) sieve. Maximum size stone passes 6-inch sieve. MDOT spec. 703.06 Type D.

- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a 2-inch (50-mm) sieve, 45-70 percent passing a 1/2-inch (13-mm) sieve, 30-55 percent passing a 1/4-inch (6-mm) sieve, 0-20 percent passing a No. 40 (0.425-mm) sieve, and not more than 6 percent passing a No. 200 (0.075-mm) sieve. MDOT spec. 703.06 Type A.
- F. Structural Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a 4-inch (100-mm) sieve, 90-100 percent passing the 3-inch (75-mm) sieve, 25-90 percent passing the 1/4-inch (6-mm) sieve, 0-30 percent passing the No. 40 (0.425-mm) sieve, and not more than 5 percent passing a No. 200 (0.075-mm) sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a 2-inch (50-mm) sieve, 25-100 percent passing 1/4-inch (6-mm) sieve, 0-30 percent passing the No. 40 (0.425-mm) sieve, and not more than 7 percent passing a No. 200 (0.075-mm) sieve.
- H. Crushed Stone: Narrowly graded mixture of washed crushed stone; ASTM C 33; grading Size 56; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.
- I. Granular Borrow: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with maximum stone size of 4" (100-mm); the portion passing a 3-inch (75-mm) sieve shall meet the following: 100 percent passing the 3-inch (75-mm) sieve, 25-100 percent passing the 1/4-inch (6-mm) sieve, 0-50 percent passing the No. 40 sieve, and not more than 7 percent passing a No. 200 (0.075-mm) sieve. MDOT spec. 703.06 Type E - Modified.
- J. Sand: ASTM C 33; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 205 lb ; ASTM D 4632.
 - 3. Sewn Seam Strength: 142 lb; ASTM D 4632.
 - 4. Tear Strength: 80 lb; ASTM D 4533.
 - 5. Puncture Strength: 130 lb; ASTM D 4833.
 - 6. Apparent Opening Size: No. 70 sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 1.2 per second, minimum; ASTM D 4491.
 - 8. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.

9. Similar to Tencate Mirafi 180N, or approved equal.

- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 20 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
1. Survivability: Class 2; AASHTO M 288.
 2. Grab Tensile Strength: 315 lbf (1402 N); ASTM D 4632.
 3. Tear Strength: 113 lbf (503 N); ASTM D 4533.
 4. CBR Puncture Strength: 900 lbf (4005 N); ASTM D 6241.
 5. Apparent Opening Size: No. 40 (0.430-mm) sieve, maximum; ASTM D 4751.
 6. Permittivity: 0.05 per second, minimum; ASTM D 4491.
 7. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.
 8. Tencate Mirafi 600X, ADS 315W, or equal.

2.03 CONTROLLED LOW-STRENGTH MATERIAL(Flowable Fill)

- A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:
1. Portland Cement: ASTM C 150, Type I.
 2. Fly Ash: ASTM C 618, Class C or F.
 3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch (10-mm) nominal maximum aggregate size.
 4. Water: ASTM C 94/C 94M.
 5. Air-Entraining Admixture: ASTM C 260
- B. Produce conventional-weight, controlled low-strength material with 140-psi (965-kPa) compressive strength when tested according to ASTM C 495.

2.04 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Water from construction dewatering operations shall be cleaned of sediment before reaching wetlands, water bodies, streams, or site boundaries. Conform to the requirements of the Department of Environmental Protection, and Erosion Control Notes drawing C00.3.

3.03 EXPLOSIVES

- A. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
 - 1. Perform blasting without damaging adjacent structures, property, or site improvements.
 - 2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.
- B. Set no charges and do no blasting prior to coordinating schedule and locations with Owner. Prior to ledge rock blasting, perform a pre-blast survey of all structures and wells within 500 ft. of blasting locations. The pre-blast survey firm shall have 5-years experience in similar survey work. For the survey, interview the landowner of the buildings and wells, obtain a certified water test for nitrates and coliform of each well, photograph and videotape glass, plaster, chimneys, concrete foundations, and other masonry components of each structure. When blasting along roadways, take still photos at 50' maximum spacing along the construction area, and videotape the entire construction length with commercial grade equipment. When explosives are used for rock removal, the work shall be done by experienced powdermen, with a minimum of 5 years documented experience. Blasting shall be conducted in accordance with 25 M.R.S.A. ch. 318, and 38 M.R.S.A. sec. 490, and shall meet listed standards. Conduct blasting in strict accordance with current Department of Interior Rules 816.61-68 and 817.610-68, and the Blasting Guidance Manual, Office of Surface Mining, Reclamation and Enforcement, covering this type of work. Conduct blasting activity in such a manner that the peak particle velocity of ground vibration measured at the nearest property line and the locations of the nearest structures to the blast does not exceed the Asafe limits@ recommended

by the U.S. Bureau of Mines in Appendix B of BUMINES RI 8507, as indicated on Figure B-1. Blasts shall be monitored by seismographs to record the effects at the nearest property line and on structures within the survey area, and demonstrate compliance with the regulations. A record of each blast must be kept for at least one year, and must be submitted to the Department of Environmental Protection upon request. Blast records shall consist of all information listed in 38 M.R.S.A. sec. 490-Z(14)(L), including such data as location of blast, depth and number of holes, type and quantity of explosives, time, etc. To reduce the risk of flyrock, blasts shall be properly covered, using blasting mats or other appropriate methods. At a minimum, flyrock must not leave the project boundary or enter a protected natural resource. Damage to structures caused by improper use of explosives shall be corrected at the Contractor's expense. Avoid blasting which will disturb new building foundations and compacted soil backfill. Following blasting activity, blasting records, pre-blast survey, and seismograph readings shall be compiled in a report and submitted to the Owner.

- C. Rock excavation is not anticipated, however if encountered ledge rock excavation shall be paid by unit prices listed in the bid form. Conform to Section 012200. Prior to blasting and rock excavation, provide survey grades of the top of the ledge surface, and calculations of the expected rock quantities to be excavated. Submit this data and obtain Architect's approval prior to proceeding with rock excavation. The Architect will determine the extent of rock excavation and classification.

3.04 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Prior to blasting and rock excavation, provide survey grades of the top of the ledge surface, and calculations of the expected rock quantities to be excavated. Submit this data and obtain Architect's approval prior to proceeding with blasting and rock excavation. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents.
 - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Ripping of weathered ledge material, not classified as rock excavation, is classified as earth excavation.
 - 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the dimensions listed in paragraph 1.3 Unit Prices.
- B. Unsuitable Soil Excavation: If unsuitable soil, as determined by the Geotechnical Engineer, is excavated within the design limits, it will be either placed on-site if appropriate, or removed and disposed off-site, as determined by the Geotechnical Engineer. There will be no added compensation for unsuitable soil excavated within the design limits, whether hauled on-site or off-site. For unsuitable soils excavated beyond the design limits, see paragraph 3.8 SUBGRADE INSPECTION and 1.2 QUANTITY ALLOWANCE.
- C. If hazardous waste or special waste as defined by the U. S. Environmental Protection Agency or State Department of Environmental Protection is encountered during excavation, the Contractor shall avoid disturbance of that material, and shall notify the Owner immediately. The State Bureau of Oil and Hazardous Waste Control must be notified and consulted prior to disturbance of the waste or contaminated soil. Removal and disposal of contaminated materials is not

included in the Contract Bid, since it must be handled as directed by the regulatory agencies on a case-by-case basis.

3.05 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 - 1. Excavations for Footings and Foundations: Excavate using smooth bucket equipment to not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 - 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.07 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line, unless pipe inverts are shown otherwise.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: As indicated.
- C. Trench Bottoms: For ductile iron pipe, excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - 2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
 - 3. Excavate trenches 8 inches (200 mm) deeper than bottom of pipe elevation in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: For pipe materials other than ductile iron, excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
 - 1. Excavate trenches 8 inches (200 mm) deeper than bottom of pipe elevation in rock or other unyielding bearing material to allow for bedding course.

3.08 SUBGRADE INSPECTION

- A. Notify Architect and Geotechnical Engineer when excavations have reached required subgrade.
- B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements as directed by Geotechnical Engineer. Do not proof-roll wet or saturated subgrades.
 - 1. Limit vehicle speed to 3 mph (5 km/h).
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Geotechnical Engineer, and replace with compacted backfill or fill as directed.
- D. Payment for the authorized additional excavation of unsuitable material beyond the design limits, including replacement materials, will be made under the Quantity Allowance listed in paragraph 1.2 B, of this section.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Engineer, without additional compensation.

3.09 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, damp-proofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Place and compact initial backfill of bedding course material, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- D. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- E. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use granular borrow material beneath gravel subbase.
 - 3. Under building steps and ramps, use structural fill.
 - 4. Under building slabs, use structural fill course and gravel base course.
 - 5. Under footings and foundations, use structural fill.
- C. Place soil fill on subgrades free of organic material, sod, mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 12 inches (300 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches (150 mm) in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 - 1. Under structures, building slabs, steps, walkways, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under lawns, turf, or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 - 3. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.
 - 4. Compact crush stone to 100% of its dry rodded weight.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn, turf, or unpaved Areas: Plus or minus 1 inch (25 mm).
 - 2. Pavements and walks: Plus or minus 1/2 inch (13 mm).
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.17 SUBSURFACE DRAINAGE

- A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 18 inches (450 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).
 - 1. Compact each filter material layer with a minimum of two passes of a plate-type vibratory compactor.
 - 2. Drainage Backfill: Place and compact filter material over subsurface drain geotextile wrap as indicated.

3.18 SUBBASE AND BASE COURSES

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade or granular fill layer, place subbase course and base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Where fill is required, place satisfactory soil or granular borrow fill on prepared subgrade.
 - 3. Place base course material over subbase course under hot-mix asphalt pavement, concrete pavement, and unit pavers.

4. Shape subbase course and base course to required crown elevations and cross-slope grades.
 5. Place subbase course and base course 6 inches (150 mm) or less in compacted thickness in a single layer.
 6. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
 7. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches (300 mm) wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.19 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified Geotechnical Engineering testing agency to perform field quality control testing and inspections, as they deem necessary. The Contractor is responsible for attaining specified compaction, whether the Owner engages a Geotechnical testing firm or not.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect or Geotechnical Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 1000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
 2. Walks: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft.
 3. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length, but no fewer than two tests.
 4. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 100 feet (30 m) or less of trench length, but no fewer than two tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.20 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Architect or Geotechnical Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.21 DISPOSAL OF SURPLUS AND WASTE MATERIALS AND RESTORATION

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property. Comply with the requirements of Division 01 "Construction Waste Management".
- B. Restore surfaces disturbed during construction, including stockpile and storage areas, to their pre-construction condition, or better. Leave vegetated areas smooth and finished with loam, seed, and erosion control mulch and mesh. Restore damaged paved areas with new pavement to the existing thickness.

END OF SECTION 31 20 00

Harriman

www.harriman.com