THRASHER

ENGINEERING
ARCHITECTURE
FIELD SERVICES

TOWN OF MONONGAH
MARION COUNTY, WEST VIRGINIA

CONTRACT #1 – PROPOSED WATER SYSTEM REPLACEMENT PROJECT

ADDENDUM #1

August 31, 2018

Thrasher Project #101-010-0924

To Whom It May Concern:

A NON-MANDATORY pre-bid conference was held on Thursday, August 23, 2018 at 10:00 am for the above referenced project. This addendum addresses questions that were asked at that Pre-Bid conference and up to Thursday, August 30, 2018, along with clarifications on this project. The sign in sheet from the pre-bid conference has been included with this addendum. The Bid opening for this project remains the same scheduled for 2:00 pm, L.P.T. on Thursday, September 13, 2018.

QUESTIONS AND RESPONSES:

QUESTION

1. Was it mandatory to attend the Pre-Bid Conference?

RESPONSE

No. Contractors that did not attend the pre-bid may bid the project.

QUESTION

2. Where and when is the Bid Opening for this project?

RESPONSE

The Bid opening for this project is scheduled for 2:00 pm, L.P.T. on Thursday, September 13, 2018, at the Town of Monongah located at 430 Bridge Street, Monongah, Marion County, West Virginia 26554.

Mailed/Shipped bid packages shall be sent to Town of Monongah, 430 Bridge Street, Monongah, West Virginia 26554 **Attn: Carol Brooks.**

It is the responsibility of the Contractor to make sure shipped packages are received.

QUESTION

3. Do Davis Bacon Wages apply to this project?

RESPONSE

No. This project is completely funded through USDA Rural Development and Davis Bacon Wages do not apply.

QUESTION

4. Does American Iron and Steel (AIS) apply to this project?

RESPONSE

No. American Iron and Steel is not a requirement for this project.

QUESTION

5. If a leak becomes present when tie-ins are made into the existing line, is the pipe to fix that leak going to be paid per foot or is payment going to end at the meter well?

RESPONSE

The cost of connecting to the existing customer service line is included with the New High Pressure Meter Setting Bid Item. The service line required to make the connection shall be paid for at the LF bid price.

QUESTION

6. How close to the existing lines are the new ones expected to be laid?

RESPONSE

The proximity that the new pipe is to be laid to the old pipe varies depending upon the area. In some areas the pipe is a good distance away, while other areas that are tighter, the pipe is expected to be laid as close as reasonably possible.

QUESTION

7. Is the Contract expected to be awarded 90 days after the bid?

RESPONSE

Yes. The Contract will be awarded within ninety (90) days after bids are opened.

QUESTION

8. Could the Contract time be extended if a smaller contracting company is awarded the bid?

RESPONSE

The Contract time will be extended by 60 days. Substantial Completion is 420 days and ready for final payment is 450 days. This supersedes contract times mentioned in other areas of the Contract Documents. Milestone dates have been described in Contract #2 and Contract #3 Addendums.

QUESTION

9. Are the existing water line locations known?

RESPONSE

Existing water line locations have been shown on the drawings based on information from the Town of Monongah and field observations during design. Some water line locations are not known.

QUESTION

10. Are there any B&O Taxes for this project?

RESPONSE

No.

QUESTION

11. Are test pits to be performed by the Contractor or the Town?

RESPONSE

Test pits are to be performed by the Contractor. There is a bid item for test pits within the bid form for Contract #1.

QUESTION

12. Is an office trailer required for the Engineer / RPR for Contract #1?

RESPONSE

Yes.

QUESTION

13. What is the Engineer's estimate for Contract #1?

RESPONSE

$4,000,000.00.

QUESTION

14. Have any soil borings been conducted for Contract #1?

RESPONSE

No. However, soil borings were performed at the Tower Hill water tank site. The Contractor can obtain a copy of the soil boring report from the Engineer. A waiver will need to be signed.

QUESTION

15. Is a project sign required for Contract #1?

RESPONSE

Yes.

QUESTION

16. Is the Town of Monongah Tax Exempt?

RESPONSE

Yes. Refer to Specification Section C-200, Instructions to Bidders, Page 9, Article 22 – Sales and Use Taxes.

QUESTION

17. Who is responsible for paying WVDOH Road Bond and Inspection Fees?

RESPONSE

Road Bond and Inspection Fees will be paid for by the Town of Monongah.

QUESTION

18. Are there any restrictions when working in local streams?

RESPONSE

Yes. No work will be conducted in local streams during fish spawning season (April 1 through June 30).

QUESTION

19. Is the Contractor responsible for Video Taping the project area?

RESPONSE

No. The Engineer will be responsible for pre-construction videotaping of the project area.

QUESTION

20. Is the proposed backwash pump at the water plant to be made part of Contract #1?

RESPONSE

Yes. Contract #1 has been revised to include the installation of a backwash pump at the Town of Monongah Water Treatment Plant. A new Bid Item has been included in the Bid Form (C-410). The revised Bid Form has been included with this Addendum. **YOU MUST USE THE REVISED BID FORM INCLUDED WITH THIS ADDENDUM WHEN PREPARING YOUR BID PACKAGE.**

QUESTION

21. What type water meters does the Town of Monongah currently use?

RESPONSE

The Town currently utilizes Master Meter. Bid item #33 consists of providing 353 new water meters to the Town of Monongah. If the Contractor decides to provide an alternative water meter, all existing water meters currently in use shall be removed and replaced with the alternative meters. This requirement is so the Town maintains consistency in the type of meters in their system.

QUESTION

22. What type fire hydrants does the Town of Monongah currently use?

RESPONSE

The Town currently utilizes American Darling. Bid item #28 consists of installing 25 new fire hydrants. If the Contractor decides to install an alternative fire hydrant, all remaining fire hydrants in the Monongah system shall be replaced with the alternative fire hydrants. This requirement is so the Town maintains consistency in the type of hydrants in their system.

CLARIFICATIONS:

1. The INDEX has been revised to include the following sections: 061000, 061600, 074113.16, 087100, 238200, 260519, 260526, 260533.13, 260533.16, 260553, 260583, 262726, 262813, 262923-A, 265100, 400565.23, and 432313.27. The revised INDEX has been included with this Addendum.

2. The Bid Form (C-410) has been revised and included with this Addendum. **YOU MUST USE THE REVISED BID FORM INCLUDED WITH THIS ADDENDUM WHEN PREPARING YOUR BID PACKAGE.**

3. Specification Section 011000 – Summary has been revised with reference to 1.3 – Work Covered by Contract Documents, paragraph A was revised to include SCADA System Upgrades and Backwash Pump at Water Plant. The revised section has been included with this Addendum.

4. Specification Section 012000 – Price and Payment Procedures has been revised with reference to 1.6 – Measurement and Payment, paragraph G was revised to include the specification sections added to the contract. The revised section has been included with this Addendum.

5. Specification Section 061000 – Rough Carpentry has been included with this Addendum.

6. Specification Section 061600 – Sheathing has been included with this Addendum.

7. Specification Section 074113.16 – Standing-Seam Metal Roof Panels has been included with this Addendum.

8. Specification Section 087100 – Door Hardware has been included with this Addendum.

9. Specification Section 238200 – Convection Heating and Cooling Units has been included with this Addendum.

10. Specification Section 260519 – Low-Voltage Conductors and Cables (600 V and Less) has been included with this Addendum.

11. Specification Section 260526 – Grounding and Bonding for Electrical Systems has been included with this Addendum.

12. Specification Section 260533.13 – Conduit for Electrical Systems has been included with this Addendum.

13. Specification Section 260533.16 – Boxes for Electrical Systems has been included with this Addendum.

14. Specification Section 260553 – Identification for Electrical Systems has been included with this Addendum.

15. Specification Section 260583 – Wiring Connections has been included with this Addendum.

16. Specification Section 262726 – Wiring Devices has been included with this Addendum.

17. Specification Section 262813 – Fuses has been included with this Addendum.

18. Specification Section 262923-A – Variable-Frequency Motor Controllers has been included with this Addendum.

19. Specification Section 265100 – Interior Lighting has been included with this Addendum.

20. Specification Section 331213 – Water Service Connections has been revised with reference to 1.2 – Unit Price – Measurement and Payment, paragraph D was revised to include the purchase of new water meters. The revised section has been included with this Addendum.

21. Specification Section 331219 – Water Utility Distribution Fire Hydrants has been revised with reference to 2.1 – Fire Hydrants, part A "Manufacturers", American Darling replaced Clow. The revised section has been included with this Addendum.

22. Specification Section 400565.23 – Swing Check Valves has been included with this Addendum.

23. Specification Section 432313.27 – Backwash Pumps has been included with this Addendum.

24. Plan Sheet I has been revised in the Index to include plan sheets BW1, BW2, BW3, and BW4. An 11" x 17" sheet has been included with this Addendum.

25. Plan Sheet BW1 (11" x 17") has been included with this Addendum.

26. Plan Sheet BW2 (11" x 17") has been included with this Addendum.

27. Plan Sheet BW3 (11" x 17") has been included with this Addendum.

28. Plan Sheet BW4 (11" x 17") has been included with this Addendum.

29. The Engineer will provide stakeout for the proposed Backwash pump building at the Monongah Water Plant.

30. Mailed/Shipped bid packages shall be sent to the Town of Monongah, 430 Bridge Street, Monongah, West Virginia 26554 **Attn: Carol Brooks.** The Town of Monongah's phone number is (304) 534-3365. Bidders should **not** assume guaranteed early (10:30 am) delivery is available and shall be mailed/shipped in sufficient time. It is the Bidder's responsibility to deliver the Bid on time.

31. Existing utilities can be marked with the assistance of the Town upon request. This doesn't remove the requirement to call MISS Utility before construction begins.

32. All work shall be coordinated through the Engineer and the Town of Monongah to ensure no disruption to the existing distribution system.

33. New meter wells are to be installed. The existing meter from the old meter well is to be transferred into the new meter well. However, new meters must be provided by the Contractor and delivered to the Town of Monongah as part of this bid item. The Town will install the new meters.

34. A section of water line to be installed in the Mill Fall Run area will require an Archaeologist to be on-site during construction. The Engineer is responsible for all fees for the Archaeologist. The Contractor will coordinate the schedule.

35. Soil borings are available for the Tower Hill Tank only. Soil borings were NOT performed for the Idamay Tank.

36. USDA is the funding agency for all Contracts associated with this project.

37. RCAP is the administrator for all Contracts associated with this project. Robin Montgomery will be the point of contact.

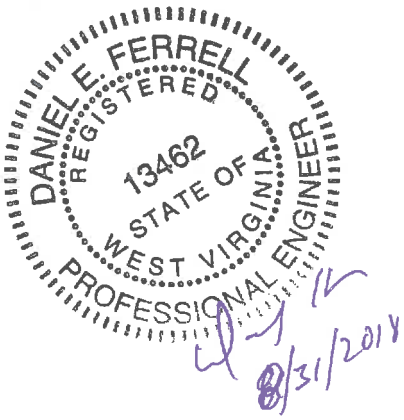
If you have any other questions or comments, please feel free to contact myself or David Watson at (304) 326-6113 at your earliest convenience.

Sincerely,

THE THRASHER GROUP, INC.

DANIEL E. FERRELL, P.E.
Project Manager

Enclosures: Pre-Bid Conference Sign-In Sheet
Revised Bid Form
Specification Sections
Plan Sheets



TOWN OF MONONGAH
MARION COUNTY, WEST VIRGINIA
PROPOSED
CONTRACT #1-PROPOSED WATER SYSTEM REPLACEMENT PROJECT
CONTRACT #2-PROPOSED TWO (2) NEW 530,000 GALLON WATER STORAGE TANKS AND ONE (1) NEW 183,000 GALLON WATER STORAGE TANK
CONTRACT #3-PROPOSED REHABILITATION AND PAINTING OF A 300,000 GALLON AND A 175,000 GALLON WATER STORAGE TANKS

THRASHER PROJECT #101-010-0924

PRE-BID CONFERENCE

AUGUST 23, 2018

Name	Representing
DAN Ferrell	The Thrasher Group
Dave WATSON	THE THRASHER GROUP
Tony Closson	JF Allen Company
Roger Hill	Hull's Contracting Inc
IAN MARTIN	SPECIALTY GROUPS, INC.
Donald Bramer	Anderson Excavating
Daniel Williams	Dan's Marine Service In
Cory Jennings	Jennings Excavating Inc
Ellen Brick	Thrasher

Revised per Addendum #1
August 31, 2018

TOWN OF MONONGAH
MARION COUNTY, WEST VIRGINIA

CONTRACT #1 – PROPOSED WATER SYSTEM REPLACEMENT PROJECT

- I N D E X -

TECHNICAL SPECIFICATIONS

Standing-Seam Metal Roof Panels	074113.16
Door Hardware	087100
Convection Heating and Cooling Units	238200
Low-Voltage Conductors and Cables (600 V and Less)	260519
Grounding and Bonding for Electrical Systems	260526
Conduit for Electrical Systems	260533.13
Boxes for Electrical Systems	260533.16
Identification for Electrical Systems	260553
Wiring Connections	260583
Wiring Devices	262726
Fuses	262813
Variable-Frequency Motor Controllers	262923-A
Interior Lighting	265100
Supervisory Control and Data Acquisition (SCADA) System	274100
Aggregates for Earthwork	310516
Geotextiles for Earthwork	310519.13
Clearing, Grubbing, and Restoration as Per Plans	311100
Excavation	312316
Trenching	312316.13
Dewatering	312319
Erosion and Sedimentation Controls	312500
Rubble Stone Riprap	313716.13
Asphalt Paving	321216
Turf and Grasses	329200
Trenchless Installation of Utility Piping	330507

Utility Horizontal Directional Drilling	330523.13
Utility Identification	330526
Public Water Utility Distribution Piping	331113
Water Utility Distribution Equipment	331200
Water Service Connections	331213
Water Utility Distribution Valves	331216
Water Utility Distribution Fire Hydrants	331219
Disinfecting of Water Utility Distribution	331300
Boring and Jacking	331400
Swing Check Valves	400565.23
Backwash Pumps	432313.27

ACCOMMODATION OF UTILITIES ON HIGHWAY RIGHT OF WAY

TOWN OF MONONGAH
MARION COUNTY, WEST VIRGINIA
CONTRACT #1 – PROPOSED WATER SYSTEM REPLACEMENT PROJECT

BID FORM

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

Town of Monongah
430 Bridge Street
Monongah, WV 26554

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

Addendum No.	**Addendum, Date**

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent

to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.

F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.

J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the e execution of the Contract.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

CONTRACT #1 – PROPOSED WATER SYSTEM REPLACEMENT PROJECT
FOR THE
TOWN OF MONONGAH
MARION COUNTY, WEST VIRGINIA
BID SCHEDULE

NOTE: BIDS shall include sales tax and all other applicable taxes and fees.

Item	Quantity	Description with Unit Price Written	Unit Price	Total Price
1	LS	Mobilization/Demobilization _____ Dollars _____ Cents	_____	_____
2	LS	Erosion and Sediment Control Measures _____ Dollars _____ Cents	_____	_____
3	4360 LF	12" Water Line 305 PSI _____ Dollars _____ Cents	_____	_____
4	7500 LF	12" Water Line 235 PSI _____ Dollars _____ Cents	_____	_____
5	420 LF	12" Ductile Iron CL-50 P.JT. Water Line _____ Dollars _____ Cents	_____	_____

6	5600 LF	10” Water Line 305 PSI _____ Dollars _____ Cents		_____	_____
7	850 LF	6” Water Line 305 PSI _____ Dollars _____ Cents		_____	_____
8	26800 LF	6” Water Line 235 PSI _____ Dollars _____ Cents		_____	_____
9	100 LF	6” Ductile Iron CL-50 P.JT. Water Line _____ Dollars _____ Cents		_____	_____
10	4800 LF	6” Water Line 250 PSI _____ Dollars _____ Cents		_____	_____
11	300 LF	6” HDPE DIPS DR-9 Horizontal Directional Drill Water Line _____ Dollars _____ Cents		_____	_____
12	1200 LF	4” Water Line 235 PSI _____ Dollars _____ Cents		_____	_____
13	600 LF	2” Water Line 250 PSI _____ Dollars _____ Cents		_____	_____

14	10500 LF	2” Water Line 315 PSI _____ Dollars _____ Cents	_____	_____	
15	4 EA	HDPE Concrete Anchor _____ Dollars _____ Cents	_____	_____	
16	160 LF	24” Steel Casing (Bore & Jack) w/Casing Spacers _____ Dollars _____ Cents	_____	_____	
17	15 LF	24” Steel Casing (Open Cut) w/Casing Spacers _____ Dollars _____ Cents	_____	_____	
18	600 LF	12” Steel Casing (Bore & Jack) w/Casing Spacers _____ Dollars _____ Cents	_____	_____	
19	300 LF	12” Steel Casing (Open Cut) w/Casing Spacers _____ Dollars _____ Cents	_____	_____	
20	20 LF	8” Steel Casing (Open Cut) w/Casing Spacers _____ Dollars _____ Cents	_____	_____	
21	150 LF	4” Steel Casing (Bore & Jack) w/Casing Spacers _____ Dollars _____ Cents	_____	_____	

22	30 LF	4” Steel Casing (Open Cut) w/Casing Spacers _____ Dollars _____ Cents	_____	_____
23	3 EA	12” M.JT. Gate Valve, Complete w/Box and Lid _____ Dollars _____ Cents	_____	_____
24	3 EA	10” M.JT. Gate Valve, Complete w/Box and Lid _____ Dollars _____ Cents	_____	_____
25	40 EA	6” M.JT. Gate Valve, Complete w/Box and Lid _____ Dollars _____ Cents	_____	_____
26	3 EA	4” M.JT. Gate Valve, Complete w/Box and Lid _____ Dollars _____ Cents	_____	_____
27	24 EA	2” M.JT. Gate Valve, Complete w/Box and Lid _____ Dollars _____ Cents	_____	_____
28	25 EA	Fire Hydrant Assembly, Complete _____ Dollars _____ Cents	_____	_____
29	20 EA	Remove Existing Fire Hydrant Assembly, Complete _____ Dollars _____ Cents	_____	_____

30	21 EA	2” Post Flushing Hydrant Assembly, Complete _____ Dollars _____ Cents	_____	_____
31	3 EA	1” Air Release Valve _____ Dollars _____ Cents	_____	_____
32	1 EA	¾” Air Release Valve _____ Dollars _____ Cents	_____	_____
33	353 EA	New High Pressure Meter Setting including 5/8” x 1/2” meter, coppersetter, meter well, lid, and tie-in to customer service line _____ Dollars _____ Cents	_____	_____
34	1700 LF	1” PE SDR-9 Service Tubing (Open Cut) _____ Dollars _____ Cents	_____	_____
35	320 LF	1” PE SDR-9 Service Tubing (Bore & Jack) _____ Dollars _____ Cents	_____	_____
36	15600 LF	¾” PE SDR-9 Service Tubing (Open Cut) _____ Dollars _____ Cents	_____	_____
37	1200 LF	¾” PE SDR-9 Service Tubing (Bore & Jack) _____ Dollars _____ Cents	_____	_____

38	750 LF	¾" Type K Copper Service Tubing (Open Cut) _____ Dollars _____ Cents	_____	_____
39	2 EA	Hot Tap on Existing 12" Water Line, Complete _____ Dollars _____ Cents	_____	_____
40	1 EA	Tie-In to Existing 12" Water Line, Complete _____ Dollars _____ Cents	_____	_____
41	1 EA	Hot Tap on Existing 10" Water Line, Complete _____ Dollars _____ Cents	_____	_____
42	1 EA	Tie-In to Existing 10" Water Line, Complete _____ Dollars _____ Cents	_____	_____
43	2 EA	Hot Tap on Existing 6" Water Line, Complete _____ Dollars _____ Cents	_____	_____
44	7 EA	Tie-In to Existing 6" Water Line, Complete _____ Dollars _____ Cents	_____	_____

45	2 EA	Hot Tap on Existing 4” Water Line, Complete _____ Dollars _____ Cents	_____	_____
46	1 EA	Tie-In to Existing 4” Water Line, Complete _____ Dollars _____ Cents	_____	_____
47	5 EA	Tie-In to Existing 2” Water Line, Complete _____ Dollars _____ Cents	_____	_____
48	2 EA	Cut and Plug Existing 12” Water Line _____ Dollars _____ Cents	_____	_____
49	1 EA	Cut and Plug Existing 10” Water Line _____ Dollars _____ Cents	_____	_____
50	1 EA	Cut and Plug Existing 8” Water Line _____ Dollars _____ Cents	_____	_____
51	3 EA	Cut and Plug Existing 6” Water Line _____ Dollars _____ Cents	_____	_____
52	8 EA	Cut and Plug Existing 4” Water Line _____ Dollars _____ Cents	_____	_____

53	5 EA	Cut and Plug Existing 2” Water Line _____ Dollars _____ Cents	_____	_____
54	30 EA	Test Pits _____ Dollars _____ Cents	_____	_____
55	3900 LF	WVDOH Type “B” Trench Repair _____ Dollars _____ Cents	_____	_____
56	4000 LF	WVDOH Shoulder Stone _____ Dollars _____ Cents	_____	_____
57	1600 LF	WVDOH Rock Lined Ditch _____ Dollars _____ Cents	_____	_____
58	600 TN	2” HMA Overlay _____ Dollars _____ Cents	_____	_____
59	550 LF	Concrete Street / Road / Driveway Repair _____ Dollars _____ Cents	_____	_____
60	2000 LF	HMA Street / Road / Driveway Repair _____ Dollars _____ Cents	_____	_____

61	4500 LF	Gravel Street / Road / Driveway Repair _____ Dollars _____ Cents	_____	_____
62	1000 LF	Stream Bank Slope Protection _____ Dollars _____ Cents	_____	_____
63	20 TN	Dump Rock Bank Protection _____ Dollars _____ Cents	_____	_____
64	300 LF	Concrete Ditch Repair _____ Dollars _____ Cents	_____	_____
65	80030 LF	Reclamation of Disturbed Area _____ Dollars _____ Cents	_____	_____
66	1 LS	Existing SCADA System Upgrades Replace Existing Outdated Radio Modems With New Radio Modems (Seven Total); Provide New Computer, Monitor, and Associated Components: Upgrade Existing Solar Power Equipment at the Carolina Tank; Provide Chemical Feed Control Equipment at Water Plant; All Wiring; Conduits; and Necessary Appurtenances for the SCADA System Upgrade _____ Dollars _____ Cents	_____	_____

67	1 LS	Backwash Pump at Water Plant Install New Backwash Pump at Water Plant to include piping, valves, concrete foundation, gravel subbase, metal building, electrical controls, electrical conduit, variable frequency drive, earthwork, tie-in to existing water line, pipe fittings, all wiring, and other miscellaneous appurtenances to create a Backwash Pumping System. _____ Dollars _____ Cents	_____	_____

TOTAL BID: _____
_____($_____)

(AMOUNTS ARE TO BE SHOWN IN BOTH WORDS AND FIGURES. IN CASE OF DISCREPANCY, THE AMOUNT SHOWN IN WORDS WILL GOVERN.)

NOTE: THE CONTRACTOR'S UNIT PRICES SHALL INCLUDE PURCHASE AND INSTALLATION, COMPLETE IN PLACE, PER BID ITEM IN ACCORDANCE WITH THE DETAILED SPECIFICATIONS.

Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and (2) estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

ORDER OF DEDUCTIVE ALTERNATIVES

NOTICE TO BIDDER: Unit prices in Deductive Alternatives must be the same unit prices used in the bid.

DEDUCTIVE ALTERNATE #1 – PLAN SHEETS 27 AND 28

Item	Quantity	Description with Unit Price Written	Unit Price	Total Price
14	2,365 LF	2" Water Line 315 PSI _____ Dollars _____ Cents	_____	_____

30	1 EA	1" Air Release Valve _____ Dollars _____ Cents	_____	_____
33	2 EA	New High Pressure Meter Setting including 5/8" x ½" meter, coppersetter, meter well, lid, and tie-in to customer service line _____ Dollars _____ Cents	_____	_____
36	60 LF	¾" PE SDR-9 Service Tubing (Open Cut) _____ Dollars _____ Cents	_____	_____
55	60 LF	WVDOH Type "B" Trench Repair _____ Dollars _____ Cents	_____	_____
62	40 LF	Stream Bank Slope Protection _____ Dollars _____ Cents	_____	_____
65	2,425 LF	Reclamation of Disturbed Area _____ Dollars _____ Cents	_____	_____

TOTAL DEDUCTIVE ALTERNATE #1: _____
_____($_____)

DEDUCTIVE ALTERNATE #2 – PLAN SHEETS 8, 9, AND 10

Item	Quantity	Description with Unit Price Written	Unit Price	Total Price
6	3,410 LF	10” Water Line 305 PSI _____ Dollars _____ Cents	_____	_____
8	40 LF	6” Water Line 235 PSI _____ Dollars _____ Cents	_____	_____
24	1 EA	10” M.JT. Gate Valve, Complete w/Box and Lid _____ Dollars _____ Cents	_____	_____
25	1 EA	6” M.JT. Gate Valve, Complete w/Box and Lid _____ Dollars _____ Cents	_____	_____
42	1 EA	Tie-In to Existing 10” Water Line, Complete _____ Dollars _____ Cents	_____	_____
44	1 EA	Tie-In to Existing 6” Water Line, Complete _____ Dollars _____ Cents	_____	_____
62	15 LF	Stream Bank Slope Protection _____ Dollars _____ Cents	_____	_____

65	3,450 LF	Reclamation of Disturbed Area _____ Dollars _____ Cents	_____	_____	

TOTAL DEDUCTIVE ALTERNATE #2: _____

_____($_____)

METHOD OF AWARD

If at the time this contract is to be awarded, the lowest total bid submitted by a qualified, responsible Bidder does not exceed the amount of funds then estimated by the Owner, as available to finance the contract, the construction contract will be awarded. If such bids exceed such amount, the Owner may reject all bids. The Owner may award the contract on the total bid submitted by a qualified responsible Bidder less the amount(s) of the deductive alternate(s) subtracted in numerical order, as listed in the contract to produce the lowest bid within the funds available for financing.

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:

A. Bid Opening Requirements

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

BIDDER: *[Indicate correct name of bidding entity]*

_____

By:
[Signature] _____

[Printed name] _____
(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:
[Signature] _____

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

_____

_____

_____

Telephone Number: _____

Fax Number: _____

Contact Name and e-mail address: _____

_____

Bidder's License No.: _____
(where applicable)

NOTE TO USER: Use in those states or other jurisdictions where applicable or required.

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and drawing conventions.
7. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: Town of Monongah – Contract # 1 - Proposed Water System Replacement Project.

1. Project Location: Monongah, WV – Marion County

B. Owner: Town of Monongah

1. Owner's Representative: Greg Vandetta, Mayor

C. Engineer: The Thrasher Group, Inc.
1. Principal – Daniel E. Ferrell, P.E.
2. Project Manager – David Watson
3. Project Engineer – Eleni Brick

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1 LS Mobilization/Demobilization, 1 LS Erosion and Sediment Control Measures, 4360 LF 12” Water Line 305 PSI, 7500 LF 12” Water Line 235 PSI, 420 LF 12” Ductile Iron CL-50 P.JT. Water Line, 5600 LF 10” Water Line 305 PSI, 850 LF 6” Water Line 305 PSI, 26800 LF 6” Water Line 235 PSI, 100 LF 6” Ductile Iron CL-50 P.JT. Water Line, 4800 LF 6” Water Line 250 PSI, 300 LF 6” HDPE DIPS DR-9 Horizontal Directional Drill Water Line, 1200 LF 4”

Water Line 235 PSI, 600 LF 2" Water Line 250 PSI, 10500 LF 2" Water Line 315 PSI, 4 EA HDPE Concrete Anchor, 160 LF 24" Steel Casing (Bore & Jack) w/Casing Spacers, 15 LF 24" Steel Casing (Open Cut) w/Casing Spacers, 600 LF 12" Steel Casing (Bore & Jack) w/Casing Spacers, 300 LF 12" Steel Casing (Open Cut) w/Casing Spacers, 20 LF 8" Steel Casing (Open Cut) w/Casing Spacers, 150 LF 4" Steel Casing (Bore & Jack) w/Casing Spacers, 30 LF 4" Steel Casing (Open Cut) w/Casing Spacers, 3 EA 12" M.JT. Gate Valve, Complete w/Box and Lid, 3 EA 10" M.JT. Gate Valve, Complete w/Box and Lid, 40 EA 6" M.JT. Gate Valve, Complete w/Bow and Lid, 3 EA 4" M.JT. Gate Valve, Complete w/Box and Lid, 24 EA 2" M.JT. Gate Valve, Complete w/ Box and Lid, 25 EA Fire Hydrant Assembly, Complete, 20 EA Remove Existing Fire Hydrant Assembly, Complete, 21 EA 2" Post Flushing Hydrant Assembly, Complete, 3 EA 1" Air Release Valve, 1 EA ¾" Air Release Valve, 353 EA New High Pressure Meter Setting including 5/8" x ¾" meter, coppersetter, meter well, lid, and tie-in to customer service line, 1700 LF 1" PE SDR-9 Service Tubing (Open Cut), 320 LF 1" PE SDR-9 Service Tubing (Bore & Jack), 15600 LF ¾" PE SDR-9 Service Tubing (Open Cut), 1200 ¾" PE SDR-9 Service Tubing (Bore & Jack), 750 LF ¾" Type K Copper Service Tubing (Open Cut), 2 EA Hot Tap on Existing 12" Water Line, Complete, 1 EA Tie-In on Existing 12" Water Line, Complete, 1 EA Hot Tap on Existing 10" Water Line, Complete, 1 EA Tie-In on Existing 10" Water Line, Complete, 2 EA Hot Tap on Existing 6" Water Line, Complete, 7 EA Tie-In on Existing 6" Water Line, Complete, 2 EA Hot Tap on Existing 4" Water Line, Complete, 1 EA Tie-In on Existing 4" Water Line, Complete, 5 EA Tie-In on Existing 2" Water Line, Complete, 2 EA Cut and Plug Existing 12" Water Line, 1 EA Cut and Plug Existing 10" Water Line, 1 EA Cut and Plug Existing 8" Water Line, 3 EA Cut and Plug Existing 6" Water Line, 8 EA Cut and Plug Existing 4" Water Line, 5 EA Cut and Plug Existing 2" Water Line, 30 EA Test Pits, 3900 LF WVDOH Type "B" Trench Repair, 4000 LF WVDOH Shoulder Stone, 1600 LF WVDOH Rock Lined Ditch, 600 TN 2" HMA Overlay, 550 LF Concrete Street / Road / Driveway Repair, 2000 LF HMA Street / Road / Driveway Repair, 4500 LF Gravel Street / Road / Driveway Repair, 1000 LF Stream Bank Slope Protection, 20 TN Dump Rock Bank Protection, 300 LF Concrete Ditch Repair, 80030 LF Reclamation of Disturbed Area, SCADA System Upgrades, Backwash Pump at Water Plant, and other necessary appurtenances.

B. Type of Contract.

1. Project will be constructed under a single prime contract.

a. Contract # 1 – Proposed Water System Replacement Project.

1.4 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.5 COORDINATION WITH PROPERTY OWNERS

A. Property Owners: Property Owners will occupy existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and

facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day activities. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, driveways, and other used areas. Do not close or obstruct walkways, driveways, or other used areas without written permission from Property Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 48 hours in advance of activities that will be conducted on Property Owner’s land.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 8:00 p.m., Monday through Friday, unless otherwise indicated.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Property Owner not less than two days in advance of proposed utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Property Owner.

1. Notify Property Owner not less than two days in advance of proposed disruptive operations.

E. Controlled Substances: Use of controlled substances on Project site is not permitted.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

A. 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. Imperative mood and streamlined language are generally used in the Specifications. 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.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.8 MISCELLANEOUS PROVISIONS

A. Environmental Protections

1. The Contractor and subcontractors, in the performance of this Contract, shall comply with all applicable Federal, State and local laws and regulations concerning environmental pollution control and abatement as well as the specific requirements stated elsewhere in the Contract Documents.
2. The Contractor shall take all precautions necessary to avoid pollution of water in adjacent watercourses or water storage areas including wells.
3. All earthwork, equipment movement, control of water in excavations and other operations which may create silting shall be conducted in a manner to keep water pollution to an absolute minimum.
4. Water used during the contract work which has become polluted with oil, harmful or objectionable chemicals, sewage or other pollutants shall be disposed of in a manner that will not affect nearby waters and land. The Contractor shall not, under any circumstances, discharge pollutants into any watercourse.

B. Noise and Air Pollution

1. The Contractor shall take all precautions necessary to avoid excessive noise and air pollution during the course of the Contract.

C. Dust Control

1. The Contractor shall maintain all work areas free from dust which would contribute to air pollution. Approved temporary methods of stabilization consisting of sprinkling, chemical treatment, or similar methods will be permitted to control dust. Sprinkling, where used, must be repeated at such intervals to keep all parts of the disturbed area at least damp at all times. Dust control shall be performed as the work proceeds and whenever the dust nuisance of hazard occurs.
2. The Contractor shall keep clean all roads used in his operations. Trucks hauling excavated materials, cement, sand, stone or other loose materials from or to the Site, shall be tight so that no spillage will occur. Before trucks start away from the site, their loads shall be carefully trimmed to prevent spillage.

D. Cost of Utilities

1. The General Construction Contractor shall be responsible for the cost of all temporary utilities such as water, power, gas, etc., required to maintain heat and provide light in the proposed structures, conduct initial operation and preliminary tests as required to put the equipment in operating order, etc., until the time that all flows have been successfully handled for twenty-four hours and it is apparent that the facilities can be put into continuous operation. At that time, all utility meters will be read and the Owner will assume the cost of utilities thereafter. The lighting system in construction areas shall be furnished by the Contractor.
2. There are overhead and buried utility lines in the vicinity of the work areas. The plans may or may not show existing utilities. However, it is the Contractor's responsibility to contact each utility to verify the exact location of all utilities and to contact Miss Utility of West Virginia before digging at 1-800-245-4848 and to post signs in all office trailers.

E. Plans and Working Drawings

1. Approved Plans will show the location, profile, typical cross section, structures except as hereinafter specified, incidental items, and a summary of all items appearing in the proposal. Any deviations which may be required by the construction will be determined by the Engineer and authorized by him in writing. The Contractor shall keep one set of approved Plans available of the work at the Project site at all times.
2. Plans will show details necessary to give a comprehensive idea of the construction contemplated. Any information which may be shown on Drawings regarding results obtained from test borings will be a record of conditions encountered at the place where such test borings were made, as nearly as these conditions could be interpreted by the Engineer observing the operations. The Contractor shall interpret the data in the light of the Contractor’s own experience. The Contractor is not bound to accept or rely on the data shown on the drawings, but may make additional borings and investigations, including test piles, to satisfy the Contractor concerning the lengths of piles and the conditions governing or entering into the construction of foundations.
3. The Plans may show the construction depths and dimensions on which the estimate of quantities is based. These depths and dimensions, however, are subject to variations as necessary to the Engineer, and the right is expressly reserved to increase or diminish the dimensions and depths as the Engineer may determine.
4. The Contractor shall submit to the Engineer for approval additional calculation sheets, shop details, and other working drawings required for the construction of any part of the work; and prior to the approval of such plans, any work done or materials ordered shall be at the Contractor's risk.
5. Working drawings for concrete structures shall consist of detailed plans required for the successful execution of the work and which are not included in the plans furnished by the Engineer. These may include plans for drainage structures, falsework, bracing, centering and formwork, masonry layout diagrams, and diagrams for reinforced concrete structures and bent reinforcement.
6. The Contractor shall furnish the Engineer copies of the working drawings for approval and for construction purposes, and upon completion of the work the original tracings of working drawings shall be delivered to the Engineer. The drawings are to be on tracing paper, in ink or in pencil. The size of all drawings and prints shall be 22 inches by 34 inches or 24 inches by 36 inches, including margins.
7. It is expressly understood that the Engineer’s approval of the Contractor's working drawings relate to the requirements for strength and general arrangement, and approval will not relieve the Contractor of responsibility for omissions, errors in dimensions, shop

fits, field connections, etc., for quantity of materials, or of the Contractor's responsibility under the contract for the successful completion of the work.

8. The Contract Price shall include the cost of furnishing all working drawings, and the Contractor will be allowed no extra compensation for such drawings.

F. Errors and Omissions

1. The Contractor shall take no advantage of any apparent error or omission in the Plans or Specifications. In the event the Contractor discovers such an error or omission, he shall immediately notify the Engineer. The Engineer will then make such corrections and interpretations necessary for fulfilling the intent of the Plans and Specifications.

G. Cooperation by Contractor

1. The Contractor shall give the work constant attention necessary to facilitate the progress thereof, and shall cooperate with the Engineer, his inspectors, other contractors, and utilities in every way possible.
2. The Contractor shall have on the work at all times, as his agent, a competent superintendent capable of reading and thoroughly understanding the Plans and Specifications, and thoroughly experienced in the type of Work being performed, who shall receive instructions from the Engineer or his authorized representatives. The superintendent shall have full authority to execute orders or directions of the Engineer without delay, and to promptly supply such materials, equipment tools, labor, and incidentals as may be required. Such superintendence shall be furnished irrespective of the amount of work sublet.
3. The Contractor shall furnish the Engineer with a list of addresses and telephone numbers of his personnel who may be reached in case of emergency during hours when no work is to be performed. On weekends, holidays, during suspensions of work, and during storms the Contractor shall alert his personnel to stand by and shall inform the Engineer of these arrangements made. On call personnel shall be on call for 24 hours a day, 7 days a week for duration of construction and 6 months after completion of Contract.
4. The Contractor shall provide all reasonable facilities and furnish the Owner, through the Engineer, the information, assistance, and samples required by the Engineer and Inspector for proper inspecting or testing of materials and workmanship.
5. To ensure proper coordination between the work of the Contractor and the work of funding agencies, permitting agencies, and utility providers, a pre-construction conference may be conducted. The Owner, or Owners agent, will arrange for the notification to parties of interest of the time and place of the meeting. The Contractor or his representative, authorized to make decisions for him in regard to the scheduling of the proposed work, is required to attend the meeting. A report of the pre-construction conference may be prepared and distributed by the Engineer to all represented at the meeting. The meeting may be recorded to preserve the actual record.

H. Construction Sequence of Events

1. Contractor shall notify Miss Utility (1-800-245-4848) for existing utility locations.
2. Videotaping of project area.
3. Install al necessary sediment & erosion control measures.
4. Begin installation of all new main line.
5. Install valves, hydrants, meter settings, & other appurtenances.
6. Complete installation of all new water lines.

7. Conduct necessary line flushing, pressure testing, & sterilization.
8. Coordinate with Town on tie-ins to existing meter settings.
9. Removal of existing meter settings.
10. Cut and cap existing 4 inch water line as shown on Plan Sheet #4 (coordinate with Contract #2).
11. Complete all surface restorations.
12. Complete all punch list items.
13. Complete final cleanup.
14. Submit all required documents & red line drawings.
15. Project contract close out.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012000 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Schedule of Values.

B. Application for Payment.

C. Change procedures.

D. Defect assessment.

E. Measurement and Payment.

F. Alternates.

1.2 SCHEDULE OF VALUES

A. Submit printed Progress Estimate schedule on Contractor's standard form or electronic media printout will be considered for this use.

B. Submit Schedule of Values in duplicate within 20 days after date established in Notice to Proceed.

C. Format: Use Table of Contents of this Project Manual. Identify each line item with number and title of major Specification Section. Also identify Site mobilization, bonds and insurance, and demobilization.

D. Include within each line item, direct proportional amount of Contractor's overhead and profit.

E. Revise schedule to list approved Change Orders with each Application for Payment.

F. Revise schedule to list approved Change Orders with each Application for Payment.

1.3 APPLICATION FOR PAYMENT

A. Submit six (6) copies of each Application for Payment on EJCDC C-620 - Contractor's Application for Payment.

B. Content and Format: Use Schedule of Values for listing items in Application for Payment.

C. Submit updated construction schedule with each Application for Payment.

D. Payment Period: Submit at intervals stipulated in the Agreement.

E. Submit submittals with transmittal letter as specified in Section 013300 - Submittal Procedures.

F. Substantiating Data: When Engineer requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:

1. Current construction photographs.
2. Partial release of liens from major Subcontractors and vendors.
3. Record Documents as specified in Section 017000 - Execution and Closeout Requirements, for review by Owner, which will be returned to Contractor.
4. Affidavits attesting to off-Site stored products.
5. Construction Progress Schedule, revised and current as specified in Section 013300 - Submittal Procedures.
6. Affidavit of Previous Payments.
7. Adverse Weather Day documentation.

1.4 CHANGE PROCEDURES

A. Submittals: Submit name of individual who is authorized to receive change documents and is responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. Carefully study and compare Contract Documents before proceeding with fabrication and installation of Work. Promptly advise Architect/Engineer of any error, inconsistency, omission, or apparent discrepancy.

C. Requests for Interpretation (RFI) and Clarifications: Allot time in construction scheduling for liaison with Engineer; establish procedures for handling queries and clarifications.

1. Use Request for Information Form for requesting interpretations (provided by Engineer upon request).
2. Engineer may respond with a direct answer on the Request for Information form, EJCDC C-942 - Field Order, Work Change Directive, or Proposal Request.

D. Engineer will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions on EJCDC C-942.

E. Engineer may issue Notice of Change information including a detailed description of proposed change with supplementary or revised Drawings and Specifications, a change in Contract Time for executing the change. Contractor will prepare and submit estimate within ten (10) days.

F. Contractor may propose changes by submitting a request for change to Engineer, describing proposed change and its full effect on the Work. Include a statement describing reason for the change and the effect on Contract Sum/Price and Contract Time with full documentation and a statement describing effect on the Work by separate or other Contractors.

G. Stipulated Sum/Price Change Order: Based on Proposal Request or Work Change Directive and Contractor's maximum price quotation or Contractor's request for Change Order as approved by Engineer.

H. Unit Price Change Order: For Contract unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of that which are not predetermined, execute Work under Work Directive Change. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Change Order.

I. Work Directive Change: Engineer may issue directive, on EJCDC C-940 - Work Change Directive, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute change.

J. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract. Engineer will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.

K. Maintain detailed records of Work done on time and material basis. Provide full information required for evaluation of proposed changes and to substantiate costs for changes in the Work.

L. Document each quotation for change in Project Cost or Time with sufficient data to allow evaluation of quotation.

M. Change Order Forms: EJCDC C-941 - Change Order.

N. Execution of Change Orders: Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract.

O. Correlation of Contractor Submittals:

1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
2. Promptly revise Progress Schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of Work affected by the change, and resubmit.
3. Promptly enter changes in Record Documents.

1.5 DEFECT ASSESSMENT

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If, in the opinion of Engineer or Owner, it is not practical to remove and replace the Work, Engineer or Owner will direct appropriate remedy or adjust payment.

C. The defective Work may remain, but unit sum/price will be adjusted to new sum/price at discretion of Engineer or Owner.

D. Defective Work will be partially repaired according to instructions of Engineer, and unit sum/price will be adjusted to new sum/price at discretion of Engineer or Owner.

E. Individual Specification Sections may modify these options or may identify specific formula or percentage sum/price reduction.

F. Authority of Owner to assess defects and identify payment adjustments is final.

G. Nonpayment for Rejected Products: Payment will not be made for rejected products for any of the following reasons:

1. Products wasted or disposed of in a manner that is not acceptable.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from transporting vehicle.
4. Products placed beyond lines and levels of the required Work.
5. Products remaining on hand after completion of the Work.
6. Loading, hauling, and disposing of rejected products.

1.6 MEASUREMENT AND PAYMENT

A. Authority: Measurement methods are described below.

B. Measurement methods delineated in individual Specification Sections complement criteria of this Section. Information described in this section shall govern in the event of conflict.

C. Take measurements and compute quantities. Engineer will verify measurements and quantities.

D. Unit Quantities: Quantities and measurements indicated on Bid Form are for Contract purposes only. Actual quantities provided shall determine payment.

1. When actual Work requires more or fewer quantities than those quantities indicated, provide required quantities at contracted unit sum/prices.
2. When actual Work requires 25 percent or greater change in quantity than those quantities indicated, Owner or Contractor may claim a Contract Price adjustment.

E. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application, or installation of item of the Work; overhead and profit.

F. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Engineer multiplied by unit sum/price for Work incorporated in or made necessary by the Work.

G. Measurement of Quantities:

1. Mobilization/Demobilization
   a. The cost of this work shall be paid for at the contract lump sum bid price for all mobilization and demobilization actives required for the project.
   b. Partial payment not exceeding three percent (3%) of the original total contract bid price shall be made as part of the first application for payments. The balance for this contract lump sum bid price shall be considered as demobilization and shall be paid for upon substantial completion.
   c. No deduction shall be made, nor shall any increase be made, in the contract lump sum bid price for Mobilization/Demobilization regardless of any decreases or increases in the final total contract price or for any other cause.
2. Specification Section 015000 – Temporary Facilities and Controls

a. When a lump sum bid item for Mobilization/Demobilization is provided, the cost of this work shall be included in the contract lump sum bid price for Mobilization/Demobilization.
b. Otherwise, the cost for Field Office and Sheds shall be included in the contract lump sum bid price(s) and/or unit bid price(s) for which the Field Office and Sheds are required. No additional compensation shall be made.

3. Specification Section 033000 – Cast-in-place Concrete
   a. The cost of this work shall be included in the contract lump sum bid price(s) and/or unit bid price(s) for which cast-in-place concrete is required.
   b. No additional compensation shall be made.
4. Specification Section 061000 – Rough Carpentry
   a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
5. Specification Section 061600 – Sheathing
   a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
6. Specification Section 074113.16 – Standing-Seam Metal Roof Panels
   a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
7. Specification Section 087100 – Door Hardware
   a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
8. Specification Section 238200 – Convection Heating and Cooling Units
   a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
9. Specification Section 260519 – Low-Voltage Conductors and Cables (600 V and Less)
   a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
10. Specification Section 260526 – Grounding and Bonding for Electrical Systems
    a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
11. Specification Section 260533.13 – Conduit for Electrical Systems
    a. The cost for this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
12. Specification Section 260533.16 – Boxes for Electrical Systems
    a. The cost for this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
13. Specification Section 260553 – Identification for Electrical Systems
    a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
14. Specification Section 260583 – Wiring Connections
    a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
15. Specification Section 262726 – Wiring Devices
    a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
16. Specification Section 262813 – Fuses
    a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
17. Specification Section 262923-A - Variable-Frequency Motor Controllers

a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.

18. Specification Section 265100 – Interior Lighting
    a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
19. Specification Section 274100 – Supervisory Control and Data Acquisition (SCADA) System
    a. The cost for this work shall be paid for at the one (1) contract lump sum bid price as listed in the bid schedule.
    b. All conduits and wiring required shall be included in the lump sum bid price.
20. Specification Section 310516 – Aggregates for Earthwork
    a. Work under this specification shall be included in the Unit bid price requiring this activity as detailed in the plans and specifications
21. Specification Section 310519.13 – Geotextiles for Earthwork
    a. Work under this specification shall be included in the Unit bid price requiring this activity as detailed in the plans and specifications.
22. Specification Section 311100 – Clearing, Grubbing, and Restoration and as Per Plans
    a. The cost for clearing and grubbing shall be included in the contract lump sum bid price(s) and/or unit bid price(s) for which clearing and grubbing is required, except where contract lump sum bid price(s) and/or unit bid prices for clearing, grubbing, and removal/abandonment items are provided in the Bid Form.
    b. Restoration shall be included in the contract lump sum bid price(s) and/or unit bid price(s) for which restoration is required, except where contract lump sum bid price(s) and/or unit bid prices for restoration items are provided in the Bid Form in grass areas, reclamation shall be paid for by the linear foot bid price.
    c. Trench, driveway, road, curb, and/or sidewalk repair and reclamation of disturbed area shall be paid for at the contract linear foot unit bid price(s) for the type of repair specified measured along the centerline of the utility pipe.
        a) Width shall not be considered.
        b) The cost for temporary stone to maintain disturbed areas until repairs are made shall be included in the contract unit bid price(s) for the repairs. No additional compensation shall be made.
    d. Pavement, graveled areas, curb, and/or sidewalk and vegetated areas disturbed by the Contractor in areas where utility pipe is not installed shall be replaced by the Contractor at his expense at no additional cost to the Owner. No additional compensation will be made.
    e. The cost for milling and overlay of asphalt/bituminous pavement shall be paid for at the contract ton unit bid price(s) for the depth of milling and overlay specified and/or shown in the detail(s) in the plans. The overlay shall include pavement markings to match the existing pavement markings that are milled.
    f. The cost for overlay of asphalt/bituminous pavement shall be paid for at the contract ton unit bid price(s) for the depth of overlay specified and/or shown in the detail(s) in the plans. The overlay shall include pavement markings to match the existing pavement markings that are overlaid as well milling required to construct the heel-in as specified and/or shown in the detail(s) of the plans.
23. Specification Section 312316 – Excavation
    a. Excavation required for construction shall be included in the Unit bid price requiring this activity as detailed in the plans and specifications.
24. Specification Section 312316.13 – Trenching

a. The cost of this work shall be included in the contract lump sum bid price(s) and/or unit bid price(s) for which trenching is required. No additional compensation shall be made.
b. Unless otherwise provided, all excavation shall be unclassified regardless of the material encountered. No additional compensation shall be made for rock or any soft or otherwise unsuitable material. No additional compensation shall be made for dewatering and/or sheet piling.

25. Specification Section 312319 – Dewatering
    a. The cost of this work shall be included in the contract lump sum bid price(s) and/or unit bid price(s) for which dewatering is required.
    b. No additional compensation shall be made.
26. Specification Section 312500 – Erosion & Sedimentation Controls
    a. The cost of this work shall be paid for at the one (1) contract lump sum bid price for all erosion and sedimentation controls at all locations directly and/or indirectly disturbed by the project.
27. Specification Section 313716.13 – Rubble Stone Riprap
    a. Work under this specification section shall be included in the Unit bid price for Dump Rock Bank Protection.
28. Specification Section 321216 – Asphalt Paving
    a. Work under this specification section shall be included in the unit bid price for the installation of HMA overlay as detailed in the plans and specifications.
29. Specification Section 329200 – Turf and Grasses
    a. Work under this specification shall be included in the Unit bid price for the Reclamation of Disturbed Areas as detailed in the plans and specifications.
30. Specification Section 330507 – Trenchless Utility Installation
    a. Work under this specification section shall be included in the Unit bid price for the work requiring this activity as detailed in the plans and specifications.
31. Specification Section 330523.13 – Utility Horizontal Directional Drilling
    a. Work under this specification section shall be included in the Unit bid price requiring this activity as detailed in the plans and specifications.
32. Specification Section 330526 – Utility Identification
    a. Work under this specification section shall be included in the Unit bid price for the installation of water lines as detailed in the plans and specifications.
33. Specification Section 331113 –Water Distribution Piping
    a. The cost of this work shall be paid for at the contract linear food unit bid price(s) for the size, type, and classification for water line pipe specified.
    b. The cost for all fitting(s) and concrete anchor(s) shown in the plans or as required shall be included in the linear foot unit bid price(s) of water line pipe specified. No additional compensation shall be made.
    c. The cost for each tie-in to existing water line shall include one(1) valve of the size, type, and classification specified including valve boxes, lids, and other appurtenances shown in the detail(s) in the plans or specified.
34. Specification Section 331200 – Water Utility Distribution Equipment
    a. Work under this specification section shall be included in the Unit bid price for the activity as detailed in the plans and specifications.
35. Specification Section 331213 – Water Service Connections
    a. The cost for connecting existing water service shall include the service saddle, corporation stop, and pack joint coupling as specified and/or shown in the detail(s) in the plans.

b. Service line shall be paid for at the contract linear foot unit bid price(s) for the size, type, and classification of water service line pipe specified.

36. Specification Section 331216 – Water Utility Distribution Valves
    a. The cost for this work shall be paid for at the contract unit bid price(s) for the size, type, and classification of valve specified.
    b. The cost for each tie-in to existing water line shall include one (1) valve of the size, type, and classification specified including valve boxes, lids, and other appurtenances shown in the detail(s) in the plans or specified.
    c. The cost for all valve boxes, lids, valve marker, and other appurtenances shown in the detail(s) in the plans or specified shall be included in the unit bid price(s) of valve(s) specified. No additional compensation shall be made.
37. Specification Section 331219 – Water Utility Distribution Fire Hydrants
    a. The cost for this work shall be paid for at the contract unit bid price(s) for the size, type, and classification of fire hydrant assembly specified and all related appurtenances as shown in the detail(s) in the plans.
38. Specification Section 331300 – Disinfecting of Water Utility Distribution
    a. The cost of this work shall be included in the contract lump sum bid price(s) and/or unit bid price(s) for which disinfection is required.
    b. No additional compensation shall be made.
39. Specification Section 331400 – Boring and Jacking
    a. The cost for this work shall be paid for at the contract linear foot unit bid price(s) for the size, type, and classification of bored and jacked or open cut casing pipe specified.
    b. Carrier pipe installed in the casing pipe shall be paid for at the contract linear foot unit bid price(s) for the size, type, and classification of carrier pipe specified.
40. Specification Section 400565.23 – Swing Check Valves
    a. The cost of this work shall be included in the lump sum bid price for Backwash Pump at Water Plant.
41. Specification Section 432313.27 – Backwash Pumps
    a. The cost of providing and installing one (1) Backwash Pump shall be included in the lump sum bid price for Backwash Pump at Water Plant.

1.7 BASIS FOR PAYMENT

A. Payment for work listed under the previously listed sections shall be as follows unless otherwise noted.

1. When a separate bid item has been included in the Bid Schedule, payment shall be under the lump sum and/or unit bid items as shown on the Bid Schedule.

OR

2. When no separate bid item has been included in the Bid Schedule, payment for such work shall be included in the lump sum and/or unit bid items as to which such work under this item is incidental.

3. In either situation, payments shall be full compensation for the furnishing of all materials and performing of all the work as shown, in a workman like and acceptable

manner, including all labor, tools, supplies and incidentals necessary to complete the work.

1.8 ALTERNATES

A. Alternates are used when Owner or Engineer wants to competitively bid additional work or bid different product or system compared to product or system specified as an integral part of base Project requirements. Submitted Bids for Alternates are expressed as cost increases or decrease to the base bid.

B. Coordinate related Work and modify surrounding Work. Description for each Alternate is recognized to be abbreviated but requires that each change shall be complete for scope of Work affected.

1. Coordinate related requirements among Specification Sections as required.
2. Include as part of each Alternate: Miscellaneous devices, appurtenances, and similar items incidental to or necessary for complete installation.
3. Coordinate Alternate with adjacent Work and modify or adjust as necessary to ensure integration.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION 012000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Rooftop equipment bases and support curbs.
4. Wood blocking, cants, and nailers.
5. Wood furring and grounds.
6. Wood sleepers.
7. Plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Engineered wood products.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Regional Materials: The following wood materials shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site:

1. Dimension lumber, except treated materials.

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

D. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Framing Other Than Non-Load-Bearing Partitions: No. 2 grade.
1. Species:

a. Hem-fir (north); NLGA.
b. Southern pine; SPIB.
c. Douglas fir-larch; WCLIB or WWPA.
d. Southern pine or mixed southern pine; SPIB.
e. Spruce-pine-fir; NLGA.
f. Douglas fir-south; WWPA.
g. Hem-fir; WCLIB or WWPA.
h. Douglas fir-larch (north); NLGA.
i. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

B. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

1. Species and Grade: As indicated above for load-bearing construction of same type.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

1. Plywood shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.5 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.

B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

C. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.6 METAL FRAMING ANCHORS

A. Simpson Strong Tie

B. Allowable design loads, as published by manufacturer, shall meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by

rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.7 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

D. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.
2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

3.2 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Foam-plastic sheathing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 WALL SHEATHING

A. Plywood Sheathing: DOC PS 1, Exterior, Exposure 1, Structural I sheathing.

B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.

C. Paper-Surfaced Gypsum Sheathing: ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Georgia-Pacific Building Products.
   b. National Gypsum Company.
   c. United States Gypsum Company.

2. Type and Thickness: Type X, 5/8 inch thick.

D. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. CertainTeed Corporation.
   b. Georgia-Pacific Building Products.
   c. United States Gypsum Company.

2. Type and Thickness: Type X, 5/8 inch thick.

E. Cellulose Fiber-Reinforced Gypsum Sheathing: ASTM C 1278/C 1278M, gypsum sheathing.

1. Product: Subject to compliance with requirements, provide "Fiberock Sheathing with Aqua-Tough" by United States Gypsum Co.
2. Type and Thickness: Type X, 5/8 inch thick.

F. Extruded-Polystyrene-Foam Sheathing: ASTM C 578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Dow Chemical Company (The).

2. Thickness: As indicated.

3. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

G. Foil-Faced, Polyisocyanurate-Foam Sheathing: ASTM C 1289, Type I or Type II, Class 2, rigid, cellular, polyisocyanurate thermal insulation. Foam-plastic core and facings shall have a flame-spread index of 25 or less when tested individually.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dow Chemical Company (The).
b. Firestone Building Products.
c. Rmax, Inc.

2. Thickness: 1” if not indicated on drawings.
3. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.

2.5 ROOF SHEATHING

A. Plywood Sheathing: DOC PS 1 sheathing.

B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.

2.6 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exterior, Structural I, C-C Plugged, Exposure 1, Structural I, Underlayment single-floor panels.

B. Plywood Subflooring: DOC PS, 1Exterior, Exposure 1, Structural I single-floor panels or sheathing.

C. Underlayment: Provide underlayment in nominal thicknesses indicated or, if not indicated, not less than 1/4 inch over smooth subfloors and not less than 3/8 inch over board or uneven subfloors.

1. Plywood Underlayment for Resilient Flooring: DOC PS 1, Exterior A-C, Exposure 1 Underlayment with fully sanded face.
2. Plywood Underlayment for Ceramic Tile: DOC PS 1, Exterior, C-C Plugged, not less than 5/8-inch nominal thickness.
3. Plywood Underlayment for Carpet: DOC PS 1, Exterior, C-C Plugged, Exposure 1, Underlayment.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Paper-Surfaced or Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."

B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

C. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.9 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 or ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.

2. Table R602.3 (1), "Fastener Schedule for Structural Members," and Table R602.3 (2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with nails or screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.3 FOAM-PLASTIC SHEATHING INSTALLATION

A. Comply with manufacturer's written instructions.

B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.

C. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

END OF SECTION 061600

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes standing-seam metal roof panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated. Provide nominal 3 x 5 inch of each color indicated. Provide panel width by 10 inch long minimum.

D. Delegated-Design Submittal: For metal roof panel assembly indicated to comply with performance requirements and design criteria, including analysis data and calculations signed and sealed by the qualified professional engineer responsible for their preparation.

E. Manufacturer Certificates: Signed by manufacturer certifying that roof panels comply with energy performance requirements specified in “Performance Requirements” Article.

1. Submit evidence of meeting performance requirements.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Sample of special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Manufacturer Qualifications:

1. Manufacturer shall be a company specializing in architectural sheet metal products with at least 10 years of experience, and capable of meeting all the requirements of this specification.
2. Manufacturer shall operate a permanent, full-time manufacturing facility where the metal roof panels are produced on a fixed based roll forming machine included in the UL field inspection services.
3. Retain "UL-Certified, Portable Roll-Forming Equipment" Paragraph below if portable roll-forming equipment is allowed for on-site roll forming.

C. Fire-Resistance Ratings: Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

D. Product Substitutions:

1. Substitutions to the specified system shall be submitted to the Engineer no later than 15 days prior to the Bid Date. Acceptance of proposed substitutes shall be indicated by written addendum prior to the Bid.
2. No product substitutions will be permitted without meeting all the performance criteria set forth in the specifications.
3. No product substitutions shall be submitted after the Bid Date.

1.6 WARRANTY

A. Workmanship Warranty: Furnish manufacturer’s Standard Watertightness Warranty, in which the manufacturer agrees to repair or replace metal roof panels and associated work that fail in materials and workmanship within the warranty period indicated. Entire source of material and labor shall be the sole responsibility of one contractor (or subcontractor).

1. Warranty Period: 10 years from date of Substantial Completion.

2. Warranty shall be limited to the value of the installed metal roof assembly.

3. Warranty shall be signed by the manufacturer of the metal roof system and his authorized installer, agreeing at their option to replace or repair defective materials and workmanship as required to maintain the metal roof system in watertight condition.

4. Warranty shall not exclude any conditions such as flashing, valleys, interior gutters, penetrations, etc. which are an integral part of the roof system.

5. The manufacturer of the metal roof system shall review installation details and perform on site inspections as required to certify proper watertight roofing material installation.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 40 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Energy Performance: Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for steep-slope roof products.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: Determine wind loads based on the following minimum design wind pressures:

a. Uniform pressure of 25lbf/sf., acting inward and outward.

2. Snow Loads: 35 lbf/sf.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft..

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

E. Hydrostatic-Head Resistance: No water penetration when tested according to ASTM E 2140.

F. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating: UL 90.

G. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A- 90.
2. Hail Resistance: MH.

H. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): Temperatures of ambient air may range from -30 degrees to 120 degrees F annually and may fluctuate up to 50 degrees F in a 24-hour period.

2. Interface between panel and expansion clip shall provide for applicable thermal movement in each direction along longitudinal direction.

2.2 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.

1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.

B. Vertical-Rib Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. ATAS International, Inc.
   b. IMETCO.
   c. Morin - A Kingspan Group Company.
   d. Petersen Aluminum Corporation.
   e. Lifetite Metal Products

2. Metallic-Coated Steel Sheet: aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.

   a. Nominal Thickness: 24 Gauge (0.024”)
   b. Exterior Finish: Silicone-Modified Polyester coating, applied on a continuous coil coating line.
   c. Color: As selected by the Engineer from the manufacturer’s full range of standard colors. Unless otherwise noted all products shall be of the same color and finish.
   d. Strippable film shall be applied to the topside of the painted coil to protect the finish during fabrication, shipping and filed handling. The strippable film must be removed during installation.

3. Clips: Two-piece expansion clip to accommodate thermal movement wind-loading, and other performance criteria.

   a. Material: 0.062-inch- thick, stainless-steel sheet.

4. Joint Type: Snap.
5. Panel Coverage: 16 inches.
6. Panel Height: 1.5 inches.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.

3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GCP Applied Technologies Inc. (formerly Grace Construction Products).
b. Henry Company.
c. Kirsch Building Products, LLC.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Sub-framing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters and Downspouts: Formed from same material as roof panels according to SMACNA's "Architectural Sheet Metal Manual." Finish to match roof fascia and rake trim. Size shall be as indicated on the Drawings. Color to match the roof panels.

E. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb sub-framing of 0.060-inch-nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and sub-framing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.

F. Panel Fasteners: Self-tapping screws designed to withstand design loads.

G. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.5 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.6 FINISHES

A. Panels and Accessories:

1. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film finish of not less than 0.2 mil for primer and 0.8 mil for topcoat.

2.7 SNOW GUARD RETENTION SYSTEM

A. Snow Guard Retention System shall be 2” iClad™ as manufactured by SNO GEM. The snow guards shall be constructed of aircraft-grade aluminum extrusion and fasten to the standing seams with set screws. No roof panel penetrations or glued guards will be accepted. Color for the iPlate™ shall be selected by the Engineer from manufacturer’s full range.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install sub-framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.

B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.3 METAL PANEL INSTALLATION

A. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
4. Watertight Installation:

    a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.

b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

B. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074113.16

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

2. Cylinders for door hardware specified in other Sections.

1.2 PRE-INSTALLATION MEETINGS

A. Pre-Installation Conference: Conduct conference at Project site.

B. Keying Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product in each finish specified.

C. Door hardware schedule.

D. Keying schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during

the course of the Work to consult Contractor, Engineer, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedule.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of acceptance of Work by hardware supplier and installer unless otherwise specified herein.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

B. Accessibility Requirements: For door hardware on doors in an accessible route, comply with [**the DOJ's "2010 ADA Standards for Accessible Design**"] [**the DOT's "ADA Standards for Transportation Facilities"**] [**the ABA standards of the Federal agency having jurisdiction**] [**ICC A117.1**] [**HUD's "Fair Housing Accessibility Guidelines"**] [**and**] <**Insert regulation**>.

2.2 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 of this Section and door hardware schedule.

1. Door hardware is scheduled in Part 3 of this Section.

2.3 PRODUCT REQUIREMENTS AND MATERIALS

A. Cylindrical Latch Sets/Locksets:

1. Lock Front: 2-1/4 inches.
2. Backset: 3-3/4 inches.
3. ANSI Lip Strike: 4 inches.
4. Finish: 626/US32D.

B. Protection Plates:

1. Kick plates, stretcher, and mops plates must be 6 inches high and 1 inch less than the full width of doors between stops.
2. Finish: 626/US32D.

C. Door Closers:

1. Manufacturer: LCN or Corbin Russwin.
2. Material: Cast Iron.

    a. Aluminum door closers will not be accepted.

3. Finish: 689/Aluminum.
4. Arm: Parallel stop hold (PSH) or parallel stop (PS).
5. All pieces must be the product of one manufacturer.

D. Door Pull and Push Plates:

1. Grips: Attached to the plates at the factory.
2. Finish: 626/US32D.

E. Door Openings: Use bull nose blocks at all door openings.

F. Door Stops:

1. Furnish a stop for each door opening against a wall, fixture, or piece of equipment, complete with fasteners as required.
2. Wall Bumpers: Equal to Quality #302 or #07 wherever possible.
3. Floor Stops: Where details make the use of wall bumpers impractical, furnish Quality #431ES floor stops.
4. Finish: 626/US32D.

G. Door Silencers:

1. Furnish three (3) rubber door silencers for all single, hollow metal frames.
2. Glue-on silencers will not be permitted.

H. Door Glass: Any required door glass must be shatterproof.

I. Door Signage: As indicated on Drawings.

J. Thresholds and Weather Stripping:

1. Furnish MIL finished thresholds and weather stripping on all exterior doors.

K. Butts Hinges:

1. Exterior doors must have non-removable pins (NRP).
2. Finish: 630/US32D.

3. Half mortise butts at steel channel door frame.

L. Keying:

1. All locksets must be master keyed and grand master keyed to meet the Owner's requirements as directed.
2. Keys are to be furnished as follows:

a. Cylinder Locks: Three (3) keys of each set.
b. Master Keys: Six (6) keys of each set.
c. Grand Master Keys: Three (3) keys of each set.

M. Panic Hardware:

1. All exit devices must be listed under "Panic Hardware" in the Accident Equipment List of Underwriters' Laboratories, Inc and be the product of one manufacturer.
2. Where devices are required on labeled doors, devices must bear the UL label indicating "Fire Exit Hardware".
3. Devices must be Sargent 90 Series in types and functions specified and with "PTB" outside trim. Equivalent functions of Von Duprin 88 Series with "880" trim will be acceptable.
4. Finish: 626/US32D.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated on Drawings, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset

pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

F. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.2 ADJUSTING

A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.3 DOOR HARDWARE SCHEDULE

A. The following schedules will be considered a guide only. It is the Contractor and hardware supplier’s responsibility to furnish all required hardware in accordance with the intent of the Drawings and Specifications for this Project.

B. The following schedules are referenced in Drawings as to the location of installation.

HARDWARE SET NO. 1 – EXTERIOR DOORS				
Quantity	**Product**	**Product Code**	**Finish**	**Manufacturer**
1	½ PR Hinges	BB1191 – 4.5 x 4.5 NRP	630/US32D	Hager Co.
1	Lockset	CL3351 – NZD	626/US26D	Corbin Russwin
1	Cylinder		626/US26D	Sargent
1	Closer	LCN 4040XP	689/Aluminum	LCN
1	Kick	193S, CSK, B3E	630/US32D	Hager Co.

1	Threshold	520S, S	MIL	Hager Co.
1	Sweep	780S, V	MIL	Hager Co.
1	Seal Set	837S (Head and Jamb)	MIL	Hager Co.

END OF SECTION 087100

SECTION 238200 - CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Unit heaters.

B. Electric heaters.

1.2 RELATED REQUIREMENTS

A. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

1.3 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
   3. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
   4. Indicate mechanical and electrical service locations and requirements.

D. Manufacturer's Instructions: Indicate installation instructions and recommendations.

E. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.5 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1 ELECTRIC HEATERS

A. Manufacturers:
   1. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com.
   2. Modine Manufacturing Company: www.modineHVAC.com.

3. Trane, a brand of Ingersoll Rand: www.trane.com.

B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

C. Assembly: Suitable for mounting from ceiling or structure above with built-in controls, thermal safety cut-out, and electric terminal box.

D. Fan: Factory balanced, direct drive, axial type with fan guard.

E. Motor: Totally enclosed, thermally protected, and provided with permanently lubricated bearings.

F. Controls:
1. Disconnect.
2. Fan override to purge residual heat when de-energized.
3. Built-in thermostat.

2.2 ELECTRIC CABINET HEATERS

A. Manufacturers:
1. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com.
2. Marley Engineered Products: www.marleymep.com.
3. Trane, a brand of Ingersoll Rand: www.trane.com.

B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

C. Heating Elements: Provide open-wire, finned tubular, or resistance wire enclosed in steel sheath.

D. Cabinet: Minimum 18 gage, 0.0478 inch thick steel front panel with exposed corners and edges rounded, easily removed panels, glass fiber insulation and integral air outlet, and inlet grilles.

E. Finish:
1. Factory applied, painted finish.
2. Color: As selected from color chart.

F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

G. Motor: Tap wound multiple speed permanent split capacitor with sleeve bearings, resiliently mounted.

H. Controls:
1. Thermal cutout with automatic reset to de-energize electric heating elements in the event of overheating.
2. Built in Thermostat.

I. Filter: Easily removed, 1 inch thick glass fiber throw-away type, located to filter air before coil.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are suitable for installation.

B. Verify that field measurements are as indicated on the drawings.

3.2 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.

C. Suspended Electric Heaters:
   1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.
   2. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

D. Wall mounted electric Heaters:
   1. Install as indicated.
   2. Coordinate to ensure correct recess size for recessed units.

E. Units with Electric Heating Elements:
   1. Install as indicated including electrical devices furnished by manufacturer but not factory installed.
   2. Install wiring in accordance with the manufacturer's wiring diagram submittal and Section 260583.

3.3 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

B. Vacuum clean coils and inside of units.

C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

3.4 PROTECTION

A. Provide finished cabinet units with protective covers during the balance of construction.

END OF SECTION

SECTION 260519 - LOW-VOLTAGE CONDUCTORS AND CABLES (600 V AND LESS)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.
B. Wiring connectors.
C. Electrical tape.
D. Heat shrink tubing.
E. Oxide inhibiting compound.
F. Wire pulling lubricant.
G. Cable ties.

1.2 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.
B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.
C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).
D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).
E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.
F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.
G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
J. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
K. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
L. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
M. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Thrasher of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Field Quality Control Test Reports.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Thrasher and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is not permitted.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Conductors for Grounding and Bonding: Also comply with Section 260526.

H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

I. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

J. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 100: 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 175: 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
   2. Control Circuits: 14 AWG.

K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

L. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
      a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
   3. Color Code:
      a. 480Y/277 V, 3 Phase, 4 Wire System:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.

b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.

c. Equipment Ground, All Systems: Green.
d. For control circuits, comply with manufacturer's recommended color code.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
a. Cerro Wire LLC: www.cerrowire.com.
b. Encore Wire Corporation: www.encorewire.com.
c. Southwire Company: www.southwire.com.
d. Substitutions: See Section 016000 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.
2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
a. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.4 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 260526.

C. Wiring Connectors for Splices and Taps:
1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.

2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
1. Manufacturers:
a. 3M: www.3m.com.
b. Ideal Industries, Inc: www.idealindustries.com.
c. NSI Industries LLC: www.nsiindustries.com.
d. Substitutions: See Section 016000 - Product Requirements.

H. Mechanical Connectors: Provide bolted type or set-screw type.
1. Manufacturers:
a. Burndy LLC: www.burndy.com.
b. Ilsco: www.ilsco.com.
c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 016000 - Product Requirements.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
1. Manufacturers:
a. Burndy LLC: www.burndy.com.
b. Ilsco: www.ilsco.com.
c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 016000 - Product Requirements.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
1. Manufacturers:
a. Burndy LLC: www.burndy.com.
b. Ilsco: www.ilsco.com.
c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 016000 - Product Requirements.

2.5 WIRING ACCESSORIES

A. Electrical Tape:
1. Manufacturers:

a. 3M: www.3m.com.
b. Plymouth Rubber Europa: www.plymouthrubber.com.
c. Substitutions: See Section 016000 - Product Requirements.

2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
1. Manufacturers:
a. 3M: www.3m.com.
b. Burndy LLC: www.burndy.com.
c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 016000 - Product Requirements.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
1. Manufacturers:
a. Burndy LLC: www.burndy.com.
b. Ideal Industries, Inc: www.idealindustries.com.
c. Ilsco: www.ilsco.com.
d. Substitutions: See Section 016000 - Product Requirements.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
1. Manufacturers:
a. 3M: www.3m.com.
b. American Polywater Corporation: www.polywater.com.
c. Ideal Industries, Inc: www.idealindustries.com.
d. Substitutions: See Section 016000 - Product Requirements.

E. Cable Ties: Material and tensile strength rating suitable for application.
1. Manufacturers:
a. Burndy LLC: www.burndy.com.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
      a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
      b. Increase size of conductors as required to account for ampacity derating.
      c. Size raceways, boxes, etc. to accommodate conductors.
   7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.

2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

G. Install conductors with a minimum of 12 inches of slack at each outlet.

H. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

K. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
2. Damp Locations: Use insulating covers specifically designed for the connectors or electrical tape.
a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.

M. Insulate ends of spare conductors using vinyl insulating electrical tape.

N. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

O. Identify conductors and cables in accordance with Section 260553.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Conductors and Cables (600 V and Less): Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

C. Section 265100 - Interior Lighting: Additional grounding and bonding requirements for interior lights.

1.3 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2014.

G. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify exact locations of underground metal water service pipe entrances to building.
2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. Notify Thrasher of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Shop Drawings:
   1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field quality control test reports.

F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Thrasher. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
      b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
      c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
   3. Metal In-Ground Support Structure:
      a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
   4. Concrete-Encased Electrode:
      a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
   5. Ground Rod Electrode(s):
      a. Provide two electrodes unless otherwise indicated or required.
      b. Space electrodes not less than 6' from each other and any other ground electrode.
      c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
   6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
   7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
      a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
      b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
      c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
   8. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

G. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
   1. Provide grounding electrode system for each separate building or structure.
   2. Provide equipment grounding conductor routed with supply conductors.

3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

H. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
   a. Transformers (except autotransformers such as buck-boost transformers).
2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
6. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

I. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.
   c. Metal process piping.
8. Provide bonding for interior metal air ducts.

9. Provide bonding for metal building frame.
10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.

J. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
1. Use insulated copper conductors unless otherwise indicated.
a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).
2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gage of specified conductors.

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors or compression connectors for accessible connections.
a. Exceptions:
1) Use exothermic welded connections for connections to metal building frame.
4. Manufacturers - Mechanical and Compression Connectors:
a. Advanced Lightning Technology (ALT): www.altfab.com.
b. Burndy LLC: www.burndy.com.
c. Harger Lightning & Grounding: www.harger.com.
d. Thomas & Betts Corporation: www.tnb.com.
e. Substitutions: See Section 016000 - Product Requirements.
5. Manufacturers - Exothermic Welded Connections:
a. Burndy LLC: www.burndy.com.
b. Cadweld, a brand of Erico International Corporation: www.erico.com.
c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com.

d. Substitutions: See Section 016000 - Product Requirements.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
a. Advanced Lightning Technology (ALT): www.altfab.com.
b. Erico International Corporation: www.erico.com.
c. Harger Lightning & Grounding: www.harger.com.
d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com.
e. Substitutions: See Section 016000 - Product Requirements.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 5/8 inch diameter by 8 feet length, unless otherwise indicated.
4. Manufacturers:
a. Advanced Lightning Technology (ALT): www.altfab.com.
b. Erico International Corporation: www.erico.com.
c. Galvan Industries, Inc: www.galvanelectrical.com.
d. Harger Lightning & Grounding: www.harger.com.
e. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 260533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Aluminum rigid metal conduit (RMC).
C. Intermediate metal conduit (IMC).
D. PVC-coated galvanized steel rigid metal conduit (RMC).
E. Flexible metal conduit (FMC).
F. Liquidtight flexible metal conduit (LFMC).
G. Electrical metallic tubing (EMT).
H. Rigid polyvinyl chloride (PVC) conduit.
I. Liquidtight flexible nonmetallic conduit (LFNC).
J. Conduit fittings.
K. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete encasement of conduits.
B. Section 260519 - Low-Voltage Conductors and Cables (600 V and Less)260519.
C. Section 260526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.
D. Section 260533.16 - Boxes for Electrical Systems.
E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.
D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.
H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2005.

K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

O. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

P. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

Q. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

R. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

S. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

T. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

U. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

V. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

W. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Thrasher of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
   1. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
   2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
   3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
   4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
   5. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
   6. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.

D. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

E. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

1. Locations subject to physical damage include, but are not limited to:
   a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

J. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

L. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit or aluminum rigid metal conduit.

M. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), aluminum rigid metal conduit, or PVC-coated galvanized steel rigid metal conduit.

N. Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
   a. Transformers.
   b. Motors.

2.2 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Electrical Service Conduits: Also comply with Section 262100.

C. Fittings for Grounding and Bonding: Also comply with Section 260526.

D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

E. Provide products listed, classified, and labeled as suitable for the purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:
1. Branch Circuits: 3/4 inch (21 mm) trade size.
2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
3. Control Circuits: 3/4 inch (21 mm) trade size.
4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
5. Underground, Interior: 3/4 inch (21 mm) trade size.
6. Underground, Exterior: 1 inch (27 mm) trade size.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com.
2. Republic Conduit: www.republic-conduit.com.
3. Wheatland Tube Company: www.wheatland.com.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 016000 - Product Requirements.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.
5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com.
2. Republic Conduit: www.republic-conduit.com.
3. Wheatland Tube Company: www.wheatland.com.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 016000 - Product Requirements.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use aluminum.
5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.5 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com.
2. Republic Conduit: www.republic-conduit.com.
3. Wheatland Tube Company: www.wheatland.com.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 016000 - Product Requirements.
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.
5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.6 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Thomas & Betts Corporation: www.tnb.com.
2. Robroy Industries: www.robroy.com.
3. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

D. Interior Coating: Urethane, minimum thickness of 2 mil.

E. PVC-Coated Fittings:
1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.
5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.
6. Interior Coating: Urethane, minimum thickness of 2 mil.

F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.7 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com.
2. Electri-Flex Company: www.electriflex.com.
3. International Metal Hose: www.metalhose.com.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com.

b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 016000 - Product Requirements.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.8 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com.
2. Electri-Flex Company: www.electriflex.com.
3. International Metal Hose: www.metalhose.com.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 016000 - Product Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.9 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com.
2. Republic Conduit: www.republic-conduit.com.
3. Picoma: http://www.picoma.com.
4. Wheatland Tube Company: www.wheatland.com.
5. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
c. Thomas & Betts Corporation: www.tnb.com.
d. Substitutions: See Section 016000 - Product Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use compression (gland) or set-screw type.
a. Do not use indenter type connectors and couplings.
5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
1. Cantex Inc: www.cantexinc.com.
2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com.
3. JM Eagle: www.jmeagle.com.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.11 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com.
2. Electri-Flex Company: www.electriflex.com.
3. International Metal Hose: www.metalhose.com.
4. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

2.12 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

F. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.

E. Install intermediate metal conduit (IMC) in accordance with NECA 101.

F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

H. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.

I. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal all conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across roofs.
      c. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
   9. Arrange conduit to provide no more than 150 feet between pull points.
   10. Route conduits above water and drain piping where possible.
   11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
   13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.
   14. Group parallel conduits in the same area together on a common rack.

J. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use of spring steel conduit clips for support of conduits is not permitted.
9. Use of wire for support of conduits is not permitted.
10. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

K. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

L. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

M. Underground Installation:

1. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
2. Provide underground warning tape in accordance with Section 260553 along entire conduit length for service entrance where not concrete-encased.

N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 033000 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

O. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

P. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.

Q. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

R. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

S. Provide grounding and bonding in accordance with Section 260526.

T. Identify conduits in accordance with Section 260553.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 260533.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Underground boxes/enclosures.

1.2 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 262726 - Wiring Devices:
   1. Wall plates.
   2. Additional requirements for locating boxes for wiring devices.

1.3 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SCTE 77 - Specification for Underground Enclosure Integrity; 2013.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

K. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Thrasher of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures and underground boxes/enclosures.
   1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual locations for pull boxes and cabinets and enclosures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Keys for Lockable Enclosures: Two of each different key.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.

2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use nonmetallic boxes where exposed rigid PVC conduit is used.
4. Use suitable concrete type boxes where flush-mounted in concrete.
5. Use suitable masonry type boxes where flush-mounted in masonry walls.
6. Use raised covers suitable for the type of wall construction and device configuration where required.
7. Use shallow boxes where required by the type of wall construction.
8. Do not use "through-wall" boxes designed for access from both sides of wall.
9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
11. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
12. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
13. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
14. Minimum Box Size, Unless Otherwise Indicated:
    a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    b. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
15. Wall Plates: Comply with Section 262726.
16. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
    b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com.
    c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com.
    d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
    e. Thomas & Betts Corporation: www.tnb.com.
    f. Substitutions: See Section 016000 - Product Requirements.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.

b. Outdoor Locations: Type 3R, painted steel.

3. Junction and Pull Boxes Larger Than 100 cubic inches:
   a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
   a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
   b. Back Panels: Painted steel, removable.
   c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
   b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com.
   c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com.
   d. Substitutions: See Section 016000 - Product Requirements.

D. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Provide logo on cover to indicate type of service.
5. Applications:
   a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77, Tier 8 load rating.
   b. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
   a. Manufacturers:
      1) Hubbell Incorporated; Quazite Products: www.hubbellpowersystems.com.
      2) MacLean Highline: www.macleanhighline.com.
      3) Oldcastle Precast, Inc: www.oldcastleprecast.com.
      4) Substitutions: See Section 016000 - Product Requirements.
   b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
   8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
   9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
      b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
   10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
   11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
      a. Concealed above accessible suspended ceilings.
      b. Within joists in areas with no ceiling.
      c. Electrical rooms.
      d. Mechanical equipment rooms.

I. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in

accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Provide cast-in-place concrete collar constructed in accordance with Section 033000, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
5. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

N. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

P. Close unused box openings.

Q. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

R. Provide grounding and bonding in accordance with Section 260526.

S. Identify boxes in accordance with Section 260553.

3.3 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.
B. Identification nameplates and labels.
C. Wire and cable markers.
D. Voltage markers.
E. Underground warning tape.
F. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Conductors and Cables (600 V and Less): Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

1.3 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.
B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2015.
E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
D. Samples:
   1. Identification Nameplates: One of each type and color specified.
   2. Warning Signs and Labels: One of each type and legend specified.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Motor Control Centers:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Use identification nameplate to identify main overcurrent protective device.
         5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      b. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
         5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      c. Transformers:
         1) Identify kVA rating.
         2) Identify voltage and phase for primary and secondary.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Identify load(s) served. Include location when not within sight of equipment.
      d. Enclosed switches:
         1) Identify voltage and phase.

2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.

e. Transfer Switches:
1) Identify voltage and phase.
2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.
4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.

3. Emergency System Equipment:
a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.

4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.

5. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
a. Service equipment.
b. Industrial control panels.
c. Motor control centers.

6. Arc Flash Hazard Warning Labels: Comply with Section 260573.

7. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
2. Identification for Communications Conductors and Cables: Comply with Section 271005.
3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
a. At each source and load connection.
b. Within boxes when more than one circuit is present.
c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
5. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

D. Identification for Raceways:

1. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
    a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
        1) Color Code:
            (a) Emergency Power System: Red.
        2) Field-Painting: Comply with Section 099123 and 099113.
        3) Vinyl Color Coding Electrical Tape: Comply with Section 260519.
2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
4. Use underground warning tape to identify underground raceways.

E. Identification for Boxes:
1. Use voltage markers or color coded boxes to identify systems other than normal power system.
    a. Color-Coded Boxes: Field-painted in accordance with Section 099123 and 099113 per the same color code used for raceways.
    b. For exposed boxes in public areas, do not color code.
2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
    a. For exposed boxes in public areas, use only identification labels.

F. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 271005.
2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
3. Use identification label to identify fire alarm system devices.
    a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
    a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
5. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
6. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
    a. Brimar Industries, Inc: www.brimar.com.
    b. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
    c. Seton Identification Products: www.seton.com.
    d. Substitutions: See Section 016000 - Product Requirements.
2. Materials:

a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
   a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Manufacturers:
   a. Brady Corporation: www.bradyid.com.
   b. Brother International Corporation: www.brother-usa.com.
   c. Panduit Corp: www.panduit.com.
   d. Substitutions: See Section 016000 - Product Requirements.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. System designation where applicable:
      1) Emergency Power System: Identify with text "EMERGENCY".
   b. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
   c. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
5. Color:
   a. Normal Power System: White text on black background.
   b. Emergency Power System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.
   a. Exceptions:

1) Provide white text on red background for general information or operational instructions for emergency systems.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
a. Include voltage and phase for other than 120 V, single phase circuits.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

2.3 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com.
2. HellermannTyton: www.hellermanntyton.com.
3. Panduit Corp: www.panduit.com.
4. Substitutions: See Section 016000 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.4 VOLTAGE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com.
2. Brimar Industries, Inc: www.brimar.com.
3. Seton Identification Products: www.seton.com.
4. Substitutions: See Section 016000 - Product Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
   1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
   2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
   3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
   4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:
   1. Markers for Voltage Identification: Highest voltage present.
   2. Markers for System Identification:
      a. Emergency Power System: Text "EMERGENCY".

F. Color: Black text on orange background unless otherwise indicated.

2.5 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. Brady Corporation: www.bradyid.com.
   2. Brimar Industries, Inc: www.brimar.com.
   3. Seton Identification Products: www.seton.com.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

D. Legend: Type of service, continuously repeated over full length of tape.

E. Color:
   1. Tape for Buried Power Lines: Black text on red background.
   2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.6 WARNING SIGNS AND LABELS

A. Manufacturers:
   1. Brimar Industries, Inc: www.brimar.com.
   2. Clarion Safety Systems, LLC: www.clarionsafety.com.
   3. Seton Identification Products: www.seton.com.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
      b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.

3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.3 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 260583 - WIRING CONNECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Conductors and Cables (600 V and Less).

B. Section 260533.13 - Conduit for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 262726 - Wiring Devices.

1.3 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
2. Determine connection locations and requirements.

B. Sequencing:

1. Install rough-in of electrical connections before installation of equipment is required.
2. Make electrical connections before required start-up of equipment.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 262816.16 and in individual equipment sections.

C. Wiring Devices: As specified in Section 262726.

D. Flexible Conduit: As specified in Section 260533.13.

E. Wire and Cable: As specified in Section 260519.

F. Boxes: As specified in Section 260533.16.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

1.2 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Conductors and Cables (600 V and Less): Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 260583 - Wiring Connections: Cords and plugs for equipment.

1.3 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.

4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Notify Thrasher of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Samples: One for each type and color of device and wall plate specified upon request.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data:
1. GFCI Receptacles: Include information on status indicators.

G. Project Record Documents: Record actual installed locations of wiring devices.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

2.2 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet of sinks.

2.3 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: Ivory with stainless steel wall plate.

2.4 WALL SWITCHES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.5 RECEPTACLES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
4. Substitutions: See Section 016000 - Product Requirements.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.
3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.

C. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
1. All GFI Receptacles: Provide with non-feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.6 WALL PLATES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell-wiring.com.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us
4. Substitutions: See Section 016000 - Product Requirements.

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

E. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
1. Mounting Heights: Unless otherwise indicated, as follows:
a. Wall Switches: 48 inches above finished floor.
b. Receptacles: 18 inches above finished floor or 6 inches above counter.
2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
3. Where multiple receptacles or wall switches are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Thrasher to obtain direction prior to proceeding with work.

5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

L. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

M. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

N. Identify wiring devices in accordance with Section 260553.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch and wall dimmer with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Thrasher.

3.6 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 262813 - FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.2 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
    a. Fusible Switches for Motor Control Centers: See Section 262419.
    b. Fusible Enclosed Switches: See Section 262816.16.
2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
3. Notify Thrasher of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1. Spare Fuse Cabinet: Include dimensions.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Fuses: One set(s) of three for each type and size installed.
3. Fuse Pullers: One set(s) compatible with each type and size installed.
4. Spare Fuse Cabinet Keys: Two.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com.

B. Littelfuse, Inc: www.littelfuse.com.

C. Mersen: ep-us.mersen.com.

2.2 APPLICATIONS

A. Feeders:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
   2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

B. General Purpose Branch Circuits: Class RK1, time-delay.

C. Individual Motor Branch Circuits: Class RK1, time-delay.

2.3 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

2.4 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

D. Identify spare fuse cabinet in accordance with Section 260553.

END OF SECTION

SECTION 262923-A - VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable frequency controllers.

1.2 RELATED REQUIREMENTS

A. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems; 2006.

B. NEMA ICS 7 - Industrial Control and Systems: Adjustable-Speed Drives; 2006.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Manufacturer's Field Reports: Indicate start-up inspection findings.

F. Operation Data: NEMA ICS 7.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

G. Maintenance Data: NEMA ICS 7.1. Include routine preventive maintenance schedule.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Air Filters: Two of each type.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Variable Frequency Motor Controllers:
1. Eaton Corporation: www.eaton.com.
2. General Electric Company: www.geindustrial.com.
3. Rockwell Automation, Inc.; Allen-Bradley Products: ab.rockwellautomation.com.
4. Schneider Electric; Square D Products: www.schneider-electric.us.
5. Siemens Industry, Inc: www.usa.siemens.com.

B. Substitutions: See Section 016000 - Product Requirements.

C. Source Limitations: Furnish variable frequency motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.

2.2 DESCRIPTION

A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.
1. Employ microprocessor-based inverter logic isolated from power circuits.
2. Design for ability to operate controller with motor disconnected from output.

B. Enclosures: NEMA 250, Type 1, suitable for equipment application in places regularly open to the public.

C. Finish: Manufacturer's standard enamel.

2.3 COMPONENTS

A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.

B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, and input power ON.

C. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control.

D. Include undervoltage release.

E. Control Power Source: Separate circuit.

F. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

G. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.

H. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.

I. Manual Bypass: Furnish contactor, motor running overload protection, and short circuit protection for full voltage, non-reversing operation of the motor. Include isolation switch to allow maintenance of inverter during bypass operation.

J. Disconnecting Means: Include integral circuit breaker on the line side of each controller.

K. Wiring Terminations: Match conductor materials and sizes indicated.

2.4 SOURCE QUALITY CONTROL

A. Shop inspect and perform standard productions tests for each controller.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

3.2 INSTALLATION

A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Select and install overload heater elements in motor controllers to match installed motor characteristics.

D. Identify variable frequency controllers in accordance with Section 260553.

E. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.

3.3 FIELD QUALITY CONTROL

A. Provide the service of the manufacturer's field representative to prepare and start controllers.

B. Perform field inspection and testing in accordance with Section 014000.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Perform inspections and tests listed in NETA ATS, Section 7.17.

3.4 ADJUSTING

A. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

3.5 CLOSEOUT ACTIVITIES

A. Demonstrate operation of controllers in automatic and manual modes.

3.6 MAINTENANCE

A. See Section 017000 - Execution Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of controllers for one year from Date of Substantial Completion.

END OF SECTION

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Ballasts and drivers.

D. Lamps.

E. Luminaire accessories.

1.2 RELATED REQUIREMENTS

A. Section 260533.16 - Boxes for Electrical Systems.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

C. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.

1.3 REFERENCE STANDARDS

A. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

B. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

C. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

E. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

F. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2011.

G. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. NFPA 101 - Life Safety Code; 2015.

J. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

K. UL 1598 - Luminaires; Current Edition, Including All Revisions.

L. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Thrasher of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
1. LED Luminaires:
a. Include estimated useful life, calculated based on IES LM-80 test data.
b. Include IES LM-79 test report upon request.
2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
3. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

D. Samples:
1. Provide one sample(s) of each luminaire proposed for substitution upon request.

E. Field quality control reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.

I. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting) and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.8 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

C. Provide five year pro-rata warranty for batteries for emergency lighting units.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 016000 - Product Requirements, except where individual luminaire types are designated with substitutions not permitted.

2.2 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.3 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
1. Sealed maintenance-free lead calcium unless otherwise indicated.
2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Accessories:
1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
3. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.4 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
1. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
2. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

B. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

2.5 LAMPS

A. Lamps - General Requirements:
1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Thrasher to be inconsistent in perceived color temperature.

2.6 ACCESSORIES

A. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
   4. Install canopies tight to mounting surface.

G. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

H. Install accessories furnished with each luminaire.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

J. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

K. Identify luminaires connected to emergency power system in accordance with Section 260553.

L. Install lamps in each luminaire.

3.4 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Thrasher.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Thrasher. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Thrasher or authority having jurisdiction.

3.6 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.7 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of luminaires to Thrasher, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 331213 - WATER SERVICE CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings for ¾" and 1- inch water service connections to structures.
2. Corporation stop assemblies.
3. Curb stop assemblies.
4. Meter setting equipment.
5. Water meters.
6. Meter Wells and Lids.

B. Related Requirements:
1. Section 312316.13 - Trenching: Excavation of pipe trench.
2. Section 312316.13 - Trenching: Backfilling of trench.
3. Section 331300 - Disinfecting of Water Utility Distribution: Flushing and disinfecting of water system.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Relocating Water Meter Settings:

1. Basis of Measurement: By Each.
2. Basis of Payment: New Water Meter Setting– The Contractor's Unit Bid Price for new meter setting shall include the purchase and installation of the well, lid coppersetter, corporation stop, curb stop, saddle, and reconnection back to customer service line. Meter settings shall include one (1) cubic foot of AASHTO #57 crushed limestone around the corporation stop and saddle area. Meters will be taken out of old meter setting and installed by the contractor.

C. Service Line:

1. Basis of Measurement: By linear foot.
2. Basis of Payment: The service line installed under this item shall be paid for by the linear foot of pipe for each type and size as specified on the plans or directed by the Engineer, and installed compete in place, including all connections and fittings.

D. Water Meters:

1. Basis of Payment: Contractor shall purchase new water meters and deliver to the Town of Monongah. Cost for new water meter shall be included in the unit bid price for New High Pressure Meter Setting. Town of Monongah currently utilizes the following water meters: Master Meter 5/8" x ½".

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. American Society of Sanitary Engineering:

1. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.
2. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

D. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
5. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
6. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
7. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
8. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
9. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
10. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
11. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:

1. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
2. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
3. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
4. AWWA C702 - Cold-Water Meters - Compound Type.
5. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
6. AWWA C800 - Underground Service Line Valves and Fittings.
7. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
8. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meter setting equipment, service saddles, and accessories.

C. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store products and materials off ground and under protective coverings and away from walls.

D. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

PART 2 - PRODUCTS

2.1 WATER PIPING AND FITTINGS

A. Polyethylene Pipe: Service Tubing

1. Comply with AWWA C901] ASTM D3035, DR 9, for <___200_____> psig pressure rating.
2. Fittings: Comply with AWWA C901, molded.
3. Joints: Compression.

2.2 CORPORATION STOP ASSEMBLIES

A. Manufacturers:

1. Ford Meter Box Co., Inc.
2. Substitutions: As approved by Engineer

B. Corporation Stops:

1. Comply with ASTM B62.
2. Body: Brass or red brass alloy.
3. Inlet End: Threaded for tapping according to AWWA C800.
4. Outlet End: Suitable for service pipe specified.

C. Service Saddles:

1. Type: On 2” PVC water lines are to be Ford S70-203 or S70-204, or equal. On C-900 lines they are to be made of brass and are to be Ford S90 Type or equal.
2. Designed to hold pressures in excess of pipe working pressure.

2.3 CURB STOP ASSEMBLIES

A. Manufacturers:

1. Ford Meter Box Co., Inc.
2. Substitutions: As approved by Engineer

B. Curb Stops:

1. Body: Brass or red brass alloy.
2. Comply with ASTM B62.
3. Valve Type: Plug.
4. Sealing: Positive pressure.

C. Curb Boxes and Covers:

1. Body: Cast iron.
2. Type: Extension.
3. Base: arch pattern.
4. Lid:

a. Inscription: WATER.
b. Plug: Pentagonal.

2.4 METER SETTING EQUIPMENT

A. Manufacturers:

1. Ford Meter Box Co., Inc.
2. Substitutions: As approved by Engineer

B. Outside Meter Setting:

1. Setters shall be furnished with a saddle nut inlet ball valve with padlock wings. The outlet shall have a saddle nut dual cartridge A.S.S.E. approved check valve.

2. Optional features of bracing eye, seal holes and padlock wings shall be furnished on each setter.

3. The height of the setter shall be 12”.

4. Setters shall have copper tubing sized to allow for a full flow to and from the meter with a 13/16” O.D. with a 0.058” wall thickness and a 0.6965” I.D. Type K copper for ¾” and with a 1-1/8” O.D. with 0.065 wall thickness and a 0.995 I.D. Type K copper for 1”.

5. Coppersetters shall beVBHC72-12WBE44-33 for 5/8” x ¾” and VBHC74-12WBE44-44 for 1” as manufactured by Ford Meter Box C., Inc.

6. All coppersetters must meet low lead requirements.

2.5 WATER METERS

A. Description: To be removed from old meter setting and placed in new

2.6 METER WELLS AND LIDS

A. Manufacturers:

1. Ford
2. Substitutions: As approved by the engineer.

B. Description: 20”x 30” white corrugated meter well for installing single service. Manufactured by ABS, Ford Meter Box Co., Mid-States Plastic or engineer’s approved equal.

C. Flat lids only, no two piece lids. 20” Flat Lid – East Jordan Iron Works – Model # 109-P,

D. Insulated rings are not acceptable.

E. Minimum thickness of 0.300” and have a smooth interior.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.

C. Remove scale and dirt from inside and outside of piping before assembly.

D. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Corporation Stop Assemblies:

1. Make connection for each different kind of water main using suitable materials, equipment, and methods as approved by Architect/Engineer.
2. Provide service clamps for mains constructed of materials other than cast iron or ductile iron.
3. Location:

    a. Screw corporation stops directly into tapped and threaded iron main at 10 and 2 o'clock positions along main's circumference.
    b. Locate and stagger corporation stops at least 12 inches apart longitudinally.

4. Plastic Pipe Mains:

    a. Provide full support for service clamp for full circumference of pipe, with minimum 2 inches width of bearing area.
    b. Exercise care against crushing or causing other damage to mains at time of tapping or installation of service clamp or corporation stop.

5. Use proper seals or other devices such that no leaks are present in mains at points of tapping.
6. Do not backfill and cover service connections until installation is approved by Engineer.

B. Bedding:

1. Excavate pipe trench as specified in Section 312316.13 - Trenching.
2. Placement:

   a. Place bedding material at trench bottom.
   b. Level fill materials in one continuous layer not exceeding 6 inches compacted depth.
   c. Compact to 95 percent maximum density.

C. Pipe and Fittings:

1. Maintain separation of water main from sewer piping (10’ horizontal, 18” vertical) according to WV Health Department requirements.
2. Route pipe in straight line.

D. Curb Stop Assemblies:

1. Set curb stops on solid bearing ground.
2. Boxes:

   a. Center and plumb curb boxes over curb stops.
   b. Set box cover flush with finished grade.

E. Water Meters:

1. Meters will be removed from old setting and installed in new setting by contractor.

F. Service Connections:

1. Install water service according to Town of Monongah requirements.
2. Setters are to be installed so that they are no less than 16” below the lid.
3. Setters are to be installed so that they are no more than 18” below the lid.

G. Meter Wells and Lids:

1. Pits are to be flush with the grade.

2. Backfill around pits with gravel or segregated fill.

H. Disinfection of Water Piping System:

1. Flush and disinfect system as specified in Section 331300 - Disinfecting of Water Utility Distribution.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION 331213

SECTION 331219 - WATER UTILITY DISTRIBUTION FIRE HYDRANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire hydrants.
2. 2” Flushing Post Hydrant
3. 2” Hidden Flushing Hydrant

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Concrete for thrust restraints.
2. Section 312316.13 - Trenching: Trenching, backfilling, and compaction requirements.
3. Section 331300 - Disinfecting of Water Utility Distribution: Flushing and disinfection requirements.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

B. Fire Hydrants:

1. Basis of Measurement: By Each.
2. Basis of Payment: The Contractor’s Unit Bid Price for fire hydrant assembly shall include the purchase and installation of the fire hydrant, 6” gate valve, all thread rods, valve riser box, thrust blocking, stone and all appurtenances as shown on the details of the contract drawings.

1.3 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA C502 - Dry-Barrel Fire Hydrants.
2. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.
3. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.

B. National Fire Protection Association:

1. NFPA 291 - Recommended Practice for Fire Flow Testing and Marking of Hydrants.

1.4 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's latest published literature, including illustrations, installation and maintenance instructions, and parts lists.

C. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.6 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of fire hydrants and service valves.

C. Operation and Maintenance Data: Submit data for hydrants.

1.7 QUALITY ASSURANCE

A. Perform Work according to ANSI/AWWA C502 standards.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Company specializing in performing Work of this Section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Prepare hydrants and accessories for shipment according to AWWA standards and seal hydrant and ends to prevent entry of foreign matter.

C. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

D. Storage:

1. Store materials in areas protected from weather, moisture, or potential damage.
2. Do not store materials directly on ground.

E. Handle materials in a way that prevents damage to interior and exterior surfaces.

PART 2 - PRODUCTS

2.1 FIRE HYDRANTS

A. Manufacturers:

1. American-Darling
2. Substitutions: As approved by the Engineer

B. Dry-Barrel Breakaway Type:

1. Comply with AWWA C502.
2. Body: Cast iron.
3. Valve: Compression type.
4. Burial Depth: As indicated on Drawings.
5. Inlet Connection Size: 6 inches.
6. Valve Opening: 5-1/4 inches in diameter.
7. End Connections: Mechanical joint.
8. Bolts and Nuts: Galvanized steel.
9. Interior Coating: Comply with AWWA C550.
10. Direction of Opening: Counterclockwise unless otherwise indicated.

C. Hose Connections:

1. One pumper, two hose nozzles.
2. 2-2 ½” Hose nozzle and 1-41/2” pumper outlet nozzle.
3. Attach nozzle caps by separate chains.

D. Finishes:
1. Color: According to NFPA 291 requirements.

2.2 2” FLUSHING POST HYDRANT

A. Post hydrants shall be red in color and have a 3'-00" bury depth with four cubic feet of clean graded #57 stone beneath the hydrant to allow for drainage. All working parts shall be brass, with hydrant main valve opening being 2-3/16". Inlet connection shall be 2" mechanical joint, with the outlet being 2 ½" National Standard Threads. The operating rod shall be non-turning and all operating parts shall be removable from above ground with no special wrenches. This self-draining, non-freeze hydrant's barrel will be made of 3" ductile iron pipe and shall have a cast iron top stock as manufactured by Kupferle Foundry, St. Louis, Model #2, or Engineer's approved equal.

B. Thrust blocking and clean #57 stone with plastic barrier as shown on detail shall be included with 2” post flushing hydrants.

C. A 2" gate valve, unless shown on plans otherwise shall be included with 2" post flushing hydrants.

2.3 2” HIDDEN FLUSHING HYDRANT

A. Hidden flushing hydrants shall be 3' - 00" bury depth with four cubic feet of clean graded #57 stone beneath the hydrant to allow for drainage. All working parts shall be brass, with hydrant main valve opening being 2 - 3/16". Inlet connection shall be 2" mechanical joint, with outlet being 2 ½" National Standard Threads. This self-draining, non-freeze hydrants barrel will be made of 3" ductile iron pipe and shall have a cast iron top stock as manufactured by Kupferle Foundry, St. Louis, Model Eclipse #85, or Engineers approved equal

B. Thrust Blocking and clean stone with plastic barrier as shown on detail shall be included with 2" hidden flushing hydrant.

C. A 2" Gate valve, unless shown on plans otherwise shall be included with 2" hidden flushing hydrants.

2.4 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type as specified in Section 033000 - Cast-in-Place Concrete.

B. Aggregate: Aggregate for hydrant drainage as specified in Section 310516 - Aggregates for Earthwork.

C. Hydrant Tee: Conform to ANSI/AWWA Specifications A21.51/C-151 and shall be U.S. Steel mechanical joint or Engineer’s approved equal.

D. Pipe: Water line connected to the hydrant shall be 6” in size and of the same pressure and class and type as the main line the hydrant is connected to. Up to 15’ of water line shall be included with the fire hydrant assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify exact location and size of hydrants from Drawings.

C. Obtain clarification and directions from Architect/Engineer prior to execution of Work.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures, utilities, and landscape in immediate or adjacent areas.

C. Identify required lines, levels, contours, and datum locations.

D. Locate, identify, and protect from damage utilities to remain.

E. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

3.3 INSTALLATION

A. Perform trench excavation, backfilling, and compaction as specified in Section 312316.13 - Trenching.

B. Provide support blocking and drainage gravel while installing fire hydrants; do not block drain hole.

C. Set fire hydrants plumb with pumper nozzle facing roadway.

D. Set fire hydrants with centerline of pumper nozzle 18 inches above finished grade, and with safety flange not more than 6 inches nor less than 2 inches above grade.

E. The breakaway ring is to be installed just above final grade.

F. Paint hydrants according to color scheme of NFPA 291.

G. After hydrostatic testing, flush hydrants and check for proper drainage.

H. Disinfection of Water Piping System:

1. Flush and disinfect system as specified in Section 331300 - Disinfecting of Water Utility Distribution.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Pressure test system according to AWWA C600 and following:

1. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
2. Conduct hydrostatic test for at least two hours.
3. Slowly fill section to be tested with water and expel air from piping at high points.

4. Install corporation cocks at high points.
5. Close air vents and corporation cocks after air is expelled.
6. Raise pressure to specified test pressure.
7. Observe joints, fittings, and valves under test.
8. Remove and replace cracked pipes, joints, fittings, and valves that show visible leakage and retest.
9. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate, maintaining test pressure within plus or minus 5.0 psi.
10. Leakage is defined as quantity of water supplied to piping as necessary to maintain test pressure during testing period.
11. Compute maximum allowable leakage using following formula:

    a. $L = SD \times \sqrt{P}/C$

        1) L = testing allowance, gph
        2) S = length of pipe tested, feet
        3) D = nominal diameter of pipe, inches
        4) P = average test pressure during hydrostatic test, psig
        5) C = 148,000

    b. If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

12. If test of pipe indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
13. Correct visible leaks regardless of quantity of leakage.

END OF SECTION 331219

SECTION 400565.23 - SWING CHECK VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Swing check valves 3 inches and larger.

B. Related Requirements:

1. Section 331113 – Public Water Utility Distribution Piping.

1.2 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.

B. ASME International:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
2. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.
3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

C. ASTM International:

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
2. ASTM A536 - Standard Specification for Ductile Iron Castings.
3. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
4. ASTM B148 - Standard Specification for Aluminum-Bronze Sand Castings.

D. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

E. SSPC - The Society for Protective Coatings:

1. SSPC-SP 6 - Commercial Blast Cleaning.

1.3 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with piping and equipment connections specified in other Sections and as indicated on Drawings.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit catalog information, indicating materials of construction and compliance with indicated standards.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

E. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents:

1. Record actual locations of piping, valves and other appurtenances, connections, and invert elevations.

1.6 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

B. Perform Work according to manufacturer’s instruction and recommendations and this Specification Section.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Protect piping and appurtenances by storing off ground.
3. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SWING CHECK VALVES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to the following:

1. VAL-MATIC Valve and Manufacturing Corp.
2. G.A. Industries, Inc.

B. The check valves shall be of full body flanged type, with a domed access cover and only one moving part, the flexible disc.

C. Provide Swing Flex Series #500 check valves as manufactured by Val-Matic Valve & Mfg. Corporation, Elmhurst, IL.

D. The valve body shall have full flow equal to nominal pipe diameter at all points through the valve. The 4-inch (350 mm) valve shall be capable of passing a 3-inch (75 mm) sphere. The seating surface shall be on a 45-degree angle to minimize disc travel. A threaded port with pipe plug shall be provided on the bottom of the valve to allow for field installation of a backflow actuator without special tools or removing the valve from the line.

E. The top access port shall be full size, allowing removal of the disc without removing the valve from the line. The access cover shall be domed in shape to provide flushing action over the disc for operation in lines containing high solids content.

F. The disc shall be of one-piece construction, precision molded with an integral o-ring type-sealing surface, and contain steel and nylon reinforcement in the hinge. The flex portion of the disc shall be warranted for twenty-five years. Non-Slam closing characteristics shall be provided through a short 35-degree disc stroke and a memory disc return action.

G. The valve shall be cycle tested 1,000,000 times with no signs of wear or distortion to the valve disc or seat and shall remain drop tight at both high and low pressures. The test results shall be independently certified.

H. The valve body shall be constructed of ASTM A126 Class B cast iron.

I. The disc shall be precision molded Buna-N (NBR), ASTM D2000-BG.

J. A screw-type backflow actuator shall be provided for field installation to allow opening of the valve during no-flow conditions. Buna-N seals shall be used to seal the stainless steel stem in a bronze bushing. The backflow device shall be of the rising-stem type to indicate position. A T-handle shall be provided for ease of operation.

2.2 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Testing:

1. Hydrostatically test check valves at twice rated pressure according to AWWA C508.
2. Permitted Leakage at Indicated Working Pressure: None.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that field dimensions are as indicated on Shop Drawings.

C. Inspect existing flanges for nonstandard bolt-hole configurations or design, and verify that new valve and flange mate properly.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Thoroughly clean valves before installation.

C. Surface Preparation:

1. Touch up shop-primed surfaces with primer as specified in Section 099010 – Coating Systems for Wastewater Treatment Plants.
2. Solvent-clean surfaces that are not shop primed.
3. Clean surfaces to remove loose rust, mill scale, and other foreign substances by power wire brushing or commercial sand blasting; SSPC-SP 6.

4. Prime surfaces as specified in Section 099010 – Coating Systems for Water Treatment Plants.

3.3 INSTALLATION

A. According to AWWA C508 and manufacturer instructions.

B. Dielectric Fittings: Provide between dissimilar metals.

3.4 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Inspection:

1. Inspect for damage to valve lining or coating and for other defects that may be detrimental as determined by Architect/Engineer.
2. Repair damaged valve or provide new, undamaged valve.
3. After installation, inspect for proper supports and interferences.

C. Pressure test valves with piping.

3.5 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Keep valve interior clean as installation progresses.

C. After installation, clean valve interior of soil, grit, loose mortar, and other debris.

END OF SECTION 400565.23

SECTION 432313.27 – BACKWASH PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single suction backwash pump.

B. Related Requirements:

1. Section 260583 - Wiring Connections: Conduit and electrical power to pumps.
2. Section 262923 - Variable-Frequency Motor Controllers: Execution and product requirements for equipment specified by this Section.
3. Section 400565.23 – Swing Check Valves.

1.2 REFERENCE STANDARDS

A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. American Iron and Steel Institute:

1. AISI 1045 - Medium Carbon Steel.

C. ASME International:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

D. ASTM International:

1. ASTM A27/A27M - Standard Specification for Steel Castings, Carbon, for General Application.
2. ASTM A29/A29M - Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought.
3. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
4. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.
5. ASTM A536 - Standard Specification for Ductile Iron Castings.
6. ASTM B91 - Standard Specification for Magnesium-Alloy? Forgings.
7. ASTM B505/B505M - Standard Specification for Copper Alloy Continuous Castings.

E. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.

2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information, including installation instructions, accessories, performance curves with specified operating point plotted, capacities and pressure differentials, power, rpm, sound power levels for both inlet and outlet at rated capacity, electrical characteristics, and connection requirements.

C. Shop Drawings:

1. Furnish diagrams showing complete layout of system, including equipment, piping, valves, wiring and ladder diagrams, controls, and control sequences.
2. Indicate size and configuration of assembly, mountings, weights, and accessory connections.
3. Indicate manufacturer's specified displacement tolerances for vibration at operational speed as specified for pumps.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures, anchoring, and layout.

F. Source Quality-Control Submittals: Indicate results of [**shop**] [**factory**] tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

I. Qualifications Statements:

1. Submit qualifications for manufacturer and installer.
2. Submit manufacturer's approval of installer.

1.4 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations and final orientation of pumps and appurtenances.

1.5 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

B. Perform Work according to **Town of Monongah** standards.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three (3) years' [**documented**] experience.

B. Installer: Company specializing in performing Work of this Section with minimum three (3) years' [**documented**] experience [**and approved by manufacturer**].

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.8 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five (5)-year manufacturer's warranty for pumps.

PART 2 - PRODUCTS

2.1 SINGLE SUCTION PUMP

A. Manufacturers:

1. Goulds Pumps, 240 Fall Street, Seneca Falls, NY 13148.

a. Model: 3196I-17 (Size 8x10-16H).

2. Substitutions: [**As specified in Section 016000 - Product Requirements**]

B. Description: Frame-mounted, centrifugal, single suction pump, with direct-coupled electric motor.

C. Pump Designation:

1. Backwash Pump.

D. Performance and Design Criteria:

1. Service Liquid: Water.
2. Rated Liquid Temperature: 70°F.
3. Specific Gravity: 1.00.
4. Viscosity: 1 mPa·s.
5. Rated and Max Suction Pressure: 0.0 psi g.
6. Design Flow Rate: 4,000 gpm.
7. Design Flow Total Dynamic Head: 75 feet.
8. Published Efficiency: 82.5 percent.
9. Rated Pump Efficiency (with contract seal): 82.5 percent.
10. Rated Total Power: 93.4 hp (including mechanical seal drag 0.20).
11. Non-Overloading Power: 94 hp.
12. NPSH Required: 14.3 feet.
13. Discharge Pressure: 33.1 psi g (43.9 psi g at shut off) based on 0.0 psi g rated suction pressure.
14. Performance Curve: 5419-3 (Rotation clockwise viewed from the coupling end).
15. Shut Off Head: 101.4 feet.
16. Minimum Flow Rate: Continuous Stable: 1,342.3 gpm. Hydraulic: 1,342.3 gpm.
17. Rated Brake Horsepower: 93.4 hp.
18. Maximum Brake Horsepower: 94 hp.
19. Maximum RPM: 1,200 rpm.
20. Maximum Drive Power per 100 RPM: 19.67 hp.
21. Maximum Solid Size: 1.00 inch.
22. Rotation: Clockwise.
23. Suction Size: 10 inches.
24. Suction Specific Speed: 10,800 gpm, feet.
25. Suction Flange Finish: Smooth.
26. Discharge Flange Finish: Smooth.
27. Discharge Size: 8 inches.
28. Pump Weight: 780 lbs.
29. Driver: 1,650 lbs.
30. Pump Material Class: Bronze fitted.
31. Maximum Temperature Limit: 350°F.
32. Minimum Temperature Limit: -25°F.

E. Casing:

1. Dual volute casing designed to equalize radial forces, withstand high working pressures with minimum distortion, and lessen radial reaction of shaft and bearings. Casing must have a rugged foot-mounted design and resist external forces and vibration to provide for a smooth, vibration-free performance.
2. Casing must be horizontally split with upper and lower halves bolted together.
3. Suction and discharge connections must be located in the lower half of the casing to allow removal of upper half of the casing for inspection, maintenance, or removal of complete rotating element without disturbing suction or discharge piping or driver.

4. The upper half of the casing must have taps for seal piping, priming, and vents. The lower half of the casing must have taps for gauges and draining.
5. Seats for stuffing box bushing must be cast and bored integrally with lower half of the casing.
6. Casing must have permanently fixed stainless steel nameplate.
7. Construction: Bronze fitted.
8. Casing Material: Cast iron, ASTM A48 Class 30B.

    a. Maximum Casing pressure at Rated Liquid Temperature: 250 psi g.

9. Case wear rings must be renewable, permit easy maintenance of proper running clearance, and lock in place with anti-rotation pins. Case wear rings must be supplied to maintain proper running clearance with impeller hubs and to minimize leakage between suction and discharge chambers of casing.

    a. Casing Wear Ring Material: Bronze, ASTM B584 Alloy.
    b. Case Wear Ring Anti-Rotation Pin Material: Stainless steel, ASTM A276 Type 420.

10. Casing Gaskets: Aramid Fiber with EPDM and Silicate Filler.
11. Case Thickness: 0.5625-inch.
12. Connections: Gage and drain.
13. Tapped Openings:

    a. Suction Gage Connection: $^{3}/_{8}$-inch.
    b. Discharge Gauge Connection: $^{3}/_{8}$-inch.
    c. Stuffing Box Seal Ring Connections: $^{3}/_{8}$-inch.
    d. Casing Prime Connection: 1/2-inch.
    e. Baseplate Drain (Half CPLG): 1/2-inch.
    f. Casing Drain Connection: 1/2-inch.
    g. Gland Flush Connections: $^{3}/_{8}$-inch.
    h. Gland Vent Connections: $^{1}/_{4}$-inch.
    i. Gland Drain Connections: $^{3}/_{8}$-inch.
    j. Gland Quench Connections: $^{3}/_{8}$-inch.

14. Casing will have $^{3}/_{8}$-inch National Pipe Thread (NPT) vent plug and 1/2-inch NPT drain plug.
15. Casing Number of Stage: 1.
16. Mounting: Bracket.
17. Casing Split: Horizontal.
18. End Connections:

    a. 150# flat face flanges.
    b. Comply with ASME B16.1, Class [**125**] [**150**] <_____>.

19. Passes standard hydraulic test.

F. Impeller:

1. Impeller must be single suction, single stage, centrifugal enclosed design and cast in one piece. Impeller must minimize axial thrust with polished waterways and fully machined exterior surfaces to allow for highly efficient, smooth performance.
2. Exterior surfaces must be machined, and interior water ways must be hand finished.
3. Impeller must be designed to accept impeller wear rings.
4. Impeller rings must be held in position by axial set screws.
5. Impeller must be dynamically balanced and keyed to shaft.
6. Impeller Material: Ductile Iron.
7. Impeller Wear Ring Material: Bronze, ASTM B584 Alloy C87600.

    a. Impeller Wear Ring Retaining Set Screw Material: 303 stainless steel.

8. Impeller Key Material: Steel, ASTM A108 Grade 1018-B1112.
9. Sleeve to Impeller Gasket: Non-asbestos.
10. Statically and dynamically balanced to ISO G6.3 after assembly.
11. Rated Diameter: 15.8750 inches.
12. Maximum Diameter: 16.7500 inches.
13. Minimum Diameter: 12.000 inches.

G. Shaft:

1. Designed for minimum deflection at maximum load. Shaft must be a dry shaft design sealed by O-rings at sleeve/impeller hub and impeller bolt. Shaft must be positively sealed from pumpage with gaskets and O-rings.
2. Shaft must be completely sealed by gaskets between the shaft sleeves and impeller hubs to assure shaft is completely dry during operation.
3. Shaft Material: SAE 4140/Bronze, ASTM A434 Grade 4140 Class BC.
4. Shaft Type: Straight bore.
5. Shaft Diameter at Coupling: 2.375 inches.
6. Shaft Diameter at Impeller: 1.500 inch.
7. Shaft Diameter at Stuffing Box with Sleeve: 2.0 inches.
8. Shaft sleeve must be held in place by sleeve nuts located outside the stuffing box area. The shaft sleeve must be key driven at the impeller end. An O-ring seal must be provided to prevent leakage between sleeves and sleeve nuts.

    a. Sleeve Material: Bronze, ASTM B584 Alloy.
    b. Sleeve Nut Material: Bronze, ASTM B584 Alloy.
    c. Sleeve Nut O-ring Material: Buna Rubber.
    d. Sleeve Diameter: 2.50 inches.

9. Stuffing Box:

    a. The stuffing box must be integral with the casing.
    b. The stuffing box must contain die-formed packing, split, removable lantern rings, and renewable stuffing box throat bushings.

        1) Lantern Ring: Glass-filled polytetrafluoroethylene (PTFE).

    c. The stuffing box must have tapped openings for water sealing either from casing or from an outside source.

d. The stuffing box must be split so it will be unnecessary to unbolt gland halves when repacking box.
e. Type of Stuffing Box: Two-piece investment cast stainless steel glands.

1) Packing: Square non-asbestos.
2) Gland: Stainless steel, ASTM A743 Grade CF8M.

10. Shaft Separation: 0.38-inch.
11. Couplings: Keyed to shaft.

H. Glands Studs Material: 316 stainless steel flush quench and drain.

I. Hex Nuts Material: 304 stainless steel.

J. Hex Cap Screw Material: Steel.

K. Coupling:

1. Type: Non-spacer.
2. Manufacturer and Model: T.B. Wood, Standard-Sure Flex 9S-S.F.1.00.
3. Guard: Carbon steel.

L. Bedplate: Bedplate must be cast iron with drip collection chamber, tapped drain connection, and opening for grouting. Flexible coupling must be supplied.

M. Bearings:

1. Type: Radial.

a. Thrust End (Outboard): Regreasable double row ball thrust bearing for high axial thrust capability. Must be locked on shaft in bearing housing so the bearing positively positions the rotating element and carries any residual axial thrust.

1) Manufacturer and Model: SKF, 5309 A/C3.

b. Coupling End (Inboard): Single row deep grove ball bearing.

1) Manufacturer and Model: SKF, 6211.

2. Bearing Span: 9.2500 inches.
3. Thrust bearing must be held in position on the shaft with a tapered snap ring and locked in the bearing housing.
4. Radial bearing must be free to float axially in housing to take radial load only.
5. Bearing Housing:

a. Bearing housing seats must be cast and bored integrally with the lower half casing to assure accurate alignment of the rotating assembly without need for external adjustment.

b. Bearing housing must be completed sealed by Inpro® VBX labyrinth seals to exclude moisture and dirt. The bearing housing must also be grease lubricated with reliefs to prevent over lubrication.
c. Bearing Housing Material: Cast iron, ASTM A48 Class 25B.

6. End Cover to Bearing Housing Gasket Material: Kraft paper.
7. Comply with ABMA [**9**] [**11**].
8. Minimum L-10 Life at Continuous Maximum Load and Speed: [**40,000**] <_____> hours.
9. Lubrication: Regreasable.
10. End Cover Material: Cast iron, ASTM A48 Class 25B.
11. The grease fitting, thrust end cover, bearing spacer, outboard ball bearing, inboard ball bearing, and thrust bearing retaining ring will be made of steel.

N. Support Plate: Fabricate steel pump and motor support with drip rim.

O. Seals: Mechanical.

1. Pump must be furnished with (single, double balanced, cartridge) mechanical seals.

a. Make and Model: John Crane, Type 5610Q XF(55)1XO(58)H (Carbon vs Silicone Carbide) – Single Cartridge.

2. Suction Side Seal Position: Centerline.
3. Discharge Side Seal Position: Side.
4. Diameter of Mechanical Seal with Sleeve: 2.50-inches.
5. Mechanical Seal Power Loss: 0.20 hp.

P. Frame Features:

1. Provide VBX-D bronze/viton labyrinth oil seals manufactured by Inpro® (A Waukesha Bearings Business) to eliminate contaminants and improve mean time between failure.
2. Single extended shaft.

Q. Painting: Goulds Blue standard paint.

2.2 OPERATION

A. Driver Characteristics:

1. As specified in Section 260583 - Wiring Connections [**and Section 262923-A - Variable-Frequency Motor Controllers**].
2. Electric motor selected by pump manufacturer and manufactured by a company approved by the pump manufacturer
3. Furnished by the distributor.
4. Mounted by the distributor.
5. Rating: 100 hp.
6. Voltage: 460 V, three phase, 60 Hz.
7. Insulation/SF: F/1.15.

8. Enclosure: Severe duty/mill and chemical premium efficiency.
9. Speed: 1,200 rpm.
10. Frame: 444T.
11. Length of Driver Including Shaft: 45.00-inches.
12. Motor Dimension: 11-inches.
13. Driver O Dimension: 23.13-inches.
14. Driver Shaft Diameter: 3.3750-inches.
15. Driver Weight: 1,650-lbs.
16. Maximum [**Fuse Size**] [**Circuit Breaker Size**] [**Overcurrent Protection**]: <_____> A.
17. Minimum Circuit Ampacity: <_____>.
18. Minimum Power Factor: <_____> percent at rated load.

B. Control Panel:

1. Factory mounted.
2. NEMA 250 Type [**1**] [**4**] <_____>.
3. Elapsed Time Meters:

a. Type: Resettable, time totalizer.
b. Range: Zero to 99,999.9 hours.
c. Single-point power connection and grounding lug.

C. Controls: <_____>.

D. Disconnect Switch: As indicated on drawings.

E. Operation Sequences: As indicated on drawings.

2.3 FABRICATION

A. Connect pump shaft to drive motor with universal flexible coupling to compensate for minor misalignment and to permit removal of pump-rotating assembly and motor without removing piping.

B. Shaft Guard: Enclose shaft and universal joint with enclosed-type metal shaft guard complying with OSHA standards.

C. Pump and Drive Mating Surfaces: Machine finished.

D. Base: Heavy cast-iron base with drip rim and drain connection.

2.4 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Provide shop inspection and testing of completed assembly.

C. Owner Inspection:

1. Make completed <**product name**> available for inspection at manufacturer's factory prior to packaging for shipment.
2. Notify Owner at least Seven (7) days before inspection is allowed.

D. Owner Witnessing:

1. Allow witnessing of factory inspections and tests at manufacturer's test facility.
2. Notify Owner at least seven (7) days before inspections and tests are scheduled.

E. Certificate of Compliance:

1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. According to manufacturer instructions.

B. Provide and connect piping, power and control conduit, and wiring to make system operational and ready for startup.

3.2 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Inspection:

1. Ensure that pumps have been installed correctly and that there is no objectionable heat or vibration.
2. Check pump and motor alignment, proper motor rotation, and pump and drive units for proper lubrication.

C. Testing:

1. Operate pump on clear water at design point for continuous period of two hours, under supervision of manufacturer's representative and in presence of Engineer.
2. Verify pump performance by performing time-drawdown test or time-fill test.

D. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than two (2) days on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

E. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

F. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.3 ADJUSTING

A. Section 017000 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Check control functions and adjust as required.

3.4 DEMONSTRATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate equipment startup, shutdown, routine maintenance, alarm condition responses, and emergency repair procedures to Owner's personnel.

3.5 ATTACHMENTS

A. Pump Schedule:

1. Backwash Pump:

a. Manufacturer: Goulds Pumps, 240 Fall Street, Seneca Falls, NY 13148.
b. Model: 3196I-17, Size H.
c. Location: As shown on Drawings.
d. Capacity: 4,000 gpm.
e. Discharge Pressure: 48.7 psi g.
f. Motor:

1) Power: 100 hp.
2) Voltage: 460 V.
3) Phase: Three.

END OF SECTION 432313.27