

**SECTION 01 11 13**  
**SUMMARY OF WORK**

**PART 1 – GENERAL**

**1.1 REQUIREMENTS INCLUDED**

- A. Related Requirements.
- B. Work covered by Contract Documents.
- C. Description of Work.
- D. Contract Method.
- E. Work by Others.
- F. Coordination.
- G. Access for Testing and Inspection.

**1.2 RELATED REQUIREMENTS**

- A. Section 00 70 00 – General Conditions.
- B. Section 00 80 00 – Supplementary Conditions.
- C. Section 01 29 73 - Schedule of Values.

**1.3 WORK COVERED BY CONTRACT DOCUMENTS**

- A. Work under this Contract consists of the construction of two projects in the community of Akhiok, Alaska: A power system upgrade project and an electrical distribution upgrade project as follows:
  - 1. Power System Upgrade Base Bid: Provide all labor, materials, and equipment required to construct the power system upgrade as described in 1.4 Description of Work below.
  - 2. Electrical Distribution Upgrade Base Bid: Provide all labor, materials, and equipment required to construct the electrical distribution upgrade as described in 1.5 Description of Work below.
  - 3. Power System Upgrade Additive Alternate 1: Provide all labor, materials, and equipment required to construct the heat recovery system to the school as described in 1.6 Description of Work below.

4. Power System Upgrade Additive Alternate 2: Provide all labor, materials, and equipment required to construct the heat recovery system to the clinic as described in 1.7 Description of Work below.
  5. Electrical Distribution Upgrade Additive Alternate 3: Provide all labor, materials, and equipment required to construct a new electrical distribution system to serve the airport as described in 1.8 Description of Work below.
- B. The intent of the Contract is to provide for the construction and completion of every detail of work described in the Contract Documents. The Contractor shall furnish all labor, materials, supervision, equipment, tools, transportation, quality control, and supplies required to complete the work in accordance with the Contract Documents.

#### **1.4 POWER SYSTEM UPGRADE BASE BID DESCRIPTION OF WORK**

- A. Receive Owner Furnished materials including completed power plant module (module) and loose ship accessories. See Section 01 64 00 – Receipt of Owner Furnished Materials. Note that at the time of transfer, the module will be fully functional and completely tested with temporary piping and electrical connections as noted on the Drawings.
- B. Disassemble the module as required to prepare for shipping. The Drawings have notes describing points intended to allow disassembly with minimal disruption to equipment and systems. These are provided for guidance only. The Contractor shall be responsible to remove exterior features and cover work as required to ensure module systems will not be damaged in shipping.
- C. Drain engine coolant glycol as required and store in sealed drums for shipment with the module. Disconnect all batteries at the engines, emergency lights, fire alarm panel, and switchgear UPS.
- D. Waterproof the module for shipping. Plug or cover all exterior openings and penetrations then cover the entire module with reinforced shrink wrap or a custom fit tarpaulin. The Contractor shall be responsible to ensure that water does not get into the module during shipping and storage.
- E. Package for shipment all loose ship Owner furnished items and all removed items. The Contractor shall be responsible to protect items from damage and moisture during shipping and storage.
- F. Furnish all materials and equipment required for all on site construction.
- G. Mobilize the module, loose ship items, and all required materials to the project site in Akhiok, Alaska.
- H. Prepare the site including all clearing, grubbing and utility demolition.

- I. Procure local fill material, place, compact and grade.
- J. Provide trenching, backfill, compaction, and warning tape as required for electrical systems.
- K. Provide concrete foundations and slabs. Place and secure the module, stairs, and tank on the concrete foundations.
- L. Re-assemble module including all piping and electrical systems. Reconnect batteries. Install ventilation system.
- M. Furnish and install roof system over module.
- N. Within 30 days of delivery of the module to the project site, make provisions to provide heat within the control room adequate to maintain minimum 50°F ambient temperature. The control room shall remain heated until the Authority begins testing.
- O. Two days prior to substantial completion, make provisions to provide heat within the generation room adequate to maintain minimum 50°F ambient temperature. The generation room shall remain heated until the Authority begins testing.
- P. Provide fencing, storage connex, and other features indicated.
- Q. Provide fuel system including tank, piping, appurtenances, equipment, and associated electrical system.
- R. Pressure test, flush, and charge all piping systems as indicated.
- S. Provide step up transformer, ground sleeve, grounding grid, and associated electrical system.
- T. Provide a minimum of two weeks' notice to the Authority to schedule the substantial completion inspection. Prior to declaring the project substantially complete, perform all required tests of mechanical and electrical systems as required by the Contract Documents. Document completion by filling out the Pre-Commissioning Substantial Completion Inspection Checklist and submitting to the Authority. Note that a draft version of the checklist is included at the end of this section. A final checklist will be provided to the Contractor at the time of mobilization.
- U. Upon substantial completion acceptance, the Authority will functionally test and commission the system. Tasks performed by the Authority shall include but not be limited to:
  - 1. A complete functional test of the generation system including automatic and manual start/stop, paralleling, load sharing, and safety shut downs.

2. Functional test of all associated systems including fuel, used oil blending, cooling, heat recovery, plant heat, and ventilation.
3. Final calibration of all mechanical and electrical instrumentation devices.
4. Test of all data and communication systems to demonstrate proper operation of SCADA system and cameras including internet access.

The Contractor shall provide technicians on site who are familiar with the mechanical and electrical systems to assist with testing and to make corrections to any deficiencies found in the Work.

- V. Upon completion of testing and commissioning the Contractor shall:
1. Correct all deficiencies noted in the Substantial Completion Inspection punchlist. Provide photographic documentation of corrections to the Authority.
  2. Finish grade the project site and all work areas.
  3. Thoroughly clean the module and all work areas. Remove all rubbish and debris and dispose of all waste in accordance with the Contract Documents and all applicable State and Federal regulations.

## **1.5 ELECTRICAL DISTRIBUTION UPGRADE BASE BID DESCRIPTION OF WORK**

- A. Provide all labor, materials, and equipment required to install all above and below ground electrical distribution system components shown on the drawings and staking sheets (including but not limited to all sectionalizing cabinets, transformers, foundations, pedestals, primary and secondary conductors, conduit, warning tape, grounding, re-serving of existing meters and street lighting, etc.) except for the items specifically indicated to be provided under Additive Alternate #3 in 1.8 Description of Work below.
- B. Procure and mobilize all required materials to the project site in Akhiok, Alaska.
- C. Provide trenching, bedding, backfill, compaction, warning tape, and finished grading as required.
- D. Protect existing service meters and streetlights and re-serve as shown on the drawings.
- E. Restore all roads and driveways disturbed during construction to original condition.
- F. Restore all drainage paths and ditches disturbed during construction to original or better condition.

- G. Demolish all existing exposed electrical distribution system components taken out of service as a result of the base bid improvements. These shall include sectionalizing cabinets, transformers, foundations, pedestals, and primary and secondary conductors and conduit exposed as a result of construction activities. The remainder of buried components taken out of service as a result of this project may be abandoned in place.
- H. Thoroughly clean all work areas. Remove all rubbish and debris and dispose of all waste in accordance with the Contract Documents and all applicable State and Federal regulations
- I. Provide a minimum of two weeks' notice to the Authority to schedule the substantial completion inspection. Prior to declaring the project substantially complete, perform all required system tests as required by the Contract Documents. Document completion by filling out the Pre-Commissioning Substantial Completion Inspection Checklist and submitting to the Authority. Note that a draft version of the checklist is included at the end of this section. A final checklist will be provided to the Contractor at the time of mobilization.
- J. Correct all deficiencies noted in the Substantial Completion Inspection punch list. Provide photographic documentation of corrections to the Authority.

**1.6 POWER SYSTEM UPGRADE ADDITIVE ALTERNATE #1 DESCRIPTION OF WORK**

- A. Provide all labor, materials, and equipment required for constructing the heat recovery system to the Akhiok School as shown on the Drawings. Materials shall include but not be limited to: arctic pipe, piping, valves, pumps, equipment, appurtenances, instrumentation, control panels, energy meter, and associated electrical system.
- B. Mobilize all required materials to the project site in Akhiok, Alaska.
- C. Provide trenching, backfill, compaction, warning tape, and insulation as required.
- D. Install all systems as indicated.
- E. Pressure test, flush, and charge all piping systems as indicated.
- F. Test all electrical and controls systems.
- G. Finish grade the project site and all work areas.
- H. Thoroughly clean all work areas. Remove all rubbish and debris and dispose of all waste in accordance with the Contract Documents and all applicable State and

Federal regulations.

- I. Correct all deficiencies noted in the Substantial Completion Inspection punchlist. Provide photographic documentation of corrections to the Authority.

**1.7 POWER SYSTEM UPGRADE ADDITIVE ALTERNATE #2 DESCRIPTION OF WORK**

- A. Provide all labor, materials and equipment required for the heat recovery system to the Akhiok Clinic as shown on the Drawings. Materials shall include but not be limited to: arctic pipe, piping, valves, pumps, equipment, appurtenances, instrumentation, control panels, energy meter, and associated electrical system.
- B. Mobilize all required materials to the project site in Akhiok, Alaska.
- C. Provide trenching, backfill, compaction, warning tape, and insulation as required.
- D. Install all systems as indicated.
- E. Pressure test, flush, and charge all piping systems as indicated.
- F. Test all electrical and controls systems.
- G. Finish grade the project site and all work areas.
- H. Thoroughly clean all work areas. Remove all rubbish and debris and dispose of all waste in accordance with the Contract Documents and all applicable State and Federal regulations.
- I. Correct all deficiencies noted in the Substantial Completion Inspection punchlist. Provide photographic documentation of corrections to the Authority.

**1.8 ELECTRICAL DISTRIBUTION UPGRADE ADDITIVE ALTERNATE #3 DESCRIPTION OF WORK**

- A. Provide all labor, materials, and equipment required to construct all above and below ground electrical distribution system components between the base bid area and the airport (including but not limited to all sectionalizing cabinets, transformers, foundations, primary and secondary conductors, conduit, warning tape, grounding, etc.) as shown on the drawings as Additive Alternate 3.
- B. Procure and mobilize all required materials to the project site in Akhiok, Alaska.
- C. Provide trenching, bedding, backfill, compaction, warning tape, and finished grading as required.
- D. Protect existing service meters and streetlights and re-serve as shown on the

drawings

- E. Restore all roads and driveways disturbed during construction to original condition.
- F. Restore all drainage paths and ditches disturbed during construction to original or better condition.
- G. Demolish all existing electrical distribution components taken out of service as a result of Additive Alternative #3. These shall include sectionalizing cabinets, transformers, foundations, pedestals, primary and secondary conductors and conduit.
- H. Thoroughly clean all work areas. Remove all rubbish and debris and dispose of all waste in accordance with the Contract Documents and all applicable State and Federal regulations
- I. Correct all deficiencies noted in the Substantial Completion Inspection punch list. Provide photographic documentation of corrections to the Authority.

## **1.9 CONTRACT METHOD**

- A. This Contract is lump sum and is composed of multiple lump sum items as shown on Section 00 32 00 – Bid Schedule. This work shall be measured and paid for in accordance with Section 00 70 00 – General Conditions, Article 13 – Payment to Contractors and Completion and Section 01 29 73 - Schedule of Values.

## **1.10 WORK BY OTHERS**

- A. The module will be shop fabricated and tested by others and be provided to the Contractor as Owner Furnished materials. See Specification Section 01 64 00 – Receipt of Owner Furnished Materials. Assume full responsibility for protection and safekeeping of materials and products provided under this Contract.
- B. The Drawings have notes delineating Shop/On-Site work. All work described as being part of the Module Shop Fabrication scope is not part of this Contract and has been performed under a separate contract.

## **1.11 COORDINATION**

- A. Coordinate Work to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.
- B. Sequence Work to maximize worker efficiency and minimize construction time.
- C. Prior to procurement, verify that characteristics of interrelated equipment are compatible.

- D. Coordinate space requirements and installation of components. Utilize spaces efficiently to maximize accessibility for other installations, maintenance, and repairs.

### **1.12 ACCESS FOR TESTING AND INSPECTION**

- A. Provide access for the Authority and the Engineer to the site. Provide on-site transportation, ladders, lifts, eye and ear protection, hard hats, appropriate and clean respiratory protection, etc. for inspections and testing of the Work.

### **PART 2 – PRODUCTS (NOT USED)**

### **PART 3 – EXECUTION**

#### **3.1 PROJECT SCHEDULE CRITICAL DATES**

- |                   |   |
|-------------------|---|
| July 29, 2020     | Owner Furnished Module and Loose Ship Items Available for Pickup. |
| October 15, 2020  | Power System Substantial Completion. Begin Testing.               |
| November 12, 2020 | Power System Final Completion.                                    |
| November 12, 2020 | Electrical Distribution Substantial Completion.                   |
| December 10, 2020 | Electrical Distribution Final Completion.                         |



**AKHIOK POWER SYSTEM UPGRADE  
 PRE-COMMISSIONING SUBSTANTIAL COMPLETION INSPECTION CHECKLIST**

<b>Heat Recovery System &amp; Arctic Pipe</b>	
Arctic Pipe Backfill, Grading, & Site Cleanup Complete	
End User Building Entrances Complete	
Wall Penetrations Flashed & Sealed	
Provide Copies of Pressure Test Reports	
Heat Recovery System Filled with Propylene Glycol	
Glycol Circulating, Air Purged, 20 PSIG Minimum, Strainers Cleaned	
Pump P-HR2A On/Off Operation, Speed & Flow Correct	
No Leaks or Drips - Pipe Flanges, Fittings, Valves	
End User Heat Recovery Panels Installed and Functioning	
School Energy Meter Installed and Functioning	
School Pump P-HR3 Set to Speed 2 & Functioning	
Clinic Pump P-HR4 Set to Speed 3 & Functioning	
Temp Sensors and Thermometers Calibrated	
<b>Intermediate Fuel Tank &amp; Piping</b>	
Footings & Shim Plates Complete, Level, Nuts Tight	
Truck Fill Drip Pan Mounted & Secure	
Piping, Wiring/Conduit, Supports Complete & Secure	
Provide Copies of Pressure Test Reports	
No Leaks or Drips - Pipe Flanges, Valves	
Pipe Painting Complete	
Verify Actuator Valve Operation	
4' Minimum Fuel Level in Intermediate Tank For Commissioning	
Evo Level Probe Installation Complete	
Evo Level and Temperature Readings Correct on Day Tank Panel	
<b>Feeder &amp; Module Exterior Wiring</b>	
Step Up Transformer Installation Complete	
Feeder Conduit Wall Penetration Complete & Sealed	
Ground Grid Complete, Module & Intermediate Tank Bonded	
Module Exterior Alarms, Lighting, Recepts, Etc. Complete & Operational	
Module Exterior Radiator Power/Control Wiring Complete & Operational	
Phone/Internet Service Installed and Operational for Commissioning	
<b>Module Structure &amp; Site</b>	
Site Grading Complete Including Drainage & Compaction	
Fence & Barrier Complete, Gate Swings & Latches Operational	
Storage Container In Place	
Footings & Shim Plates Complete, Level, Nuts Tight	
Roofing / Siding / Trim Complete	
Stairs/Landings In Place	
Doors, Closures, Latches, Panic Hardware, Etc. Operational	
Site Signs and Placards In Place	
Spare Filters, Break-In Oil, Tools, Etc. On Site	
Site Cleanup Complete	

**AKHIOK POWER SYSTEM UPGRADE  
 PRE-COMMISSIONING SUBSTANTIAL COMPLETION INSPECTION CHECKLIST**

<b>Day Tank, Used Oil Hopper &amp; Piping</b>			
Vent Piping Complete & Secured			
Fuel Filter Reinstalled, Exterior Pipe Connection Complete			
Day Tank Full For Commissioning			
<b>Heating &amp; Ventilation</b>			
Intake Ducts & Dampers Installation Complete			
Exhaust Hoods Installation Complete			
<b>Generator Cooling System</b>			
Radiators, Structural Support, & Piping Installation Complete			
Piping Charged With Glycol & Bled			
Glycol Storage Tank Filled & Excess In Sealed Marked Drums			
<b>Fire Suppression System</b> <i>(Note that this may need to be done after plant commissioning)</i>			
Exterior Devices Reinstalled			
System Filled With Potable Water			
Full Nitrogen Bottle In Rack			
Full Spare Nitrogen Bottle On Site			
Fire Suppression System Field Recertified			
On Site Training Performed			
<b>Generators</b>			
	<b>Gen #1</b>	<b>Gen #2</b>	<b>Gen #3</b>
Batteries Reconnected			
Exhaust & Crank Vent Piping Installed			
Exhaust Pipe Insulation Installed			
Exhaust Wall Cover Plates Installed			
<b>Miscellaneous Power Prior to Startup</b>			
Switchgear UPS Battery Reconnected			
Emergency Light Batteries Reconnected			
<b>Substantial Completion Acceptance</b> Time:                      Date:                      Outside Temp (F):			
Engineer Signature, Printed Name, & Date			
Contractor Signature, Printed Name, & Date			
AEA Staff Signature, Printed Name, & Date			
Utility Staff Signature, Printed Name, & Date			

**AKHIOK ELECTRICAL DISTRIBUTION UPGRADE  
 PRE-COMMISSIONING SUBSTANTIAL COMPLETION INSPECTION CHECKLIST**

<b>Underground Power Distribution</b>	
Certification of Completion Complete	
Pedestals & Sectionalizing Cabinets Complete & Secure	
Installation of Markers for Pedestals & Sectionalizing Cabinets	
Conduit Ends Sealed with Cold Shrink	
All Transformers Complete & Grounded	
Installation of Bollards for Transformers Complete	
Connection of Distribution Conductors to Step Up Transformer Complete	
Conduit Ends Sealed with Cold Shrink	
All Building Services Connections Complete	
All Light Pole Services Connections Complete	
Backfill, Grading, & Site Cleanup Complete	
Installation of Line Location Markers	
Conductor Operating Tests Complete	
Ground Measurement Tests Complete	
<b>Substantial Completion Acceptance</b> Time:	Date: Outside Temp (F):
Engineer Signature, Printed Name, & Date	
Contractor Signature, Printed Name, & Date	
AEA Staff Signature, Printed Name, & Date	
Utility Staff Signature, Printed Name, & Date	

Draft

**END OF SECTION**

**SECTION 01 12 19**  
**CONTRACTOR'S CERTIFICATION OF SUBCONTRACTS**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Procedures for preparing, submitting and accepting subcontracts.

**1.2 RELATED REQUIREMENTS**

- A. Section 00 10 00 – Information to Bidders.
- B. Section 00 43 00 – Subcontractor List.
- C. Section 00 70 00 – General Conditions: Subcontractor Certification and Approval.
- D. Section 00 80 00 – Supplementary Conditions: Subcontract Provisions.
- E. Section 01 33 00 – Submittal Procedures.

**1.3 PREPARATION OF CERTIFICATION**

- A. Certification Forms: Use forms provided by the Authority.
- B. Contractor shall prepare certification form and submit to the Authority prior to the start of work. Where required, attach additional information to the certification form.
- C. Substitute certification forms will not be considered.

**1.4 SUBMITTAL OF CERTIFICATION**

- A. The CONTRACTOR shall submit certification forms for all subcontractors for review and approval by the Authority.

**1.5 CONSIDERATION OF CERTIFICATION**

- A. Following receipt of submitted subcontractor certification forms, the Authority will review for the following, at minimum:
  - 1. Completeness of forms and attachments
  - 2. Proper execution (signatures) of forms and attachments
- B. Incomplete or improperly executed subcontractor certification forms will be returned to the Contractor for revision and resubmittal.
- C. Contractor shall remove its subcontractor from the project site until its subcontractor certification form is submitted, reviewed, and approved.
- D. The Authority will not process payments for work performed by a non-certified subcontractor.

**1.6 ACKNOWLEDGMENT OF CERTIFICATION**

- A. Submittals which have been examined by the Authority and are determined to be complete and properly executed shall be acknowledged as such by the Project Manager's signature.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**

**Note: The Contractor shall provide this form for ALL subcontractors working on this project.** This form is applicable to all projects, including Small Procurement Contracts, and must be completed in full.

PROJECT: Akhiok Site Construction ITB#20048

PRIME CONTRACTOR: \_\_\_\_\_

Pursuant to the Contract Documents, we hereby stipulate the following concerning the award of Work to the last Subcontractor on the following list:

1. First Tier Subcontractor: \_\_\_\_\_ DBE? Yes  No   
 Second Tier: \_\_\_\_\_ DBE? Yes  No   
 Third Tier: \_\_\_\_\_ DBE? Yes  No   
 Fourth Tier: \_\_\_\_\_ DBE? Yes  No
2. Date of Subcontract: \_\_\_\_\_
3. Amount of Subcontract: \$ \_\_\_\_\_
4. Scope of Work: \_\_\_\_\_  
 \_\_\_\_\_
5. Are the following documents kept on file by both the Contractor and the Subcontractor (check the appropriate answer)?  
 Contract Minimum Wage Schedule Yes  No
6. Does the Subcontract contain provisions for prompt payment, release of retainage, and interest on late payment and retainage conforming to AS 36.90.210?  
 Yes  No
7. Does the Subcontract specifically bind the Subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of the Authority and does it contain waiver provisions and termination provisions as required by the Contract Documents?  
 Yes  No
8. a. Does the Subcontractor have adequate insurance coverages as specified in the Contract Documents?  
 Yes  No   
 If not, does the Contractor stipulate that the insurance limits of the Subcontractor are acceptable to the Contractor and that he has notified his insurance carrier of the reduced insurance limits?  
 Yes  No
- b. Does the evidence of insurance certify that the policies described thereon comply with all aspects of the insurance requirements for this project?  
 Yes  No

Subcontractor Name: \_\_\_\_\_

c. Does the evidence of insurance list the Authority as an "Additional Insured" or "Certificate Holder"?

Yes  No

d. Does the evidence of insurance commit to providing 30 day written notice of cancellation or reduction of any coverage?

Yes  No

e. Insurance Expiration dates:

Comprehensive or Commercial General Liability: \_\_\_\_\_

Automobile: \_\_\_\_\_ Workers' Compensation: \_\_\_\_\_

(Other): \_\_\_\_\_

9. Copies of the following professional certifications, licenses, and registrations are attached (circle all that apply):

- Business License (mandatory)
- Contractor License (mandatory)
- Land Surveyor's License
- Electrical Administrator's License (mandatory for electrical subs)
- Mechanical Administrator's License (mandatory for mechanical subs)
- Engineer/Architect
- Other: \_\_\_\_\_

10. Exceptions to any of the above are explained as follows: \_\_\_\_\_

**CERTIFICATION (to be completed and signed by PRIME CONTRACTOR):** I certify all the above to be true and correct.

Signature: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Company: \_\_\_\_\_

Date: \_\_\_\_\_

**AUTHORITY'S APPROVAL/DISAPPROVAL**

The subject subcontract is **APPROVED**. Nothing in this approval should be construed as relieving the Prime Contractor of the responsibility for complete performance of the work or as a waiver of any right of the Approval to reject defective work.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Project Manager

The subject subcontract is **NOT APPROVED** for the following reasons:

\_\_\_\_\_  
\_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
Project Manager

**SECTION 01 26 63**  
**CHANGE PROCEDURES**

**PART 1 – GENERAL**

**1.1 RELATED REQUIREMENTS**

- A. Section 00 32 00 – Bid Schedule.
- B. Section 00 51 00 – Construction Contract.
- C. Section 00 70 00 – General Conditions.
- D. Section 00 80 00 – Supplementary Conditions.
- E. Section 01 29 73 – Schedule of Values.
- F. Section 01 29 76 – Application for Payment.
- G. Section 01 32 16 – Construction Progress Schedule.
- H. Section 01 73 00 – Execution Requirements.

**1.2 SUBMITTALS**

- A. Submit the name of the individual authorized to accept changes, and to be responsible for informing others in the Contractor's employ of changes in the Work.
- B. Submit with each price proposal a complete, detailed, itemized cost breakdown defining all impacts on Contract Price and Contract Time, in sufficient detail to fully explain the basis for the proposal.
- C. All change forms shall be provided by the Authority.

**1.3 CHANGE AUTHORIZATION**

- A. In accordance with Section 00 70 00 – General Conditions, Article 9 Changes, the Authority may authorize changes to the Work. The Authority may authorize changes in one of the following ways:
  - 1. Directive (Section 00 70 00, Article 9.3).



2. Change Order (CO) (Section 00 70 00, Article 9.4).
3. Acceptance of Shop Drawing variations, which have been identified by the Contractor. (Section 00 70 00, Article 9.5).
4. Interim Work Authorization (IWA) (Section 00 70 00, Article 9.10).

#### **1.4 CHANGE PROCEDURES**

- A. The Authority may initiate change to the contract by issuing to the Contractor a Request for Proposal (RFP) document. The RFP may include:
  1. Change narrative.
  2. Supplementary revised drawings, specifications, additional details, or sketches.
  3. Other information as deemed appropriate.
- B. The Contractor shall request a change to the contract by submitting to the Authority a written Change Notice on a form provided by the Authority. The Authority may respond by rejecting it, or with an RFP to initiate contract change. The Contractor's Change Notice shall include, at minimum:
  1. A description of the proposed change with a statement of the justification of the change.
  2. Statement of the effect of the change on Contract Price and Contract Time.
  3. The information required in Section 00 70 00 – General Conditions, Article 15 Claims and Disputes.
- C. Upon receipt of a Request for Proposal (RFP) from the Authority, the Contractor shall respond with a price proposal. The Contractor shall make every effort to return its price proposal in response to the RFP within the time frame requested by the Authority, but in no event later than 14 calendar days from date the RFP is issued. For work to be performed after the execution of a Change Order, the basis of pricing shall be estimated. For work performed prior to the execution of a Change Order, the pricing shall be based upon documentation of actual incurred costs. The price proposal shall include:
  1. A complete, detailed, itemized price breakdown.

2. For the prime contractor and subcontractors, detailed documentation of costs for direct costs, labor, equipment, consultants, sub-contractor markups, overhead and profit, and other items set forth in General Conditions Section 00 70 00, Article 10.
  3. Other information as required by the Authority.
- D. Upon receipt of pricing response to an RFP, the Authority may execute a change to the contract. The issuance of an RFP or the receipt of pricing response to an RFP shall not obligate the Authority to execute a change to the contract.

### **1.5 DIRECTIVES**

- A. The Authority may issue Directives as per Section 00 70 00 – General Conditions, Article 9.3.

### **1.6 INTERIM WORK AUTHORIZATIONS (IWA)**

- A. The Authority may issue Interim Work Authorizations in accordance with Section 00 70 00 – General Conditions, Article 9.10.

### **1.7 CHANGE ORDER**

- A. Any change in Contract Time, Contract Price, or associated responsibility within the general scope of the Contract, shall be made by Change Order.
- B. The Contractor shall use forms furnished by the Authority for Change Orders.

### **1.8 CHANGE PRICING AND TIME ANALYSIS**

- A. Unless specified elsewhere, Section 00 70 00 – General Conditions, Article 10 shall be applied to the negotiation of all changes to the scope of the contract.
1. Unit Price, when unit prices are contained in the Contract.
  2. Mutually acceptable Lump Sum Price, including overhead and profit.
  3. Cost of the Work.
- B. UNIT PRICE CHANGE – For unit price CHANGE PROCEDURES, prices shall be determined by multiplying the contractual unit price(s) by the estimated quantities of Work associated with changed scope. Payment will be based on the actual installed quantities. Document actual installed quantities and submit information requested by

the Authority on a daily basis for its approval and certification. Refer to Section 00 70 00 – General Conditions, Article 10 for additional requirements.

- C. LUMP SUM PRICE CHANGE – The Contractor and the Authority shall negotiate an equitable price (and time adjustment if appropriate) in good faith. If negotiations do not result in a mutually acceptable lump sum price, the Authority may, at its discretion, direct the Contractor to perform the work under Cost of the Work Change Order.
- D. COST OF THE WORK CHANGE – The Contractor shall document Cost of the Work on forms acceptable to the Authority, and shall submit documented costs to the Authority daily for verification and certification. Cost of the Work pricing proposals shall be supported by invoices for substantiation of purchase and rental costs and with additional data as may be requested by Authority.
- E. Time Analysis: NOT USED.
- F. The Authority shall have the right to audit all records in possession of the Contractor relating to activities covered by the Contractor's pricing of Contract CHANGE ORDER PROCEDURES, including Cost of the Work pricing, as set forth in Section 00 70 00 – General Conditions. If the Contractor is a joint venture, the right of Authority shall apply collaterally to the same extent to the records of joint venture sponsor, and of each individual joint venture member.

**1.9 FORM EXECUTION**

- A. Contract forms issued under this section shall be effective the date the Authority's authorized person signs the form.
- B. For Change Orders, Contractor signature will indicate acceptance of the terms or acknowledgment of order, depending on box checked. Acknowledgment of Change Order does not substitute for notification requirements of Section 00 70 00 – General Conditions, Article 15.1.

**1.10 PAYMENT**

- A. The Contractor shall promptly revise its Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item. For Change Orders, adjust the Contract Price as shown on the Change Order.
- B. The Contractor shall promptly revise and resubmit its progress schedules to reflect any change in Contract Time, including adjustments for other items of Work affected by the change.
- C. Payment for contract changes shall be made only following the execution of Change Orders and the inclusion of the Change Order by reference on the Application for Payment form.
- D. Payment shall not be made for Work authorized via Interim Work Authorization until such work is formalized in a Change Order.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**

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**SECTION 01 29 73**  
**SCHEDULE OF VALUES**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Requirements for preparing and submitting the schedule of values.

**1.2 RELATED REQUIREMENTS**

- A. Section 00 70 00 – General Conditions.
- B. Section 01 11 13 – Summary of Work.
- C. Section 01 26 63 – Change Procedures.
- D. Section 01 29 76 – Application for Payment.
- E. Section 01 32 16 – Construction Progress Schedule.
- F. Section 01 33 00 – Submittal Procedures.
- G. Section 01 77 00 – Contract Closeout Procedures.

**1.3 FORMAT**

- A. Form and content must be acceptable to the Authority.
- B. Form shall have a signature block for submission by Contractor and a signature block for approval by the Authority.
- C. Content shall include the following column headings.
  - 1. Pay Item Activity Number.
  - 2. Pay Item Activity Description.
  - 3. Pay Item Activity Dollar Value.
  - 4. Current Percent Complete.
  - 5. Current Dollar Complete.

- 6. Previous Percent Complete.
- 7. Previous Dollar Complete.
- 8. Percent Complete this Period.
- 9. Dollar Complete this Period.

**1.4 CONTENT**

- A. List installed value of each activity shown on the submitted and approved CPM Schedule.
- B. For items on which payments will be requested for stored products, list sub values for cost of stored products with taxes paid.
- C. Limits for specific line item values shall be as specified below and shall be included on all approved Schedules of Values and Applications for Payment.

- 1. Mobilization and Demobilization: NOT APPLICABLE
- 2. Contract Closeout Procedures: Unless specified elsewhere, the assigned values for tasks specified under Contract Closeout Procedures shall be based upon the estimated value of each task. The breakdown shall include separate amounts for the requirements of Final Completion and Final Acceptance, as set forth below:

<u>Contract Price</u>	<u>Value for Final Completion</u>	<u>Value for Final Acceptance</u>
Less than \$200,000	\$2,000	\$2,000
\$200,000 - \$500,000	\$5,000	\$5,000
\$500,001 - \$1,000,000	\$10,000	\$10,000
\$1,000,001 - \$5,000,000	\$20,000	\$20,000
Greater than \$5,000,000	\$30,000	\$30,000

- D. The sum of values listed on the Schedule of Values shall equal total Contract Price.

**1.5** A Schedule of Values containing costs for early activities in excess of actual value (“front end loading”) will be rejected by the Authority until the Contractor corrects the deficiency. The Authority shall not be obligated to pay the Contractor until front end loading is eliminated and the Schedule of Values is approved.

**1.6 SUBMITTAL**

- A. Submit proposed Schedule of Values with updated CPM Schedule per specification sections for Summary of Work, Construction Progress Schedule, and Submittals.
- B. Submit Schedule of Values with updated completion percentages sufficiently in advance of each Application for Payment to enable the Authority to resolve differences.

**1.7 SUBSTANTIATING DATA**

- A. When the Authority requires substantiating information, submit data justifying line item amounts in question.
- B. Provide one copy of data with cover letter for each copy of the Application for Payment. Show application number and date, and line item by number and description.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**



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**SECTION 01 29 76**  
**APPLICATION FOR PAYMENT**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Procedures for preparation and submittal of Application for Payment.

**1.2 RELATED REQUIREMENTS**

- A. Section 00 32 00 – Bid Schedule.
- B. Section 00 70 00 – General Conditions.
- C. Section 00 80 00 – Supplementary Conditions.
- D. Section 01 11 13 – Summary of Work.
- E. Section 01 26 63 – Change Procedures.
- F. Section 01 29 73 – Schedule of Values.
- G. Section 01 32 16 - Construction Progress Schedule
- H. Section 01 33 00 – Submittal Procedures.
- I. Section 01 45 00 – Quality Control.
- J. Section 01 51 00 – Construction Facilities.
- K. Section 01 77 00 – Contract Closeout Procedures.
- L. Section 01 78 39 – Project Record Documents.

**1.3 FORMAT**

- A. Submit Application for Payment on form approved by the Authority.

#### **1.4 PREPARATION OF APPLICATIONS**

- A. Type required information on Application for Payment form acceptable to the Authority.
- B. Execute certification by original signature of authorized officer upon each copy of the Application for Payment.
- C. Show breakdown of costs for each item of the Work on accepted Schedule of Values as specified in Section 01 29 73 – Schedule of Values.
- D. List each authorized Change Order as an extension on continuation sheet, listing Change Order number and dollar amount as for an original item of Work.
- E. Submit Stored Materials Worksheet with every Application for Payment requesting payment for stored materials. Show only direct costs of materials and freight. Submit documentation in accordance with Section 00 70 00 – General Conditions, Article 13.5 Stored Materials and Equipment, for materials shown in column titled “New Material This Pay Request Period.”

#### **1.5 SUBMITTAL PROCEDURES**

- A. Submit two originals of each Application for Payment at one-month intervals. Each document shall bear original signature of authorized executive.
- B. Submit with Authority-approved transmittal letter bearing Authority’s project number.

#### **1.6 SUBSTANTIATING DATA**

- A. When Authority requires substantiating information, submit all requested data justifying line item amounts in question.
- B. Provide one copy of data with cover letter for each copy of Application for Payment. Show Application for Payment number and date, and line item by number and description.

### **1.7 SUBMITTALS WITH APPLICATION FOR PAYMENT**

- A. Submit the following for review sufficiently in advance of Application for Payment to allow detailed review by Authority and resolution of differences.
  - 1. Schedule of Values with updated percentages of completion as required by Section 01 29 73 – Schedule of Values.
  
- B. Submit the following with each Application for Payment.
  - 1. Updated construction schedule as required by Section 01 32 16 - Construction Progress Schedule.
  - 2. Updated Project Record Documents as required by Section 01 78 39 – Project Record Documents.
  - 3. Letter certifying that all Project Record Documents, including as-built drawings and submittals are current.

### **1.8 ADDITIONAL REQUIREMENTS FOR FIRST APPLICATION FOR PAYMENT**

- A. The first Application for Payment will be processed after the Project Manager has received all of the following:
  - 1. Superintendent Data (Section 00 70 00 – General Conditions, Article 6.2).
  - 2. Progress Schedule (Section 00 70 00 – General Conditions, Paragraph 6.6.1, and Section 01 32 16 - Construction Progress Schedule).
  - 3. Schedule of Values (Section 00 70 00 – General Conditions, Paragraph 6.6.2, and Section 01 29 73 – Schedule of Values).
  - 4. Submittal Schedule (Section 00 70 00 – General Conditions, Paragraph 6.6.2).
  - 5. Safety Representative Designation (Section 00 70 00 – General Conditions, Article 6.18).
  - 6. Building Permits (Section 00 70 00 – General Conditions, Article 7.2).
  - 7. Name of Individual Authorized to Accept Changes (Section 01 26 63 – Change Procedures).
  - 8. Contractor Quality Control Plan (Section 01 45 00 – Quality Control).
  - 9. Freeze Protection Plan (Section 01 51 00 – Construction Facilities).

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**

**SECTION 01 31 19**  
**PROJECT MEETINGS**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Requirements for various meetings during the construction project.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 11 13 – Summary of Work.
- B. Section 01 32 16 - Construction Progress Schedule.
- C. Section 01 33 23 – Shop Drawings, Product Data, and Samples.
- D. Section 01 45 00 – Quality Control.
- E. Section 01 73 00 – Execution Requirements.

**1.3 PRECONSTRUCTION CONFERENCES**

- A. The Authority will administer preconstruction conference for execution of Contract and exchange of preliminary submittals. Attendance by all key Contractor and Subcontractor project personnel is required.
- B. The Authority will document the meeting and distribute minutes within 2 working days of adjournment. Minutes will be typed, reflecting date, list of attendees and in a format to facilitate correction of previous meeting minutes. Distribution will be to all attendees and those affected by discussions or decisions made at meeting.

**1.4 PREINSTALLATION CONFERENCES**

- A. When required in an individual Specification section, and as shown in the Contractor's quality control plan, or as directed by the Authority, convene a pre-installation conference prior to commencing Work for a specific item.
- B. Require attendance of entities directly affecting, or affected by, Work of the section.

- C. Review conditions of installation, preparation and installation procedures, and coordination with related Work.
- D. Record significant discussions and agreements and disagreements of each conference, and approved schedule. Distribute record of conference to all attendees within 24-hours of adjournment.

### **1.5 PROGRESS MEETINGS**

- A. The Contractor shall attend Progress Meetings when scheduled by the Project Manager or requested by the Authority. Progress Meetings will be held on a day and time which is mutually convenient to both the Authority and the Contractor. These meetings shall be documented by the Contractor as well as the Project Manager.
- B. Progress Meeting shall be attended by all key Contractor personnel and, as appropriate, Subcontractor project personnel.
- C. The Contractor shall furnish copies of its updated schedule, per Section 01 32 16 - Construction Progress Schedule, to all attendees of the meeting. This schedule will be reviewed in detail during the meeting and will be used for the coordination of activities by others.
- D. Progress Meetings will also be used to review other key aspects of the Work, such as safety, quality, critical items, etc.
- E. Meeting Minutes: The Contractor shall document the meetings and distribute minutes within 2 working days of adjournment. Minutes shall be typed, reflecting date, attendees followed by company or organization, who stated each item, and in format to facilitate correction of previous meeting minutes. Distribution shall be to all attendees and those affected by discussions or decisions made at meeting.

### **1.6 SAFETY MEETING**

- A. The Contractor shall conduct Safety Meetings as required by its project Safety Program.
- B. The Contractor shall invite the Authority to attend Safety Meetings.

**1.7 OTHER MEETINGS**

- A. At various times throughout the duration of the Contract, the Contractor will be required to attend meetings as requested by the Authority. It is anticipated that such meetings will involve coordination with others, project schedule review, problem resolution, change order negotiations, and other topics of mutual importance.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**



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**SECTION 01 32 16**  
**CONSTRUCTION PROGRESS SCHEDULE**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

**1.2 RELATED REQUIREMENTS**

- A. Section 00 70 00 – General Conditions.
- B. Section 00 80 00 – Supplementary Conditions.
- C. Section 01 11 13 – Summary of Work.
- D. Section 01 26 63 – Change Procedures.
- E. Section 01 29 73 – Schedule of Values.
- F. Section 01 29 76 – Application for Payment.
- G. Section 01 31 19 – Project Meetings.
- H. Section 01 33 00 – Submittal Procedures.

**1.3 SUBMITTALS**

- A. Within fifteen (15) days after date established in Notice to Proceed, submit preliminary schedule.
- B. Within ten (10) days after joint review, submit complete schedule.
- C. Submit updated schedule with each Application for Payment.

**1.4 SCHEDULE FORMAT**

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum 22 x 17 inches.

- C. Scale and Spacing: To allow for notations and revisions.

## **PART 2 – PRODUCTS (NOT USED)**

## **PART 3 – EXECUTION**

### **3.1 PRELIMINARY SCHEDULE**

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

### **3.2 CONTENT**

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by Specification section number.
- C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- D. Provide legend for symbols and abbreviations used.

### **3.3 BAR CHARTS**

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

### **3.4 REVIEW AND EVALUATION OF SCHEDULE**

- A. Participate in joint review and evaluation of schedule with Project Manager at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

### **3.5 UPDATING SCHEDULE**

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Indicate changes required to maintain Date of Substantial Completion.

### **3.6 DISTRIBUTION OF SCHEDULE**

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Engineer, Authority, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

**END OF SECTION**

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**SECTION 01 33 00**  
**SUBMITTAL PROCEDURES**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Procedures for the preparation, tracking, and review of submittals for the project.

**1.2 RELATED REQUIREMENTS**

- A. Section 00 70 00 – General Requirements.
- B. Section 00 80 00 – Supplementary Conditions.
- C. Section 01 11 13 – Summary of Work.
- D. Section 01 12 19 – Contractor’s Certification of Subcontracts.
- E. Section 01 29 73 – Schedule of Values.
- F. Section 01 29 76 – Application for Payment.
- G. Section 01 32 16 - Construction Progress Schedule.
- H. Section 01 33 23 – Shop Drawings, Product Data, and Samples.
- I. Section 01 45 00 – Quality Control.
- J. Section 01 60 00 – Material and Equipment.
- K. Section 01 73 00 – Execution Requirements.
- L. Section 01 77 00 – Contract Closeout Procedures.
- M. Technical Product Specifications.
- N. Operations and Maintenance Manuals.
- O. Equipment Installation Data.

### 1.3 SUBMITTAL REGISTER

- A. Submit preliminary Submittal Register as required by Section 00 70 00 – General Conditions. In addition to manufacturer’s data and shop drawing submissions, include all submittals required by the Contract Documents in the Submittal Register.
- B. Submittal Register shall portray an orderly sequence of submittals, early submittals for long lead-time items, and submittals which require extensive review.
- C. Preliminary Submittal Register shall be provided to the Authority within **7** calendar days of the contract award.
- D. Submittal Register shall be reviewed by the Authority and shall be revised and resubmitted until accepted by the Authority.

### 1.4 SUBMITTAL PREPARATION

- A. The Contractor shall prepare all submittals as required by the provisions of Section 00 70 00 – General Conditions, Section 00 80 00 – Supplementary Conditions, the technical specifications, and the drawings.
- B. The Contractor shall review submittals for accuracy and completeness prior to submitting.
- C. **All Submittals shall be provided to the Authority within 28 calendar days of the contract award.**

### 1.5 SUBMITTAL REQUIREMENTS

- A. Unless otherwise directed in these documents or by Authority, provide each submittal as an electronic portable document format (PDF) file, transmitted via email. If file is too large to be received by Authority via email, provide a download link, deliver in portable USB drive, or as otherwise instructed by Authority.
- B. Submit each submittal with a Submittal Summary form as its face document. Use a Submittal Summary form provided by the Authority, or a substitute approved by the Authority.
- C. Label submittals with a numbering system approved by the Authority. Identify the project by title and Authority’s project number; identify Work and product by Specification section and Article number.

- D. Submit items required by individual Specification sections together. Do not mix items specified in different sections in the same submittal. Sequence the submission of submittals to correspond with the approved Submittal Register.
- E. Before the submission of each submittal, the Contractor shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each submittal with other submittals and with the requirements of the Work and the Contract Documents, upon which the Contractor shall certify in writing on each submittal that it has made this determination. The failure to review and certify a submittal shall be cause for the Authority to return the submittal without review.
- F. On the submittal, notify the Authority in writing of any deviations from requirements of the Contract Documents.
- G. Organize the submittals into logical groupings to facilitate the processing of related submittals, such as:
  - 1. By Specification Section number. Sequentially number each submittal. Resubmittals shall be identified with the original submittal number followed by a sequential alphabetic suffix.
  - 2. Finishes which involve Authority selection of colors, textures, or patterns.
  - 3. Items required by the individual Technical Product Specification Sections.
  - 4. Associated items, which require correlation for efficient function or for installation.
- H. Submit all required color and finish samples in order to receive approval for colors and finishes.

## **1.6 RESUBMITTALS**

- A. Provide complete copies of re-submittals. Do not re-submit partial copies of submittals for incorporation into the Authority's retained submittals from the prior submission.
- B. If drawings, product submittals, samples, mockups, or other required submittals are incomplete or not properly submitted, the Authority will not review the submittal and will return it to the Contractor. The Authority will review a submittal no more than 2 times without additional charge to the Contractor (incomplete or improperly



submitted submittals count as one of these submittals). The Contractor shall pay all review costs associated with more than 2 reviews.

## 1.7 AUTHORITY REVIEW

A. The Authority will review submittals and re-submittals, and return submittal comments within 7 calendar days of receipt.

B. The Authority or authorized agent will receive, review and return submittals to the Contractor with one of the following dispositions noted:

“No Exceptions Taken” – denotes that the submittal is generally consistent with the requirements of the Contract Documents. A resubmittal is not required.

“Approved as Noted” – denotes that the submittal is generally consistent with the requirements of the Contract Documents but only as conditioned by notes and corrections made on the submittal. A resubmittal is not required provided the Contractor understands the review comments and desires no further clarification.

“Revise and Resubmit” – denotes that revisions are required in the submittal in order for the submittal to be generally consistent with the requirements of the Contract Documents. The Authority will indicate on the returned submittal what revisions are necessary. A resubmittal is required.

“Rejected” – denotes that the submittal does not meet the requirements of the Contract Documents and shall not be used in the Work. The Authority will indicate on the returned submittal the reasons for its rejection. A resubmittal is required.

C. Review by the Authority of submittals shall not be construed as a complete check, but will indicate only that the general method of construction and detailing is consistent with the requirements of the Contract Documents. Review of submittals shall not relieve the Contractor of the responsibility for compliance with the requirements of the Contract Documents or for errors, dimensions, and quantities unless specific exception is requested and approved on the submittal.

D. The Authority’s review shall not extend to the means, methods, techniques, sequences or procedures of construction or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

**1.8 DISTRIBUTION**

- A. The Contractor shall be responsible for making and distributing any reproductions of approved submittals that it may require for its use.
- B. The Contractor shall perform work in accordance with approved submittals.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**

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**SECTION 01 33 23**  
**SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

**PART 1 – GENERAL**

**1.1 RELATED REQUIREMENTS**

- A. Section 00 70 00 – General Conditions.
- B. Section 01 11 13 – Summary of Work.
- C. Section 01 31 19 – Project Meetings.
- D. Section 01 33 00 – Submittal Procedures.
- E. Section 01 45 00 – Quality Control.
- F. Section 01 60 00 – Material and Equipment.
- G. Section 01 73 00 – Execution Requirements.
- H. Section 01 78 39 – Project Record Documents.
- I. Technical Specifications: Identification of submittal requirements.

**1.2 SHOP DRAWINGS**

- A. Present in a clear and thorough manner. Label each Shop Drawing with Authority's Project name, Project number and date of submittal. Identify each element of the Shop Drawings by reference to specification section, sheet number and detail, schedule, or Area of Work.
- B. The data shown on the Shop Drawings shall be complete with respect to specified performance and design criteria, materials and similar data to show the Authority materials and equipment the Contractor proposes to provide.
- C. Identify dimensions; show relation to adjacent or critical features or Work or products.

- D. Designation of work "by others", if shown in submittals, shall mean that work will be responsibility of Contractor rather than subcontractor or supplier who has prepared submittals.
- E. Minimum Sheet Size: 11"x17".

### **1.3 PRODUCT DATA**

- A. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to Specification section and Article number. Show reference standards, performance characteristics and capacities; wiring, piping and control diagrams; component parts; finishes; dimensions; and required clearances.
- B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information not applicable.
- C. Submit manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, commissioning, and finishing.

### **1.4 SAMPLES**

- A. Submit full range of manufacturer's standard finishes except when more restrictive requirements are specified, indicating colors, textures and patterns for Authority selection as specified in technical product sections.
- B. Submit samples to illustrate functional characteristics of products, including parts and attachments.
- C. Approved samples which may be used in the Work are indicated in the Specification section.
- D. Samples shall be identified clearly as to material, supplier, pertinent data such as catalog numbers and the use for which they are intended, and otherwise as the Authority may require, to enable the Authority to review the submittal.
- E. Label each sample with identification required for transmittal letter.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**

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**SECTION 01 42 19**  
**REFERENCE STANDARDS**

**PART 1 – GENERAL**

**1.1 RELATED SECTION**

- A. Section 00 70 00 – General Conditions.

**1.2 QUALITY ASSURANCE**

- A. For Products or workmanship specified by association, trade, or other technical standards: comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of bid advertisement, unless otherwise stated in the Contract Documents.
- C. Provide copies of standards through the submittal process when required by the Contract Documents. Maintain a copy of each reference standard on site during construction.
- D. Should specified reference standards conflict with Contract Documents, request clarification from the Authority before proceeding. Local code requirements, where more stringent than referenced standards, shall govern.
- E. Neither the contractual relationship, duties, and responsibilities of the parties to the Contract, nor those of the Engineer, shall be altered by the Contract Documents by mention or inference otherwise in any reference document.

**1.3 CODES, STANDARDS, AND REGULATORY REQUIREMENTS**

- A. All work shall be in accordance with the latest edition of governing Codes, Standards and regulatory requirements, including but are not limited to:
  - 1. International Fire Code (IFC).
  - 2. National Fire Protection Association (NFPA) NFPA 30.
  - 3. International Building Code (IBC).
  - 4. National Electrical Code (NEC).



5. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME).
6. American Petroleum Institute (API).
7. American Society of Testing and Materials (ASTM).
8. American Society of Mechanical Engineers (ASME).
9. American Welding Society (AWS).
10. American Institute of Steel Construction (AISC).
11. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS).
12. Alaska Department of Environmental Conservation (ADEC) 18 AAC 75.
13. Steel Structures Painting Council (SSPC).
14. Occupational Safety and Health Administration (OSHA) 29 CFR 1910.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**

**SECTION 01 45 00**  
**QUALITY CONTROL**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Contractor's quality assurance program and control procedures for executing the Work.
- B. Contractor's technical qualifications to be able to execute the Work in accordance with the Contract Documents.

**1.2 RELATED REQUIREMENTS**

- A. Section 00 70 00 – General Conditions.
- B. Section 01 33 00 – Submittal Procedures.
- C. Section 01 33 23 – Shop Drawings, Product Data, and Samples.
- D. Section 01 42 19 – Reference Standards.
- E. Section 01 60 00 – Material and Equipment.
- F. Technical Specifications (Division 21, 23, and 26): Contractor and Fabricator Qualifications, Quality Control, and Testing.

**1.3 SUBMITTALS**

- A. Submit a Quality Control Program and Testing Plan for review and approval.
- B. Submit required progress reports in accordance with the Contract Documents.

**1.4 GENERAL**

- A. The Contractor shall provide and maintain an effective Quality Control Program related to testing and inspection. The Contractor shall perform Quality Control Testing as specified and shall provide copies of all results to the Authority for use in observing contract compliance.

- B. The Contractor's Quality Control Program shall include, but is not limited to: administration, management, supervision, reports, record-keeping, submittals, services of independent testing agencies and labs, and other related services.
- C. Quality Control is the sole responsibility of the Contractor.
- D. Quality Control services are required to verify compliance with requirements specified or indicated and do not relieve the Contractor of responsibility for compliance with the Contract Documents.
- E. Specific Quality Control requirements are included in the Technical Specifications. General Quality Control requirements entail ensuring that all aspects of the Work conform to the technical requirements of the Contract Documents.
- F. The Contractor's Quality Control Program described herein is not intended to limit the Contractor's Quality Control activities, which may be necessary to achieve compliance with the Contract Documents.

## **1.5 JOB CONDITIONS**

- A. Where Specifications require work to be field-tested or approved, it shall be tested in the presence of the Authority after timely notice of its readiness for inspection and testing, and the work after testing shall be concealed only upon approval of Authority.
- B. The Authority shall have the right to witness all tests. The Contractor shall notify the Authority at least seven (7) calendar days prior to testing.
- C. The results of tests are for use by the Authority to evaluate the acceptability of Work with respect to specified testing requirements. Regardless of the test results, Contractor is solely responsible for quality of workmanship and materials and for compliance with requirements of Contract Documents.
- D. Maintain quality control over sub-contractors, suppliers, manufacturers, products, services, site conditions, and workmanship to produce work of specified quality. Verify applicability and follow all manufacturers' recommendations and instructions for assembly, installation and testing of materials and equipment. In any case where the Contractor believes that such recommendations or instructions are not applicable, the Contractor shall so notify the Authority and state the reasons for the Contractor's

determination. The Contractor shall then follow the Authority's written direction on whether to follow manufacturer's recommendations and instructions.

- E. Upon failure of Work which has been tested or inspected, previous acceptance may be withdrawn and Work be subject to removal and replacement with Work in accordance with the Contract Documents, at no cost to the Authority.

## **1.6 MANUFACTURER'S FIELD SERVICES**

- A. Required when technical specifications require the manufacturer or fabricator to provide qualified personnel to observe field conditions, installation, quality of workmanship, and to start, test, and adjust equipment as applicable.
- B. Submit to the Authority the manufacturer or fabricator representative's written reports containing observations and recommendations within five (5) calendar days of manufacturer's field services. Provide three (3) copies and a digital version.

## **PART 2 – PRODUCTS**

### **2.1 CONTRACTOR QUALIFICATION TECHNICAL REQUIREMENTS**

- A. The Contractor shall meet all technical requirements of the Contract Documents. The Contractor may use sub-contractors as required to meet the requirements. The Authority may request documentation of all required qualifications after the bid opening and prior to award in order to verify Contractor qualifications.
- B. In accordance with Alaska statues and regulations, all Electrical work falling under the scope of 12 AAC 32.165 shall be performed under the supervision of an Electrical Administrator with a current license in the State of Alaska in the Unlimited Commercial Wiring Category.
- C. In accordance with Alaska statues and regulations, all Mechanical work falling under the scope of 12 AAC 39.212 shall be performed under the supervision of a Mechanical Administrator with a current license in the State of Alaska in the Unlimited Commercial and Industrial Plumbing Category.
- D. All Fire Suppression work shall be performed by a contractor that meets the qualifications listed under Division 21 Specifications.

- E. Fabricators for specialty equipment such as engine-generators or switchgear shall meet the minimum requirements of the technical specifications.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. The Contractor shall provide full and complete documentation of Quality Control procedures and activities in a Quality Control Program and Quality Control Testing Plan.

### **3.2 QUALITY CONTROL**

- A. The Contractor shall establish the methodology to perform the Contractor's inspection and tests of all items including that of its subcontractors. The Contractor shall ensure conformance to applicable technical specifications and drawings with respect to the materials, Codes, workmanship, storage, installation, construction, finishes, functional performance, and identification. The Contractor shall ensure quality for all construction work performed under this Contract, including assigned subcontract work. The Contractor shall specifically include surveillance and tests required in the technical specifications.
- B. The Contractor shall coordinate all work requiring Special Inspection, where specified, to ensure full access by Special Inspectors and Quality Assurance testing personnel.
- C. The Contractor shall provide, as a minimum, the following components for all definable features of work:
  - 1. Preparatory Inspection Meeting: Contractor shall schedule and attend a preparatory meeting to review testing procedures a minimum of a week prior to beginning work on any element of Work which has been identified in the Contract Documents to require testing and inspection by the Contractor and Code-required Special Inspection. Subsequent meetings shall be conducted as necessary to ensure continued accuracy of testing and inspection procedures.
  - 2. Document Control: Contractor shall have and follow a procedure for ensuring that all Work is performed in accordance with the following:
    - a. Conformed sets of Contract Drawings and Specifications.
    - b. Contract Change Order documents.
    - c. Approved Submittals.

- d. Applicable Requests for Information (RFI's) or Design Clarification Verifications (DCVR's).
  - e. Manufacturer's Instruction.
3. In Progress Inspection: Contractor shall perform in-progress inspections as work progresses on the Work which shall include, but not be limited to:
    - a. Examination of the quality of workmanship with respect to Contract Drawings, Technical Specifications and Approved Submittals.
    - b. Review of control testing for compliance with Contract requirements.
    - c. Inspection for use of defective or damaged materials, omissions and dimensional requirements.
    - d. Review of timeliness and scheduling requirements for all tests, retests and eventual approvals.
    - e. Contractor Deficiency Reports and punch lists as appropriate to the level of completion of the Work.
  4. Non-Conformance Procedure: Contractor shall have and follow a procedure for identifying, documenting, tracking, and resolving items in the Work which do not comply with Contract Documents, Specifications, Approved Submittals, or Manufacturer's Instructions. If a quality control test indicates that the tested material does not conform to the requirements of the Contract Documents, the Contractor shall take supplemental tests at the same location from which the non-conforming result was obtained, after correction of the work, to document conformance with the Contract Documents. Otherwise, the Authority reserves the right to reject materials for which final Quality Control tests indicate non-conformance with the Contract Documents.
  5. Code Required Inspection: Contractor shall coordinate and make timely requests for inspections, tests and other activities required by Codes and Regulations as specified.

### **3.3 RECORD KEEPING**

- A. The Contractor shall maintain current Quality Control records, on forms acceptable to the Authority, of all inspections and tests performed. The records shall include factual evidence that the required inspections or tests have been performed, including, but not limited to, the following information for each such test and inspection: Specification reference, date, type and number of inspections or test involved; results of the inspections, tests or retests; the nature of defect, causes for rejection, proposed remedial action, corrective action(s) taken, and similar information related to any re-inspection.

- B. The Contractor shall maintain and submit to the Authority the following Quality Control records and reports:
1. Daily Reports: The Contractor shall maintain a daily log of all inspections performed for both Contractor and subcontractor operations. The Daily Log shall include compliance with shop drawings submittals, identification by Specification section and schedule activity of inspections, tests, and retests conducted, results of inspections and tests, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed. One copy of each Daily Report shall be submitted to the Authority on a weekly basis.
  2. Immediate Notification of Deficiencies: Contractor shall provide immediate notification to the Authority whenever a failed or nonconforming test or inspection occurs. This immediate notification shall be followed up with the required written reports.
  3. Non-Conformance Report: Contractor shall submit a weekly Non-Conformance Report to the Authority identifying all substandard inspections and tests taken during the week, including identification by Specification section and schedule activity of the inspection or test, location and nature of defects, causes for rejection and remedial actions taken or proposed. The Non-Conformance Report shall also identify corrective actions taken or proposed for any open items on prior Non-Conformance Reports including a scheduled date for resolution of each item. The Non-Conformance Report shall be submitted and discussed in Progress Meetings.
  4. Inspection Control Log: Contractor shall maintain an inspection control log chronologically recording each inspection and test performed by the Contractor, including the nature of the inspection, test or retest, the date performed, the results, causes for rejection, remedial action or corrective action taken and dates of subsequent inspections and retests, and final acceptance. The Contractor shall submit the updated Inspection Control Log weekly to the Authority; the Log will be discussed in Progress Meetings.

### **3.4 ORGANIZATION**

- A. Staffing Levels: Provide sufficient qualified personnel to monitor the work quality at all times. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity.
1. In cases where multiple trades, disciplines or subcontractors are on site at the same time, each activity shall be inspected and tested by personnel skilled in that portion of the work.
  2. In cases where multiple shifts are employed, the Quality Control staff shall be increased as required to monitor the work on each shift.

### **3.5 QUALITY SURVEILLANCE BY THE AUTHORITY**

- A. All items of materials and equipment shall be subject to surveillance testing and inspection by the Authority at the point of production, manufacture or shipment to determine if the producer, manufacturer or shipper maintains an adequate inspection system which insures conformance to the applicable specifications and drawings with respect to materials, workmanship, construction, finish, functional performance and identification. In addition, all items or materials, equipment and work in place shall be subject to surveillance testing and inspection by the Authority at the site for the same purposes. Surveillance by the Authority does not relieve the Contractor of performing Quality Control inspections and testing of either onsite or offsite Contractor's or subcontractor's workplace or manufacturing assembly plant.

**END OF SECTION**



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**SECTION 01 51 00**  
**CONSTRUCTION FACILITIES**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Requirements for furnishing and maintaining construction facilities during the project.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 11 13 – Summary of Work.
- B. Section 01 29 76 – Application for Payment.
- C. Section 01 73 00 – Execution Requirements.

**1.3 TEMPORARY ELECTRICITY**

- A. Unless specified elsewhere, the Contractor shall make their own provisions for temporary electrical service.
- B. Provide lighting for construction operations.
- C. Provide additional lighting for inspections if requested by Authority or Engineer.

**1.4 TEMPORARY HEAT**

- A. Provide and pay for heat devices, insulated enclosure, tenting, and heat as required to maintain specified conditions for construction operations, to protect materials and finishes from damage due to temperature or humidity.

**1.5 TEMPORARY VENTILATION**

- A. Provide and pay for ventilation of enclosed areas to cure materials, to disperse humidity, to prevent accumulations of dust, fumes, vapors, or gases, and to maintain a safe work environment.

## **1.6 TEMPORARY WATER SERVICE**

- A. Unless specified elsewhere, the Contractor shall make its own provisions for temporary water service.

## **1.7 TEMPORARY SANITARY FACILITIES**

- A. Unless specified elsewhere, provide and maintain required sanitary facilities and enclosures.

## **1.8 TEMPORARY TELEPHONE AND INTERNET SERVICE**

- A. Unless specified elsewhere, provide, maintain and pay for telephone and internet service to the Contractor field offices. Internet service shall be in accordance with Section 01 11 13 – Summary of Work.

## **1.9 FREEZE PROTECTION**

- A. Provide freeze protection for the Power Plant Module in accordance with Section 01 11 13 – Summary of Work.
- B. Provide freeze protection for temporary water service piping, valves, batteries, and other components.

## **1.10 CONSTRUCTION FENCES**

- A. Include all supplementary parts necessary or required for a complete and satisfactory installation of temporary fences. All runs of the fence shall present the same general appearance.
- B. Material requirements, unless shown otherwise on the Drawings:
  - 1. Fabric: No. 9 ASW gage zinc coated or approved equal.
  - 2. Barbed Wire (Zinc-coated): 3-strand twisted No. 12 ½ ASW gage galvanized steel wire with 4-point barbs of No. 14 ASW gage galvanized steel wire, or approved equal. The barbs shall be spaced approximately 4 inches apart.
  - 3. Wire ties and tension wire: No. 7 ASW gage marcelled steel wire with same coating as fabric and conforming to ASTM A824.
  - 4. Plywood, if used shall be painted.

- C. Other requirements:
1. Used materials may be installed provided the used materials are good, sound, and are suitable for the purpose intended.
  2. Posts and braces shall be galvanized steel pipe conforming to the requirements of ASTM F1038 and sized in accordance with Tables 1 through VI of Federal Specifications RR-F-191/3. Posts shall be spaced no more than 10 feet apart.
  3. Galvanizing of steel items will be required.
  4. Temporary fences that are damaged from any cause during the progress of the work shall be repaired or replaced by the Contractor at the Contractor's expense.
  5. If no longer required for the Work as determined by the Authority, temporary fences shall be removed. Removed fence materials shall become the property of the Contractor and shall be removed from the site of the work.
  6. Fence shall be 8 feet high. Fence construction shall include top and bottom tension wires. All fabric tension wire and barbed wire shall be installed taut with no more than 2-inch open gaps between bottom of fence and underlying surface.

#### **1.11 PROTECTION OF INSTALLED WORK**

- A. Protect installed Work and provide special protection where required and where Work is installed in unsecure areas.
- B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to prevent damage.

#### **1.12 SECURITY**

- A. Provide security and facilities to protect Work from unauthorized entry, vandalism, or theft.

#### **1.13 REMOVAL OF UTILITIES AND FACILITIES**

- A. Remove Construction Facilities, Services, Utilities and other related materials, prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.

- C. Restore permanent facilities used during construction to a 'like new' condition if it was provided by Contract, or the condition the facility was found prior to construction of this project for existing facilities.

#### **1.14 SHORING AND BRACING**

- A. The Contractor is responsible for providing shoring and bracing required to accomplish the work. This includes shoring of adjacent facilities, shoring for installed work, and shoring and bracing for installation of structural steel.
- B. The Contractor's shoring and bracing shall be designed by an Alaska registered structural engineer.
- C. Provide a sealed and signed copy of shoring and bracing calculations to the Authority for informational purposes only. The submission of calculations to the Authority shall not transfer responsibility for the design of shoring and bracing to the Authority. Rather, the Authority will receive the calculations to verify they have been done by a registered engineer.

#### **1.15 COST RESPONSIBILITY**

- A. Except as otherwise noted, the cost of construction facilities and utilities shall be the responsibility of Contractor.

#### **PART 2 – PRODUCTS (NOT USED)**

#### **PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**

**SECTION 01 60 00**  
**MATERIAL AND EQUIPMENT**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Requirements for transportation and handling, storage and protection, substitutions, and product options.

**1.2 RELATED REQUIREMENTS**

- A. Section 00 70 00 – General Conditions.
- B. Section 01 11 13 – Summary of Work.
- C. Section 01 33 00 – Submittal Procedures.
- D. Section 01 33 23 – Shop Drawings, Product Data, and Samples.
- E. Section 01 42 19 – Reference Standards.
- F. Section 01 45 00 – Quality Control.
- G. Section 01 51 00 – Construction Facilities.
- H. Section 01 60 00 – Material and Equipment.
- I. Section 01 73 00 – Execution Requirements.

**1.3 TRANSPORTATION AND HANDLING**

- A. Transport products by methods to avoid product damage; deliver in dry, undamaged condition, in manufacturer's unopened containers or packaging.
- B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.
- C. Immediately on delivery, inspect shipment to assure:

1. Product complies with requirements of Contract Documents and reviewed submittals.
2. Quantities are correct.
3. Accessories and installation hardware are correct.
4. Containers and packages are intact and labels legible.
5. Products are protected and undamaged.

#### **1.4 STORAGE AND PROTECTION**

- A. Handle and store materials for construction, products of demolition, and other items to avoid damage to existing buildings, and infrastructure.
- B. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.
- C. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
- D. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter. Cover such material to prevent material from being blown or transported away from the stockpile.
- E. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

#### **1.5 SUBSTITUTIONS**

- A. Prior to the bid opening, the Bidder shall make his own determination in selecting which specified or substitute equipment to base his proposal upon. Substituted items shall be equal to or better than that specified or indicated in regards to quality, workmanship, finish, space requirements, electrical requirements, performance, and warranties.
- B. After the bid opening, the Contractor shall submit sufficient data in accordance with this Section to establish equality. The Authority shall be the sole judge of equality and acceptability.

- C. Acceptance of substitute materials will not relieve the Contractor of the responsibility for any changes in his own Work or in the Work of other crafts caused by the substitution. Any additional costs resulting from substitutions are the responsibility of the Contractor.
- D. Only one request for substitution will be considered for each product. When substitution is not accepted, provide specified product.
- E. The Authority will consider requests for Substitutions only within 30 days after date established by the Notice to Proceed.
- F. Substitutions may be considered when a Product becomes unavailable through no fault of the Contractor.
- G. Document each request with complete data substantiating compatibility of proposed Substitution with Contract Documents.
- H. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

#### **1.6 SUBSTITUTION SUBMITTAL PROCEDURE:**

- A. Submit Request for Substitution for consideration on Substitution Request Form provided by the Authority (Section 01 60 00-A). Limit each request to one proposed Substitution.
- B. Submit certification signed by the Contractor, that the Contractor:
  - 1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product. List similar projects using proposed product, dates of installation and user telephone number.
  - 2. Will provide an equivalent warranty for the Substitution as for the specified Product.
  - 3. Will coordinate installation and make changes to other Work, which may be required for the Work to be complete with no additional cost to the Authority.
  - 4. Waives claims for additional costs or time extension, which may subsequently become apparent from indirect costs.



5. Will reimburse the Authority for review or redesign services associated with re-approval by Authorities.
- C. Submit shop drawings, manufacturers' product data, and certified test results attesting to the proposed Product equivalence and variations between substitute and specified product. The burden of proof is on proposer.
- D. The Authority will notify the Contractor in writing of decision to accept or reject request.

## **PART 2 – PRODUCTS**

### **2.1 PRODUCTS**

- A. Products include material, equipment, and systems.
- B. Comply with Specifications and referenced standards as minimum requirements.
- C. Components required to be supplied in quantity within a Specification section shall be the same, and shall be interchangeable.
- D. Do not use materials and equipment removed from existing structure, except as specifically required, or allowed, by Contract Documents.

### **2.2 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers followed by the term "No Substitutions": use only specified manufacturers, no substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named that meets the description specifications of the named manufacturers, equal in substance, function, dimension, appearance, and quality.

## **PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**



Project: Akhiok Site Construction ITB# 20048

Project No.: TBD

Contractor: \_\_\_\_\_

Specified item for which substitution is requested: \_\_\_\_\_  
(reference specification section and paragraph)

The following product is submitted for substitution: \_\_\_\_\_  
(describe proposed substitution and differences from specified item; attach complete technical, performance, and test data; state whether substitution affects dimensions and functional clearances shown on drawings or affects other trades, and include complete information for changes to drawings and/or specifications which proposed substitution will require for its proper installation.)

I certify the following:

- | Yes                      | No                       |  |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | The substitute will perform adequately and achieve the results called for by the general design.   |
| <input type="checkbox"/> | <input type="checkbox"/> | The substitute is similar, of equal substance, suited to the same use, and will provide the same warranty as the product specified.  |
| <input type="checkbox"/> | <input type="checkbox"/> | An equivalent source of replacement parts is available.  |
| <input type="checkbox"/> | <input type="checkbox"/> | The evaluation and approval of the proposed substitute will not delay the Substantial or Final Completion of the project.  |
| <input type="checkbox"/> | <input type="checkbox"/> | Any change in the design necessitated by the proposed substitution will not delay the Substantial or Final Completion of the project.  |
| <input type="checkbox"/> | <input type="checkbox"/> | The cost of any change in the design necessitated by the proposed substitution, including engineering and detailing costs, and construction costs caused by the substitution will be paid by the Contractor at no cost to the Authority. |
| <input type="checkbox"/> | <input type="checkbox"/> | The cost of any license fee or royalty necessitated by the proposed substitution will be paid by the Contractor at no cost to the Authority.   |

The undersigned states that the function, appearance and quality are equivalent or superior to the specified item.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
Authorized Contractor Signature

Architect/Engineer Recommendation:

- Accepted     
  Accepted as Noted     
  Not Accepted     
  Received Too Late

Remarks:

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
Architect/Engineer

Accepted  
 Rejected  
 \_\_\_\_\_ Date: \_\_\_\_\_  
 Project Manager

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**SECTION 01 64 00**  
**RECEIPT OF OWNER FURNISHED MATERIALS**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. This section describes receipt, unloading, transportation, storage, and handling of materials furnished by the Owner (Authority) for this project as described herein.
- B. See Section 01 11 13 – Summary of Work for delivery dates for Owner Furnished materials.

**1.2 RELATED REQUIREMENT**

- A. Section 01 11 13 – Summary of Work.

**1.3 DESCRIPTION OF OWNER FURNISHED MATERIAL**

- A. Module: One (1) each steel modular power plant. The module construction was performed under a separate contract as detailed on the Drawings. The module will be fully assembled, functionally tested, and approved by the Authority prior to transfer to the Contractor. The overall module dimensions are 45' long by 15' wide by 13' high and the total weight is estimated to be 80,000#. The module will be staged at Electric Power Constructors, 3305 Arctic Boulevard, Anchorage, AK 99503. The Contractor will make arrangements with the Authority to receive the module at this location and take possession.
- B. Loose Ship Accessories: Two (2) each fabricated steel stair assemblies, two (2) each 55-gallon drums ethylene glycol coolant, two (2) each exhaust hoods, three (3) each intake duct systems, and miscellaneous boxes of small parts such as filters. The loose ship items will be staged at Electric Power Constructors, 3305 Arctic Boulevard, Anchorage, AK 99503. The Contractor will make arrangements with the Authority to receive the module at this location and take possession.

**1.4 ACCEPTANCE OF OWNER FURNISHED MATERIAL**

- A. The Contractor shall (1) receive and accept the materials at the staging location specified; (2) inspect all materials to confirm that the materials delivered are in good condition and the quantities are correct; and (3) execute a receipt for all materials

accepted from the Authority. Delinquency in signing material receipts may result in delayed progress payments.

- B. All material furnished by the Authority shall comply with the plans and specifications. All materials which do not meet specifications or are received broken or damaged shall be culled by the Contractor and a report made to the Authority within 5 days of receipt of material as to the number culled and reason for culling.
- C. If the Authority fails to deliver the materials according to the dates set forth in Section 01 11 13 – Summary of Work, the Contractor's sole remedy and compensation shall be an extension of time not greater than the delay. Any such time extension shall be requested in writing by the Contractor.

#### **1.5 RECEIPT, TRANSPORTING AND STORING OWNER FURNISHED MATERIAL**

- A. The Contractor shall receive, transport, and protect all material in accordance with accepted industry standards.
- B. All handling charges required for receiving, loading, unloading, hauling, transporting or storing the material shall be provided by the Contractor.
- C. Any demurrage charges or other fees incurred as a result of the Contractor not receiving, moving and storing the material shall be paid by the Contractor. If the Authority is required to pay these fees, the fees will be deducted from the first Contractor pay request.
- D. The Contractor shall provide proper equipment as necessary to load, unload, and transport Owner furnished material. The equipment shall be rated as required to properly handle the material.

#### **1.6 DAMAGE TO OWNER FURNISHED MATERIAL**

- A. Upon receipt of the materials as specified above, the Contractor shall become solely responsible for their care, transportation, storage, and protection. In the event materials are damaged, lost, stolen, or destroyed by any cause whatsoever after the Contractor has signed a receipt for them, their repair or replacement shall be entirely at the Contractor's expense.
- B. All material replaced by the Contractor shall be equal to the material provided by the Authority and shall meet the material purchase specifications.

**1.7 STORAGE OF OWNER FURNISHED MATERIAL**

- A. The Contractor shall provide secure storage for all Authority furnished material and shall be responsible for transporting the material to the jobsite as required to support the construction schedule.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**

**SECTION 01 71 13**  
**MOBILIZATION AND DEMOBILIZATION**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Requirements for mobilization and demobilization.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 11 13 – Summary of Work.
- B. Section 01 29 73 – Schedule of Values.
- C. Section 01 29 76 – Application for Payment.
- D. Section 01 51 00 – Construction Facilities.
- E. Section 01 77 00 – Contract Closeout Procedures.

**1.3 DEFINITIONS**

- A. Mobilization and Demobilization includes:
  - 1. CONTRACTOR's work to prepare Site for Work under Contract and to marshal workers, materials and equipment, and those of subcontractors, to accomplish the Work.
  - 2. Mobilization of all construction equipment, materials, suppliers, appurtenances, and the like, staffed and ready for commencing and prosecuting the Work, and the subsequent demobilization and removal from the site of said equipment, appurtenances, and the like upon completion of the Work.
  - 3. Assembly and delivery to the site equipment, materials, and supplies necessary for the prosecution of Work which are not intended to be incorporated in the Work; the clearing of and preparation of the Contractor's work area; the complete assembly, in working order, of equipment necessary to perform the required work; personnel services preparatory to commencing actual work; all other preparatory work required to permit commencement of the actual work on construction items for which payment is provided under the Contract.

#### **1.4 REQUIREMENTS**

- A. Haul routes, staging areas, and equipment positioning at the project site will be subject to approval by Authority, who will coordinate with Contractor to determine requirements and locations.
- B. Cooperate with Authority in allocation and use of Mobilization and Demobilization areas of Site, field offices and sheds, materials storage, traffic, and parking facilities.
- C. During construction, coordinate use of Site and facilities through the Authority.
- D. Comply with Authority's procedures of contract communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- E. Comply with instructions of Authority for use of utilities and construction facilities.
- F. Coordinate field engineering and layout Work under instructions of Authority.
- G. Walk through Site with Authority prior to start of Work.

#### **1.5 SUBMITTALS**

- A. Refer to Section 01 33 00 – Submittal Procedures, for submittal requirements.
- B. If requested by Authority, submit a plan of the proposed layout of the construction site, including equipment, access ways, temporary facilities, staging, and storage areas, within thirty (30) days after Notice to Proceed.

#### **PART 2 – PRODUCTS (NOT USED)**



### **PART 3 – EXECUTION**

#### **3.1 EXECUTION REQUIREMENTS**

- A. Delivery to the jobsite of construction tools, equipment, materials, and supplies shall be accomplished in conformance with local governing body, ordinances, regulations, and the requirements of the Contract Documents.
  
- B. Upon completion of the Work, remove construction tools, apparatus, equipment, unused materials and supplies, and personnel from the jobsite.

**END OF SECTION**

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**SECTION 01 71 23.16**  
**CONSTRUCTION SURVEYING**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Construction surveying requirements.

**1.2 RELATED REQUIREMENTS**

- A. Existing survey data and survey control are presented on the Drawings.
- B. Available electronic survey data is available to the contractor upon request.
- C. Section 01 33 00 – Submittal Procedures.

**1.3 SUBMITTALS**

- A. Submit, upon request of the Engineer, copies of all field notes and survey data.
- B. Provide marked-up as-built drawings.

**PART 2 – PRODUCTS**

**2.1 SURVEY MATERIALS**

- A. Provide all construction surveying and staking materials to stake construction work.

**PART 3 – EXECUTION**

**3.1 SURVEYING BY ENGINEER**

- A. No surveying will be provided by the Engineer.

**3.2 CONTRACTOR RESPONSIBILITIES**

- A. Contractor shall set all lines and grades by instrument survey in order to correctly layout the following:
  - 1. Building foundation.

2. Proposed Utilities.
  3. All other Construction.
- B. Contractor shall provide vertical and horizontal as-built locations of buried utilities.
  - C. Contractor shall locate and protect all survey reference points. Contractor shall have a Professional Land Surveyor, licensed in the State of Alaska, reset any survey points that have been disturbed at Contractor's expense.
  - D. Survey shall be tied to the basis of horizontal and vertical control indicated on the Drawings.
  - E. Contractor shall provide and pay for all surveying as required for project completion and acceptance.
  - F. All survey work shall be by, or under the direct supervision of, a licensed Professional Land Surveyor registered in the State of Alaska.
  - G. Field-adjust grades to meet the minimum fill depth required by the Drawings.

### **3.3 ACCURACY AND TOLERANCES**

- A. Contractor's surveys shall be subject to the following tolerances, unless another tolerance is specified elsewhere in the Contract Documents:
  1. Building Foundation:  $\pm 1/4$ -inch in 10 foot.
  2. All other Construction:
    - a.  $\pm 0.10$  feet horizontally.
    - b.  $\pm 0.10$  feet vertically.

### **3.4 RECORDS**

- A. Maintain a complete, accurate, and reduced set of field notes of all survey work and submit all notes to the Engineer at the conclusion of work and as requested.

**END OF SECTION**

**SECTION 01 73 00**  
**EXECUTION REQUIREMENTS**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Requirements for addressing defects, cleaning, operating and maintenance manuals, spare parts, training, warranties and bonds, and maintenance service.

**1.2 RELATED REQUIREMENTS**

- A. Section 00 70 00 – General Conditions: Fiscal provisions, legal submittals, and other administrative requirements.
- B. Section 01 26 63 – Change Procedures.
- C. Section 01 31 19 – Project Meetings.
- D. Section 01 33 00 –Submittal Procedures.
- E. Section 01 33 23 – Shop Drawings, Product Data, and Samples.
- F. Section 01 60 00 – Material and Equipment.
- G. Section 01 74 00 – Cleaning and Waste Management.

**1.3 CLOSEOUT PROCEDURES**

- A. Comply with Section 01 77 00 - Contract Closeout Procedures.

**1.4 DEFECTS**

- A. Product defects shall be all items that affect the visual appearance or function of the Products. Defects shall be as identified below unless more stringent requirements are specified within specific sections.
- B. Products shall typically be viewed from a distance of 30.0 inches (760 mm).
- C. Defects shall be solely determined by the Authority.

D. Defects, Product:

1. Cuts, Scrapes, Gouges Abrasions 0.250 inch (6 mm) long or longer, and 0.03125 inches (0.79375 mm) wide or wider that are visible at a distance of 30.0 inches (762 mm) shall be considered defects.
2. Abrasions less than the above shall be accepted.
3. Burns of any size that permanently discolor the surface material shall be considered defects.
4. Product color variation.

E. Defects, Joint:

1. Non-alignment of Products. Visual defects and non-alignment of joints shall be considered defective.

F. Defects, Structural:

1. Bent members or other structural damage shall be considered defective.
2. Incorrectly manufactured members shall be considered defective.

G. Defects, Corrosion:

1. Surface corrosion not exceeding one percent (1%) of the surface area shall be considered a visual defect.
2. Surface corrosion exceeding one percent (1%) and not exceeding five percent (5%) of the surface area shall be evaluated by the Authority to determine defect type.
3. Surface corrosion exceeding five percent (5%) of the surface area shall be considered a structural defect.

H. Defects shall be repaired or replaced at no additional cost to the Authority.

1. Structural defects shall be replaced, no exceptions.
2. Visual defects shall be repaired or replaced as solely determined by the Authority.

## 1.5 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain work and storage areas free of waste materials, debris, and rubbish. Maintain site in a neat and orderly condition to maintain safe passage and exits and

to avoid fire and tripping hazards. Provide covered containers for deposit of waste materials.

- B. Collect and remove waste materials, debris, and rubbish from site periodically and at least weekly, and dispose off-site. Have equipment and personnel available on-site daily to sweep and clean work sites and interior work areas.
- C. Comply with Section 01 74 00 – Cleaning and Waste Management.

## **1.6 FINAL CLEANING**

- A. Execute final cleaning prior to Substantial Completion inspection.
- B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances.
- C. Use materials which will not create hazards to health or property, and which will not damage surfaces. Follow manufacturer's recommendations.
- D. Maintain cleaning until the Authority issues certificate of Substantial Completion.
- E. Remove waste, debris and surplus materials from site. Clean work site and interior work areas; remove stains, spills, and foreign substances from all areas and sweep clean. Rake clean work site. Comply with Section 01 74 00 – Cleaning and Waste Management.

## **1.7 ADJUSTING**

- A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

## **1.8 OPERATION AND MAINTENANCE (O&M) DATA**

- A. Submit data bound in 3-ring slant “D” presentation ring binders, maximum 11-5/8” high and 11-1/4” deep. Spine, front, and back shall be heavy virgin vinyl sealed over heavy board. Binders shall have clear, full size pockets on spine and front cover. Thickness of content shall not exceed 75% of binder manufacturer’s stated capacity. All pages shall be 8 1/2” x 11”, or 11” x 17” folded to 8 1/2” x 11” in a manner to permit unfolding without removal from binder.

B. O&M Manual binders shall be black, clearly and permanently labeled as follows:

1. Spine

Project Name

Project Number

Operations & Maintenance Manual, Volume \_\_\_\_\_ of \_\_\_\_\_

Facility Name:

2. Front Cover:

Project Name:

Project No.:

Facility Name:

Contractor:

Address

City, State, ZIP

Phone:

Fax:

E-mail Address:

Major Sub-Contractors:

Address

City, State, ZIP

Phone:

Fax:

E-mail Address:

Operations & Maintenance Manual, Volume \_\_\_\_\_ of \_\_\_\_\_

Discipline:

Date:

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titles clearly printed under reinforced laminated plastic tabs.



- D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified. Include the complete Table of Contents in each volume, typed on 24-pound white paper, in three parts as follows:
1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
  2. Part 2: Operation and Maintenance instructions, arranged by system process flow and subdivided by Specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
    - a. List of equipment.
    - b. Parts list for each component.
    - c. Operating instructions.
    - d. Maintenance instructions for equipment and systems.
    - e. Maintenance instructions for finishes, including recommended cleaning methods and materials, special precautions identifying detrimental agents, and touchup procedures/materials.
  3. Part 3: Project documents and certificates, including the following:
    - a. Shop drawings and product data.
    - b. Start-up and Commissioning reports.
    - c. Certificates.
    - d. Originals of warranties and bonds.
- E. Submit one (1) draft copy of completed volumes 30 calendar days prior to Training or Substantial Completion inspection, whichever is earliest. This copy will be reviewed and returned, with Authority's comments. Revise content of all document sets as required prior to final submission.
- F. Submit four (4) sets of revised final volumes 7 days prior to Training or Substantial Completion inspection, whichever is earliest.
- G. In addition to required hardcopies, provide electronic copy on \*.PDF format with Table of Contents hyperlinked to all referenced sections.

## **1.9 TRAINING**

- A. Before Substantial Completion, instruct the Authority's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times. For equipment requiring seasonal operation, or placed into

operation subsequent to Final Completion, perform instructions within six (6) months.

- B. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. Unless specified elsewhere, the duration of on-site instruction shall be eight (8) hours, minimum.
- D. Provide digital video recordings of all provided instruction in format approved by the Authority. Training videos shall be submitted prior to Final Completion.
- E. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

#### **1.10 SPARE PARTS AND MAINTENANCE PRODUCTS**

- A. Provide spare parts, maintenance, and extra Products in quantities specified in individual Specification sections. These shall be labeled and stored per manufacturer's recommendations and as specified.
- B. Deliver to Project site and place in location as directed; obtain receipt prior to Substantial Completion payment.

#### **1.11 WARRANTIES AND BONDS**

- A. Provide duplicate notarized copies.
- B. Execute and assemble transferable warranty documents from Subcontractors, suppliers, and manufacturers.
- C. Provide Table of Contents and assemble in three D side ring binder with durable plastic cover, similar to O&M Manual.
- D. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

**1.12 MAINTENANCE SERVICE**

- A. Furnish service and maintenance of all equipment, products, components, specialties and appurtenances provided for this project for one year from date of Substantial Completion.
- B. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- D. Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the Authority.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**

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**SECTION 01 74 00**  
**CLEANING AND WASTE MANAGEMENT**

**PART 1 – GENERAL**

**1.1 GENERAL**

- A. During the term of this Contract, the Contractor shall remove as promptly as possible any materials and equipment which are not required for the completion of the Work. All debris shall be removed from the site and disposed of daily. The Contractor shall take particular care to eliminate any hazards created by these operations.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 73 00 – Execution Requirements.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION**

**3.1 PROGRESS CLEANING**

- A. At the completion of the project, or prior thereto if so directed by the Authority, the Contractor shall be responsible for completely cleaning of those portions of the project which his work affects.
  - 1. Contractor shall remove from the facility all tools, equipment, surplus materials, debris, temporary structures, and other material not incorporated in the permanent installation.
- B. Restoration of Damaged Property: To the extent that any roads, vegetation, structures, utilities, or other items are damaged or displaced by the Contractor's operations, these shall be restored to their original or better condition prior to Substantial Completion inspection. This shall include both on-site and off-site items. Any damage which is severe enough to disrupt community travel or utilities shall be repaired by the Contractor immediately.
- C. Cleaning, repair, and restoration must be accomplished prior to Final Inspection, to the satisfaction of, and at no additional cost to the Authority.
- D. Disposal of hazardous and construction materials shall be accomplished as specified in Section 00 70 00 – General Conditions and this Section.

### **3.2 WASTE DISPOSAL**

#### **A. Construction Waste.**

1. Construction waste generated during the process of completing the project scope of work shall be removed from the limits of the project site and disposed of. All construction waste shall be disposed of as required by local, state and federal laws, rules, regulations and requirements.

**END OF SECTION**

**SECTION 01 77 00**  
**CONTRACT CLOSEOUT PROCEDURES**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Requirements for Substantial Completion.
- B. Requirements for Final Completion.
- C. Requirements for Final Acceptance and Payment.

**1.2 RELATED REQUIREMENTS**

- A. Section 00 70 00 – General Conditions: Substantial Completion, Final Completion, Final Payment, Final Acceptance.
- B. Section 01 11 13 – Summary of Work.
- C. Section 01 29 73 – Schedule of Values.
- D. Section 01 29 76 – Application for Payment.
- E. Section 01 33 00 – Submittal Procedures.
- F. Section 01 73 00 – Execution Requirements
- G. Section 01 78 39 – Project Record Documents.

**1.3 SUBSTANTIAL COMPLETION SUBMITTALS**

Submit the following prior to requesting the Substantial Completion Inspection:

- A. Evidence of Compliance with Requirements of the Authority Having Jurisdiction:
  - 1. Certificate of Occupancy.
  - 2. Required Certificates of Inspection.
  - 3. Other approvals as may be required.
- B. Project Record Documents.

- C. Operation and Maintenance Data.
- D. Spare Parts and Maintenance Materials.
- E. Warranties and Bonds.
- F. Keys and Keying Schedule.
- G. No progress payments will be made for Substantial Completion until all required submittals have been submitted and accepted by the Authority.

#### **1.4 SUBSTANTIAL COMPLETION**

- A. In accordance with Section 00 70 00 – General Conditions, Article 13.10 Substantial Completion, the Contractor shall notify the Authority in writing that the Work or a portion of the Work which has been specifically identified in the Contract Documents (except for items specifically listed by the Contractor as incomplete) is substantially complete and request that the Authority issue a Certificate of Substantial Completion. The Authority will consider the Contractor's request for Substantial Completion only when:
  - 1. Written request for Substantial Completion is provided at least fourteen (14) calendar days in advance of the Authority's scheduled Substantial Completion inspection date.
  - 2. List of items to be completed or corrected is submitted.
  - 3. All Operation and Maintenance Manuals are submitted and approved by the Authority.
  - 4. All commissioning requirements have been met.
  - 5. All equipment and systems have been tested, adjusted, are properly operating and fully operational.
  - 6. All demonstration and training requirements have been completed, or the date(s) for required demonstration and training have been scheduled with the Authority.
  - 7. All automated and manual controls are fully operational.
  - 8. Operation of all equipment and systems has been demonstrated to the Authority or their designated representative.
  - 9. Certificate of Occupancy is submitted.



10. Certificates of Inspection for required inspections have been submitted for all required inspections.
  11. Project Record Documents for the Work or the portion of the Work being accepted are submitted and approved.
  12. Spare parts and maintenance materials are turned over to the Authority.
  13. All keys are turned over to the Authority.
  14. All warranties and bonds are submitted and approved.
  15. Final cleaning has been completed to the satisfaction of the Authority.
- B. When all of the preceding requirements for the consideration of Substantial Completion have been met, the Authority will conduct a scheduled Substantial Completion inspection with its Architect/Engineers and other required representatives. If upon the completion of the inspection, the Authority should find that the Work is not substantially complete, the Authority will promptly notify the Contractor in writing, listing observed deficiencies.
- C. The Contractor shall remedy deficiencies and send a second written notice of Substantial Completion.
- D. When the Authority finds the Work is substantially complete, it will have fourteen (14) days to issue a certificate of Substantial Completion with an attached punch list of deficiencies, all in accordance with the provisions of the General Conditions.
- E. The Contractor shall be responsible for scheduling the activities required for Substantial Completion to enable completion within the Contract Time.

## **1.5 FINAL COMPLETION**

- A. In accordance with Section 00 70 00 – General Conditions, Article 13.13 Final Completion, when the Contractor considers that it has completed all the deficiencies listed on the Substantial Completion punch list, and that the Work is otherwise complete, it shall submit written certification that:
1. Contract Documents have been reviewed.

2. Work has been completed in accordance with Contract Documents, and deficiencies listed with certificate of Substantial Completion have been corrected.
  3. Work is complete and ready for final inspection.
- B. Upon the receipt of the preceding written notice, the Authority will conduct a Final Completion inspection. If the Authority should then find the Work to be incomplete, it will promptly notify the Contractor in writing with a list of observed deficiencies.
  - C. The Contractor shall remedy deficiencies and transmit to the Authority a second certification of Final Completion.
  - D. When the Authority determines the Work is complete, all in accordance with the General Conditions article, "Final Completion and Application for Payment", the Contractor may make application for Final Payment.

#### **1.6 REINSPECTION FEES**

- A. In accordance with Section 00 70 00 – General Conditions, Articles 13.10 Substantial Completion and 13.12 Final Inspection, the Contractor shall pay for all costs incurred by the Authority for re-inspection.
- B. The Authority may deduct the re-inspection costs from the application for final payment.

#### **1.7 FINAL ACCEPTANCE**

- A. Following the issuance of Final Completion, and subject to the completion of requirements specified in Section 00 70 00 – General Conditions, Articles 13.14 Final Payment and 13.15 Final Acceptance, the Authority will review the project files for completeness. The Authority may require the Contractor to submit or re-submit any of the following documents, upon request:
  1. Contractor's transmittal letter: O&M Manuals.
  2. Contractor's transmittal letter: Warranty/Bonds.
  3. Contractor's transmittal letter: Record Documents.
  4. Spare parts, maintenance materials receipts.

5. Contractor's transmittal letter: Keys & keying schedule.
  6. Contractor's certification of insurance.
  7. EEO compliance certification (Federally funded projects only).
  8. Submittals and miscellaneous registers.
  9. Original final pay estimate.
  10. Contractor's release.
  11. Authority of Labor Notice of Completion (NOC).
  12. Other documentation as required by the Authority.
- B. Statement of Adjustment of Accounts – The Authority may require the Contractor to submit a final statement reflecting adjustments to the Contract Price showing:
1. Original Contract Price.
  2. Previous Change Orders.
  3. Changes under Allowances.
  4. Changes under Unit Prices.
  5. Deductions for uncorrected Work.
  6. Penalties and Bonuses.
  7. Deductions for Liquidated Damages.
  8. Deductions for Re-inspection Fees.
  9. Other adjustments to Contract Price.
  10. Total Contract Price as adjusted.
  11. Previous payments.
  12. Sum remaining due.
- C. The Authority will issue a final Change Order reflecting all remaining adjustments to Contract Price not previously made by Change Orders.
- D. See Section 01 29 73 – Schedule of Values for minimum value that shall be assigned for Final Acceptance.

- E. The Contractor shall cooperate with the Authority and shall provide the requested documentation.
- F. When the Authority determines its files are complete, it may make final payment and issue a letter of Final Acceptance.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**

**SECTION 01 78 39**  
**PROJECT RECORD DOCUMENTS**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Maintenance of Record Documents and Samples.
- B. Submittal of Record Documents and Samples.

**1.2 RELATED REQUIREMENTS**

- A. Section 00 70 00 - General Conditions: Record Documents.
- B. Section 01 11 13 – Summary of Work.
- C. Section 01 29 76 – Application for Payment.
- D. Section 01 33 23 – Shop Drawings, Product Data, and Samples.
- E. Section 01 77 00 – Contract Closeout Procedures.
- F. Individual Specifications Sections: Manufacturer's certificates and certificates of inspection.

**1.3 MAINTENANCE OF DOCUMENTS AND SAMPLES**

- A. In addition to requirements in General Conditions, maintain at the site for the Authority one accurate and up to date record copy of:
  - 1. Contract Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders and other modifications to the Contract.
  - 5. Reviewed Shop Drawings, product data, and samples.
  - 6. Field test records.

7. Inspection certificates.
  8. Manufacturer's certificates.
- B. Prior to Substantial Completion, provide original or legible copies of each item maintained by the Contractor in other Sections, as listed by spec section in Paragraph 1.2.B, C, and D above.
  - C. Delegate responsibility for management of maintenance of Record Documents to one person on the Contractor's staff as approved in advance by the Authority.
  - D. Promptly following award of Contract, secure from the Authority, at no cost to the Contractor, one complete set of all Documents comprising the Contract.
  - E. Immediately upon receipt of job set described above, identify each Document with title "RECORD DOCUMENTS – JOB SET".
  - F. Store record documents and samples in field office apart from documents used for Construction. Provide files, racks, and secure storage for Record Documents and samples.
  - G. Label and file Record Documents and samples in accordance with Section number listings in table of contents of this Project manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
  - H. Maintain Record Documents in a clean, dry and legible condition. Do not use record documents for construction purposes.
  - I. Use all means necessary to maintain job set of Record Documents completely protected from deterioration and from loss and damage until completion of Work and transfer of recorded data to the Authority.
  - J. Keep record documents and samples available for inspection by the Authority.
  - K. Upon request by the Authority, and at time of each Application for Payment, enable inspection of Record Documents by the Authority for review as to completeness.
  - L. The Authority's approval of the current status of Record Documents will be prerequisite to the Authority's approval of requests for progress payments and request for final payment.

1. Prior to submitting each request for progress payment, secure the Authority's approval of Record Documents as currently maintained.
  2. Prior to submitting request for Final Payment, obtain the Authority's approval of final Record Documents.
- M. Do not use job set for any purpose except entry of new data and for review and copying by the Authority.

#### **1.4 RECORDING**

- A. Record information on a set of 'black-line' opaque Drawings, and in a copy of a Project manual, provided by the Authority.
- B. Using felt tip marking pens or colored pencil, maintaining separate colors for each major system, clearly describe changes by note and by graphic line, as required. Date all entries. Call attention to entry by a "cloud" around area or areas affected.
- C. Thoroughly coordinate all changes within Record Documents, making adequate and proper entries on each Specification Section and each sheet of Drawings and other Documents where such entry is required to properly show change or selection.
- D. When a change within Record Documents is referenced to another document, such as a RFI's, Shop Drawing or Change Order, attach a copy of the referenced document to the respective Record Drawing or Record Specification where the entry is made.
- E. Contract Drawings and Shop Drawings: Legibly mark each item to record actual construction, including:
  1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.
  2. Field changes of dimension and detail.
  3. Changes made by modifications.
  4. Details not on original Contract Drawings.
  5. References to related Shop Drawings and modifications.
  6. Clearly label all changes and show dimensions to establish size and location. All identifications shall be sufficiently descriptive to relate reliably to Specifications.

- F. Other Documents: Maintain manufacturer's certifications, inspection certifications, and field test records required by individual Specifications sections.

## **1.5 SUBMITTALS**

- A. Upon submittal of the completed Record Documents, make changes in Record Documents as required by the Authority.
- B. Transmit with cover letter in duplicate, listing:
  - 1. Date.
  - 2. The Authority's Project title and number.
  - 3. Contractor's name, address, and telephone number.
  - 4. Number and title of each record document.
  - 5. Signature of the Contractor or authorized representative.
- C. Final Record Documents shall include both hard copies and digitally scanned copies in \*.PDF format (high quality grayscale scans, minimum 200 pixels/inch). Scans shall include front and back of drawings/documents where information occurs on both sides.

## **PART 2 – PRODUCTS (NOT USED)**

## **PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**



**SECTION 02 32 00**  
**GEOTECHNICAL INVESTIGATIONS**

**PART 1 - GENERAL**

**1.1 RELATED REQUIREMENTS**

- A. Section 00 73 13 Supplementary Conditions.
- B. Section 31 23 00 Excavation and Fill.

**1.2 SOIL REPORTS**

- A. Existing Geotechnical Conditions:
  - 1. A limited geotechnical investigation and Ground Penetrating Radar (GPR) study for this project was completed in August 2019. To estimate bedrock depths.
  - 2. A copy of the Geotechnical report is included in these bid documents for informational purposes. However, contractor understands that actual field conditions may vary significantly.
  - 3. Contractor is encouraged to visit the site and acquaint himself with site conditions before submitting a Bid, and the submission of a Bid shall be prima facie evidence that he has done so.
  - 4. Prior to bidding, Contractor may make his own sub-surface investigations, as approved by the project manager and owner, to satisfy himself with site and subsurface conditions.

**PART 2 - PRODUCTS**

Not Used.

**PART 3 - EXECUTION**

Not Used.

**END OF SECTION**

**SECTION 02 41 00**  
**DEMOLITION**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Selective demolition of built site elements.

**1.2 RELATED REQUIREMENT**

**1.3 REFERENCE STANDARDS**

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. USACE EM 385-1-1 Safety and Health Requirements Manual.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION**

**3.1 SCOPE**

- A. Remove items selected for demolition as indicated by on the Drawings.
- B. Remove sections of out of service utilities encountered during construction activities.

**3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Provide, erect, and maintain temporary barriers and security devices.
  - 3. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
  - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 5. Do not close or obstruct roadways or sidewalks without permit.

6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
  7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. If hazardous materials are discovered during removal operations, stop work and notify the Authority. Hazardous materials include but are not limited to fuels, regulated asbestos containing materials, lead, PCB's, and mercury.

### **3.3 EXISTING UTILITIES**

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits and locates.
- B. Do not disrupt utilities without permit from authority having jurisdiction.
- C. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

### **3.4 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site or returned to the local utility company.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**

**SECTION 03 30 00**  
**CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

**1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.
- C. Shop Drawings: For steel reinforcement.
- D. Material test reports.

**1.3 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 and Section 7.
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- C. Pre-installation Conference: Conduct conference at Project site.

## **PART 2 - PRODUCTS**

### **2.1 FORM-FACING MATERIALS**

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as- drawn steel wire into flat sheets.
- C. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from galvanized steel wire into flat sheets.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

### **2.3 CONCRETE MATERIALS**

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150, Type IA, II, IIIA.
- B. Aggregates: All aggregates shall be provided from an approved source.
  - 1. Normal-Weight Aggregates: ASTM C 33, graded, 1-inch nominal maximum coarse-aggregate size.
  - 2. Fine Aggregate: ASTM C 33, Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble

chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

## **2.4 CURING MATERIALS**

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap polyethylene sheet.
- C. Water: Potable.

## **2.5 CONCRETE MIXTURES**

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Proportion normal-weight concrete mixture as follows:
  1. Minimum Compressive Strength: 4000 psi at 28 days.
  2. Maximum Water-Cementitious Materials Ratio: 0.45.
  3. Slump Limit: 4 inches, plus or minus 1 inch.
  4. Air Content: 4-7 percent.

## **2.6 FABRICATING REINFORCEMENT**

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## **2.7 CONCRETE MIXING**

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M.

## **PART 3 - EXECUTION**

### **3.1 FORMWORK**

- A. Design, erect, shore, brace, and maintain formwork according to ACI 301 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.

### **3.2 EMBEDDED ITEMS**

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

### **3.4 CONCRETE PLACEMENT**

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
- C. Cold-Weather Placement: Comply with ACI 306.1.
- D. Hot-Weather Placement: Comply with ACI 301.

### **3.5 FINISHING FORMED SURFACES**

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces not exposed to public view.

### **3.6 FINISHING FLOORS AND SLABS**

- A. General: Comply with ACI 302.1R recommendations for screening, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

### **3.7 CONCRETE PROTECTING AND CURING**

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

### **3.8 CONCRETE SURFACE REPAIRS**

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

### **3.9 FIELD QUALITY CONTROL**

- A. Testing and Inspecting: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and



prepare test reports.

1. Testing Services: Tests shall be performed according to ACI 301 & the Design Drawings.

**END OF SECTION**

**SECTION 05 12 00**  
**STRUCTURAL STEEL FRAMING**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Structural steel framing members and support members.
- B. Plates and fabricated connections.

**1.2 WORK INCLUDED**

- A. This section includes fabrication and erection of structural steel work, as shown on Contract Drawings including schedules, notes, and details showing size and location of members, typical connections, and types of steel required.
  - 1. Structural steel is that work defined in American Institute of Steel Construction (AISC) “Code of Standard Practice” and as otherwise shown on Contract Drawings.
  - 2. This section applies, but is not limited to, stairways, module framing, and other miscellaneous steel fabrications.

**1.3 RELATED REQUIREMENTS**

- A. Section 05 50 00 – Metal Fabrications.
- B. Section 09 96 00 – High Performance Coatings.
- C. Section 09 98 00 – Hot Dip Galvanized Coatings.

**1.4 REFERENCE STANDARDS**

- A. AISC (MAN) – Steel Construction Manual; American Institute of Steel Construction, Inc.
- B. AISC S303 – Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.
- C. ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
- D. ASTM 53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

- E. ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
- F. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- G. ASTM A325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- H. ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts.
- I. ASTM A572 /A572M – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
- J. ASTM A992/A992M – Standard Specification for Structural Steel Shapes.
- K. ASTM F436 – Standard Specification for Hardened Steel Washers.
- L. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength.
- M. AWS A2.4 – Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society.
- N. AWS D1.1/D1.1M – Structural Welding Code – Steel; American Welding Society.

## **1.5 SUBMITTALS**

- A. Product data or manufacturer's specifications and installation instructions for products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
- B. Shop Drawings:
  - 1. Indicate profiles, sizes, spacing, and locations of structural members, openings, attachments, and fasteners.
  - 2. Connections.
  - 3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
- D. Mill Test Reports: Indicate structural strength, destructive test analysis, and non-destructive test analysis.

- E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.
- F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

## **1.6 QUALITY ASSURANCE**

- A. Fabricate structural steel members in accordance with AISC "Steel Construction Manual".
- B. Qualifications for Welding Work: Qualify welding procedures and welding operators in accordance with AWS "Qualification" requirements.
  - 1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests.
  - 2. If recertification of welders is required, retesting will be Contractor's responsibility.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Fabricate or deliver materials to site at such intervals to ensure uninterrupted progress of work.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. If bolts and nuts become dry or rusty, clean and re-lubricate before use.
  - 1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. At Contractor's expense, repair or replace damaged materials or structures as directed.

## **PART 2 – PRODUCTS**

### **2.1 MATERIALS**

- A. Metal Surfaces, General: For fabrication of work that will be exposed to view, use only materials that are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and applying surface finishes.
- B. Steel Angles and Channels: ASTM A36/A36M.

- C. Steel Shapes: ASTM A992/A992M.
- D. Steel Plate: ASTM A572/A572M, Grade 50 (345) high-strength.
- E. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.
- F. Pipe: ASTM A53/A53M, Grade B, Finish black.
- G. Electrodes for Welding: Comply with AWS Code.
- H. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 or A325M, Type 1, medium carbon, galvanized, with matching compatible ASTM A563 or A563M nuts and ASTM F436 washers.

## **2.2 FABRICATION**

- A. Shop fabricate to greatest extent possible.
- B. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.
  - 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence that will expedite erection and minimize field handling of materials.
  - 2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
- C. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- D. Fabricate connections for bolt, nut, and washer connectors.
- E. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
- F. Assemble and weld built up sections by methods that will produce true alignment of axes without warp.
- G. Holes for Other Work: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on final shop drawings.
- H. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

- I. Tolerances: Structural component tolerances shall be +/- 1/8 inch and as required to adequately support loads.

### **2.3 STEEL COATING**

- A. The structural steel members not noted to be galvanized shall be coated per Section 09 96 00.
- B. The stairs, landings, ladders, fence components, steel foundation plates, miscellaneous hardware, and shop fabrications not part of the structural building framing system shall be hot-dipped galvanized per Section 09 98 00.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.
- B. Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
  1. At Contractor's expense, promptly remove and replace materials or fabricated components that do not comply.
- C. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the Work.
  1. Promptly notify Project Manager whenever design of members and connections for any portion of structure are not clearly indicated.

### **3.2 ERECTION**

- A. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges".
- B. Temporary Shoring and Bracing: Allow for erection loads, and provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.
- C. Shop Welding: Contractor shall inspect and test during fabrication of structural steel

assemblies, as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
  2. Perform visual inspection of all welds.
- D. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces that will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- E. Level and plumb individual members of structure within specified AISC tolerances.
- F. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members that are not under stress, as acceptable to Project Manager. Finish gas-cut sections equal to a sheared appearance when permitted.
- G. Touch-Up Repairs: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint or galvanizing.
- H. Galvanizing Repair: Galvanized coating at damaged areas shall be repaired according to ASTM A 780 (Annex A1) using zinc-based alloy repair sticks commonly known as "hot sticks".
- I. Coating Repair: If underlying metal surface is exposed, wheel abrade or sandblast to clean metal and re-coat same as tanks. If damage does not fully penetrate coating then reapply top coat only to minimum DFT.
- J. Field weld components indicated on shop drawings.
- K. Do not field cut or alter structural members without approval of Engineer.

### **3.3 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

### **3.4 FIELD QUALITY CONTROL**

- A. The Authority, or Authority's representatives, will visually inspect welded connections.
- B. The Authority reserves the right to contract an independent testing firm to test welded connections.
- C. Provide access for the Authority's inspectors or testing agency representatives to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
- D. The Authority may inspect structural steel at plant before shipment.
- E. Correct deficiencies in structural steel work that inspection and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as necessary, to reconfirm any noncompliance of original work and to show compliance of corrected work.
- F. Shop Welding: Contractor shall inspect and test during fabrication of structural steel assemblies, as follows:
  - 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
  - 2. Perform visual inspection of all welds.
- G. Field Welding: Contractor shall inspect and test during erection of structural steel as follows:
  - 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
  - 2. Perform visual inspection of all welds.

**END OF SECTION**



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**SECTION 05 50 00**  
**METAL FABRICATIONS**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Shop fabricated steel items including miscellaneous metal fabrications not part of the structural building framing system.
- B. Shop fabricated steel stairs, guardrails, handrails, and grating.
- C. Miscellaneous metal fabrications and fasteners.
- D. Hot dipped galvanized metal fabrication such as access stairs, guardrails, handrails, access ladders, platforms, and platform supports.
- E. Other hot dipped galvanized metal fabrications where specified or indicated.

**1.2 RELATED REQUIREMENTS**

- A. Section 05 12 00 – Structural Steel Framing.
- B. Section 09 98 00 – Hot Dip Galvanized Coatings.

**1.3 REFERENCE STANDARDS**

- A. ANSI A14.3 – American National Standard for Ladders – Fixed – Safety Requirements.
- B. ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
- C. ASTM A53/A53M – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- D. ASTM A123/A123M – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- E. ASTM A153/A153M – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- F. ASTM A325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

- G. ASTM A500/A500M – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- H. AWS A2.4 – Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society.
- I. AWS D1.1/D1.1M – Structural Welding Code – Steel; American Welding Society.
- J. IAS AC172 – Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.
- K. SSPC-Paint 15 – Steel Joist Shop Primer; Society for Protective Coatings.
- L. SSPC-Paint 20 – Zinc-Rich Primers (Type I, “Inorganic”, and Type II, “Organic”); Society for Protective Coatings.
- M. SSPC-SP 2 – Hand Tool Cleaning; Society for Protective Coatings.

#### **1.4 SUBMITTALS**

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
  - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- B. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.
- C. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

#### **1.5 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Fabricator must be a firm experienced in producing metal fabrications similar to those indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, “Structural Welding Code – Steel”.
  - 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

## **PART 2 – PRODUCTS**

### **2.1 MATERIALS – STEEL**

- A. Steel Wide Flange Shapes: ASTM A992.
- B. Miscellaneous Steel Sections and Plate: ASTM A36/A36M.
- C. Steel Tubing: ASTM A500, Grade B cold-formed structural tubing.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black and hot-dip galvanized finish, as indicated.
- E. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.
- F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- H. Touch-Up of Galvanized Surfaces: SSPC-Paint 20, Type I – Inorganic, complying with VOC limitations of authorities having jurisdiction.
- I. GS Metals Corp. Product Grip Strut Safety Grating with fasteners and saddle clips by manufacturer: Galvanized finish.

### **2.2 FABRICATION**

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

### **2.3 FABRICATED ITEMS**

- A. Stairs and Landings: Steel members, connections, and fasteners as detailed in

Drawings; hot-dipped galvanized finish.

- B. Guardrails and Handrails: Fabricate guardrails and handrails of pipe of dimensions indicated. All transitions shall be made using smooth radius fittings. Handrails shall be fabricated continuous, without interruptions, and shall return to terminate at end posts or walls.
- C. Grip Strut Grating Panels: Manufactured die stamped type, serrations facing upward, galvanized steel:
  - 1. Profile 11-3/4" x 2", 5 diamond pattern.
  - 2. Thickness: 14 gauge.
  - 3. Stair Treads: Provide manufacturer's standard end plate connection.
  - 4. Attachments: Provide manufacturer's standard saddle clips and fasteners.

## **2.4 FINISHES – STEEL**

- A. All metal fabrications not part of the module structural steel framing shall be hot-dipped galvanized as noted in the Drawings and in Section 09 98 00.
- B. The module metal framing shall be coated per Section 09 96 00.

## **2.5 FABRICATION TOLERANCES**

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive Work.

### **3.2 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.

### **3.3 INSTALLATION**

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Grip Strut Grating Attachment: Anchor by bolting through saddle clips.
  - 1. Bolt Size: 5/16" carriage bolts and nuts with diamond connection clip.
  - 2. Quantity: Minimum 2 clips at each end support location.
- E. Obtain approval from Architect/Engineer prior to site cutting or making adjustments not scheduled.

### **3.4 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

**END OF SECTION**

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**SECTION 06 10 00**  
**ROUGH CARPENTRY**

**PART 1 – GENERAL**

**1.1 WORK INCLUDED**

- A. This section covers the work necessary to install the module roof system as shown on the Drawings.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 60 00 – Material and Equipment.
- B. Section 01 74 00 – Cleaning and Waste Management.

**1.3 REFERENCE STANDARDS**

- A. PS 20 – American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.
- B. WWPA G-5 – Western Lumber Grading Rules; Western Wood Products Association; 2011.

**1.4 SUBMITTALS**

- A. Manufacturer's Certificate: 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 American Lumber Standards Committee Board of Review.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
  - 1. Power-driven fasteners.



## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

## **PART 2 – PRODUCTS**

### **2.1 GENERAL REQUIREMENTS**

- A. Dimension Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSA Board of Review. Provide lumber graded by an agency certified by the ALSA 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. Provide dressed lumber, S4S, unless otherwise indicated.
  - 3. Species: Hem or Douglass Fir, unless otherwise indicated.
  - 4. Grade: No. 2 or better.

### **2.2 FASTENERS**

- A. General: Provide fasteners of size and type indicated that comply with requirements specified.
- B. Power-Driven Fasteners: NES NER-272.
- C. Wood screws: ASME B18.6.1.
- D. Bolts: Wood to steel or wood to wood, Structural Bolts, Nuts, and Washers: ASTM A307, medium carbon, galvanized, with matching compatible nuts and washers.

### **2.3 METAL FRAMING ANCHORS**

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

- B. Basis-of-Design Products: Subject to compliance with requirements, provide products indicated on Drawings or comparable products by one of the following:
  - 1. Alpine Engineered Products, Inc.
  - 2. Cleveland Steel Specialty Co.
  - 3. Harlen Metal Products, Inc.
  - 4. KC Metals Products, Inc.
  - 5. Simpson Strong-Tie Co., Inc.
  - 6. Southeastern Metals Manufacturing Co., Inc.
  - 7. USP Structural Connectors.
- C. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, which 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.
- D. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION**

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction", unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.
- E. Do not splice structural members between supports, unless otherwise indicated.

- F. Comply with AWWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule", in ICC's International Building Code.
  - 3. Table 23-II-B-1, "Nailing Schedule", and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule", in ICBO's Uniform Building Code.
  - 4. Table 2305.2, "Fastening Schedule", in BOCA's National Building Code.
  - 5. Table 2306.1, "Fastening Schedule", in SBCCI's Standard Building Code.
  - 6. 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.
  - 7. Table 602.3(1), "Fastener Schedule for Structural Members", and Table 602.3(2), "Alternate Attachments", in ICC's International One- and Two-Family Dwelling Code.

### **3.2 PROTECTION**

- A. Do not burn scrap on project site.
- B. Do not burn scraps that have been pressure treated.
- C. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

**END OF SECTION**

**SECTION 07 21 00**  
**THERMAL INSULATION**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Polystyrene foam-plastic board.
- B. Mineral-wool blanket.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-In-Place Concrete
- B. Section 31 23 23 – Fill.
- C. Section 33 61 13 - Underground Hydronic Energy Distribution.

**1.3 SUBMITTALS**

- A. Product Data: For each type of product.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Do not expose foam-plastic board to sunlight except to necessary extent for period of installation and concealment.

**PART 2 – PRODUCTS**

**2.1 POLYSTYRENE FOAM-PLASTIC BOARD**

- A. Insulation Board: AASHTO M 230, Type VI, except that extrusion is not required and the maximum water absorption shall not exceed 0.3% by volume, as determined in ASTM C272. Thermal resistance (R-value) shall not be less than 4.5 per inch at 75°F as determined by ASTM C177. The minimum board size shall be 2-inches by 2-feet by 8-feet. Compressive strength at yield or 10% deformation shall not be less than the following:

1. Insulation under concrete foundations: 60 psi.
2. Insulation over buried arctic pipe: 25 psi.

### **PART 3 – EXECUTION**

#### **3.1 PREPARATION**

- A. Prior to placing the insulation board, blade, shape, and compact subgrade to a flat, smooth, firm, and unyielding surface. Visually inspect embankment surface and remove bumps, ruts, deleterious material, debris, and any other objects that may prevent proper installation, attachment, and performance of the insulation board.
- B. Place a sand bedding leveling course at least two (2) inches thick on the subgrade.

#### **3.2 CONSTRUCTION OF INSULATION BOARD**

- A. Set each board accurately to the line and grade established and anchor firmly in place.
- B. Do not compact fill over insulation until it is completely thawed through its entire thickness.
- C. Use caution and appropriate construction techniques to ensure the insulation is protected and not damaged during formation of embankments.
- D. Remove and replace, at no cost to the Owner, any insulation that has been damaged or displaced.

**END OF SECTION**

**SECTION 07 41 13**  
**FORMED METAL ROOF PANELS**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Metal roof panels.
- B. Flashing and trim integral to roof panels.
- C. Clips, anchoring devices, fasteners, and accessories for installation of panel system.

**1.2 SUBMITTALS**

- A. Submit the following:
  - 1. Product Literature and data sheets for each material used.
  - 2. Manufacturer's surface preparation and installation instructions.

**1.3 REFERENCE STANDARDS**

- A. UL 580 - Uplift Resistance of Roof Assemblies.
- B. UL 1897 - Uplift Test for Roof Covering Systems.
- C. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A 792 - Standard Specification for Steel Sheet, Aluminum-Zinc Alloy Coated Steel by the Hot-Dip Process.
- E. ASTM A 924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Structural and Wind Load Tests:
  - 1. Design load/deflection criteria verified from tests per ASTM E 72 "Chamber Method" using a 20 psf (0.96 kPa) simulated wind load with a deflection limit of L/240.
  - 2. FM Approval Standard 4471: Meets windstorm Class 1A [90] and hailstorm Class 1-SH classifications.

3. Underwriters Laboratory (UL) Uplift Tests for Roof Assemblies: UL Class 90 rated in accordance with UL 580 and shall withstand static uplift load of 140 psf when tested on 7 foot purlin spacing and 166 psf when tested on 5-foot purlin spacing.

## **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installation of the products specified for projects of similar size and scope with minimum five years documented experience.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in accordance with Manufacturer's written instructions. Store under cover in manufacturer's unopened packaging with labels intact until ready for installation.
- B. Store products off the ground, with panels sloped for drainage and covered to protect factory finishes from damage.
- C. Do not overload roof structure with stored materials. Do not permit material storage or traffic on completed roof surfaces.

## **1.7 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer's two year limited warranty that panels are free from defects in materials and workmanship, beginning from the date of shipment of panels, but excluding coil coatings (paint finishes) covered under a separate warranty. Warranty does not include interior painted surface of panels.
- B. Submit exterior paint manufacturer's written twenty year limited warranty on paint finish for adhesion to the substrate and a thirty year limited warranty on chalk and color fade.

## **PART 2 – PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Acceptable Manufacturer: AEP Span or approved equal.

## 2.2 MATERIALS

- A. Standing Seam Metal Roof Panels: AEP Span-Lok HP or approved equal.
  - 1. Prefinished Galvalume® or Zinalume® sheet, ASTM AZ50 made of 55% aluminum, 1.6% silicon and the balance zinc as described in ASTM specification A792.
  - 2. Fabricated panel with integral continuous overlapping seams suitable for continuous crimping by mechanical means during installation.
  - 3. Seam Height: 2” high ribs @ 16” centers.
  - 4. Provide pre-installed, high grade, hot-melt elastomeric sealant or butyl mastic, within the confines of panel’s female leg, designed to seal against adjacent male panel leg.
  - 5. Minimum Thickness: 24 gauge (0.0250 inch) or as indicated on Drawings.
- B. Panel Finish:
  - 1. Exterior Finish: Cool Dura Tech 5000, color cool Forest Green.
- C. Flashing and Trim: Brake-formed sheet metal in the same thickness and finish to match the panels.
- D. Fasteners: Clips, anchoring devices, fasteners, and accessories for installation of panel system as recommended by panel manufacturer for the system specified.
- E. Sealant: Sealant as recommended by panel manufacturer.

## 2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick. Grace Ice and Water Shield, or approved equal.

## 2.4 SNOW FENCE

- A. Provide snow fence system as shown on the Drawings. The snow fence shall be a complete system that is compatible with the roof panels and is engineered for the application.
- B. The number of rows indicated on the Drawings is the minimum quantity. If the calculations indicate more, provide additional rows as required. If the calculations indicate less, provide the minimum quantity shown on the Drawings. Install first row 12” above the eave and second row 12” above the bearing wall.



## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Examine structural members before beginning installation to ensure that all supporting members are straight, level, plumb and satisfactory for panel installation.
- B. Panel Support Tolerances:
  - 1. Overall rake to rake tolerances plus or minus 2 inches or plus or minus 1 inch at each rake.
  - 2. Overall eave to ridge tolerance plus or minus 1 inch or plus or minus 1/2 inch at the eave, end lap and ridge.
  - 3. Vertical deviation from the nominal roof plane of plus or minus 1/8 inch in any 5 foot length, plus or minus 1/4 inch in any 20 foot length and plus or minus 1/2 inch over the entire roof area.
- C. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets are in place, and nailing strips located.
- D. Correct defective conditions before beginning work.
- E. If substrate is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

### **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 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.

### **3.3 INSTALLATION GENERAL**

- A. Install in accordance with manufacturer's instructions and recommendations including approved shop drawings, installation guidebook and manufacturer's handbook of construction details.
- B. Anchor securely in place using clips and fasteners spaced in accordance with manufacturer's recommendations for design wind load criteria.
- C. Form seams with manufacturer-approved motorized or hand seaming tool. Completely engage panel, clip, and factory-applied sealant in seam.

- D. Form panel shape as indicated on Drawings, accurate in size, square, and free from distortion or defects.
- E. Install flashing and trim true and in proper alignment.
- F. Protective film on trim shall be removed before exposure to sunlight.
- G. Install sealants where indicated to clean dry surfaces only without skips or voids, to ensure weather tight

### **3.4 CLEANING**

- A. Replace damaged panels and other components of work, which cannot be repaired by finish touch-up or similar minor repair.
- B. Wipe finished surfaces clean of any filings caused by drilling or cutting to prevent rust staining.

### **3.5 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION**

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**SECTION 07 42 13**  
**FORMED METAL WALL PANELS**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Metal wall panels.
- B. Flashing and trim integral to wall panels.
- C. Fasteners and accessories for installation of panel system.

**1.2 SUBMITTALS**

- A. Submit the following:
  - 1. Product Literature for each material used.
  - 2. Manufacturer's surface preparation and installation instructions.

**1.3 REFERENCE STANDARDS**

- A. UL 580 - Uplift Resistance of Roof Assemblies.
- B. UL 1897 - Uplift Test for Roof Covering Systems.
- C. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A 792 - Standard Specification for Steel Sheet, Aluminum-Zinc Alloy Coated Steel by the Hot-Dip Process.
- E. ASTM A 924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Structural and Wind Load Tests:
  - 1. Design load/deflection criteria verified from tests per ASTM E 72 "Chamber Method" using a 20 psf (0.96 kPa) simulated wind load with a deflection limit of L/240.
  - 2. FM Approval Standard 4471: Meets windstorm Class 1A [90] and hailstorm Class 1-SH classifications.

3. Underwriters Laboratory (UL) Uplift Tests for Roof Assemblies: UL Class 90 rated in accordance with UL 580 and shall withstand static uplift load of 140 psf when tested on 7-foot purlin spacing, and 166 psf when tested on 5-foot purlin spacing.

## **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installation of the products specified for projects of similar size and scope with minimum five years documented experience.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in accordance with Manufacturer's written instructions. Store under cover in manufacturer's unopened packaging with labels intact until ready for installation.
- B. Store products off the ground, with panels sloped for drainage and covered to protect factory finishes from damage.
- C. Do not overload roof structure with stored materials. Do not permit material storage or traffic on completed roof surfaces.

## **1.7 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer's two-year limited warranty that panels are free from defects in materials and workmanship, beginning from the date of shipment of panels, but excluding coil coatings (paint finishes) covered under a separate warranty. Warranty does not include interior painted surface of panels.
- B. Submit exterior paint manufacturer's written twenty-year limited warranty on paint finish for adhesion to the substrate and a thirty-year limited warranty on chalk and color fade.

## **PART 2 – PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Acceptable Manufacturer: AEP Span or approved equal.

## 2.2 MATERIALS

- A. Metal Wall Panels: AEP Super-Span, or approved equal.
  - 1. Prefinished Galvalume® or Zinalume® sheet, ASTM AZ50 made of 55% aluminum, 1.6% silicon and the balance zinc as described in ASTM specification A792.
  - 2. Fabricate panels with sufficient thickness to meet specified UL 90 wind uplift requirements.
  - 3. Fabricated panel with integral continuous overlapping seams.
  - 4. Seam Height: 1-1/4" high.
  - 5. Provide pre-installed, high grade, hot-melt elastomeric sealant or butyl mastic, within the confines of panel's female leg, designed to seal against adjacent male panel leg.
  - 6. Thickness: 24 gauge (0.0250 inch).
- B. Panel Finish:
  - 1. Exterior Finish: One coat 70 percent polyvinylidene fluoride, nominal 0.7 mil (0.02 mm) thick, over 0.2 mil (0.005 mm) primer. Color as indicated on Drawings.
- C. Flashing and Trim: Brake-formed sheet metal in the same thickness and finish to match the panels.
- D. Fasteners: Fasteners and accessories for installation of panel system as recommended by panel manufacturer for the system specified.
- E. Sealant: Sealant as recommended by panel manufacturer.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Examine structural members before beginning installation to ensure that all supporting members are straight, level, plumb and satisfactory for panel installation.
- B. Panel Support Tolerances:
  - 1. Overall rake to rake tolerances plus or minus 2 inches or plus or minus 1 inch at each rake.
  - 2. Vertical deviation from the nominal wall plane of plus or minus 1/8 inch in any 5 foot length, plus or minus 1/4 inch in any 20 foot length and plus or

minus 1/2 inch over the entire wall area.

- C. Verify wall openings, curbs, pipes, sleeves, ducts, or vents through wall are solidly set, reglets are in place, and nailing strips located.
- D. Correct defective conditions before beginning Work.
- E. If substrate is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.2 INSTALLATION – GENERAL**

- A. Install in accordance with manufacturer's instructions and recommendations including approved shop drawings, installation guidebook and manufacturer's handbook of construction details.
- B. Anchor securely in place using fasteners spaced in accordance with manufacturer's recommendations for design wind load criteria.
- C. Form panel shape as indicated on Drawings, accurate in size, square, and free from distortion or defects.
- D. Install flashing and trim true and in proper alignment.
- E. Protective film on trim shall be removed before exposure to sunlight.
- F. Install sealants where indicated to clean dry surfaces only without skips or voids, to ensure weather tight

### **3.3 CLEANING**

- A. Replace damaged panels and other components of work, which cannot be repaired by finish touch-up or similar minor repair.
- B. Wipe finished surfaces clean of any filings caused by drilling or cutting to prevent rust staining.

### **3.4 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION**

**SECTION 07 43 13**  
**FORMED VENTED SOFFIT PANELS**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Metal Soffit panels.
- B. Flashing and trim integral to wall panels.
- C. Fasteners and accessories for installation of panel system.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 33 00 - Submittal Procedures.
- B. Section 01 45 00 - Quality Control.

**1.3 SUBMITTALS**

- A. Submit the following in accordance with Section 01 33 00.
  - 1. Product Literature for each material used.
  - 2. Manufacturer's surface preparation and installation instructions.

**1.4 REFERENCE STANDARDS**

- A. UL 580 – Uplift Resistance of Roof Assemblies.
- B. UL 1897 – Uplift Test for Roof Covering Systems.
- C. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM A 792 – Standard Specification for Steel Sheet, Aluminum-Zinc Alloy Coated Steel by the Hot-Dip Process.
- E. ASTM A 924 – General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.



## **1.5 PERFORMANCE REQUIREMENTS**

- A. Structural and Wind Load Tests:
  - 1. Design load/deflection criteria verified from tests per ASTM E 72 "Chamber Method" using a 20 psf (0.96 kPa) simulated wind load with a deflection limit of L/240.
  - 2. FM Approval Standard 4471: Meets windstorm Class 1A [90] and hailstorm Class 1-SH classifications.
  - 3. Underwriters Laboratory (UL) Uplift Tests for Roof Assemblies: UL Class 90 rated in accordance with UL 580 and shall withstand static uplift load of 140 psf when tested on 7-foot purlin spacing and 166 psf when tested on 5-foot purlin spacing.

## **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installation of the products specified for projects of similar size and scope with minimum five years documented experience.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in accordance with Manufacturer's written instructions. Store under cover in manufacturer's unopened packaging with labels intact until ready for installation.
- B. Store products off the ground, with panels sloped for drainage and covered to protect factory finishes from damage.
- C. Do not overload roof structure with stored materials. Do not permit material storage or traffic on completed roof surfaces.

## **1.8 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer's two-year limited warranty that panels are free from defects in materials and workmanship, beginning from the date of shipment of panels, but excluding coil coatings (paint finishes) covered under a separate warranty. Warranty does not include interior painted surface of panels.
- B. Submit exterior paint manufacturer's written twenty-year limited warranty on paint finish for adhesion to the substrate, and a thirty-year limited warranty on chalk and color fade.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Acceptable Manufacturer: AEP Span or approved equal.

### **2.2 MATERIALS**

- A. Metal Wall Panels: AEP Vented Flush-Panel or approved equal.
1. Prefinished Galvalume® or Zinalume® sheet, ASTM AZ50 made of 55% aluminum, 1.6% silicon and the balance zinc as described in ASTM specification A792.
  2. Fabricate panels with sufficient thickness to meet specified UL 90 wind uplift requirements.
  3. 1" Standoff from Substrate.
  4. Thickness: 24 gauge (0.0250 inch).
  5. Two pencil ribs.
  6. Provide 7.8% Net Free Area.
  7. Concealed Fasteners.
  8. 12" Net Coverage.
- B. Panel Finish:
1. Exterior Finish: One coat 70 percent polyvinylidene fluoride, nominal 0.7 mil (0.02 mm) thick, over 0.2 mil (0.005 mm) primer. Color as indicated on Drawings.
- C. Flashing and Trim: Brake-formed sheet metal in the same thickness and finish to match the panels.
- D. Fasteners: Fasteners and accessories for installation of panel system as recommended by panel manufacturer for the system specified.
- E. Sealant: Sealant as recommended by panel manufacturer.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine structural members before beginning installation to ensure that all supporting members are straight, level, plumb and satisfactory for panel installation.
- B. Panel Support Tolerances:
  - 1. Overall rake to rake tolerances plus or minus 2 inches, or plus or minus 1 inch at each rake.
  - 2. Vertical deviation from the nominal wall plane of plus or minus 1/8 inch in any 5 foot length, plus or minus 1/4 inch in any 20 foot length, and plus or minus 1/2 inch over the entire wall area.
- C. Verify wall openings, curbs, pipes, sleeves, ducts, or vents through wall are solidly set, reglets are in place, and nailing strips located.
- D. Correct defective conditions before beginning work.
- E. If substrate is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.2 INSTALLATION – GENERAL**

- A. Install in accordance with manufacturer's instructions and recommendations including approved shop drawings, installation guidebook and manufacturer's handbook of construction details.
- B. Anchor securely in place using fasteners spaced in accordance with manufacturer's recommendations for design wind load criteria.
- C. Form panel shape as indicated on Drawings, accurate in size, square, and free from distortion or defects.
- D. Install flashing and trim true and in proper alignment.
- E. Protective film on trim shall be removed before exposure to sunlight.
- F. Install sealants where indicated to clean dry surfaces only without skips or voids, to ensure weather tight.

### **3.3 CLEANING**

- A. Replace damaged panels and other components of work, which cannot be repaired by finish touch-up or similar minor repair.
- B. Wipe finished surfaces clean of any filings caused by drilling or cutting to prevent rust staining.

### **3.4 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION**

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**SECTION 07 92 00**  
**JOINT SEALANT**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Furnishing and installing all sealant where indicated on the Drawing.

**1.2 RELATED REQUIREMENTS**

- A. Division 1.
- B. Section 23 05 00 - Common Work Results for Mechanical.

**1.3 SUBMITTALS**

- A. Submit the following in accordance with Section 01 33 00.
  - 1. Product Literature for each material used.
  - 2. Manufacturer's surface preparation and installation instructions.

**1.4 QUALITY ASSURANCE**

- A. Installers: Use only skilled workmen specially trained in the techniques of sealing and familiar with the published recommendations of the manufacturers of the sealants being used.
- B. Verify that sealants are compatible with the substrates and accessory materials provided under other Sections. Notify Engineer of evidence of incompatibility.

**1.5 ENVIRONMENTAL CONDITIONS**

- A. Install and protect sealants under conditions recommended by the manufacturer and as follows:
  - 1. Do not apply sealant when ambient temperatures are below 40 degrees F, or expected to fall below 40 degrees F before sealant cure is complete.
  - 2. Do not apply sealant to substrates or accessories that are moist.

## **PART 2 – PRODUCTS**

### **2.1 MATERIALS**

- A. Polyurethane-based sealant, Sika Sikaflex 1A, or equal, meeting Fed. Spec. TT-S-00230C, Type II, Class A.
- B. Color shall be gray except where installed against white painted surfaces color shall be white.

### **2.2 ACCESSORY MATERIALS**

- A. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- B. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence. Notify the Authority in writing of conditions detrimental to the proper and timely completion of the Work.
- B. Verify joint dimensions and conditions are acceptable to receive the work of this Section.
- C. Beginning of installation means acceptance.

### **3.2 PREPARATION**

- A. Clean and prepare joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant.
- B. Apply masking tightly around joints to protect adjacent surfaces from excess sealant.
- C. Prime as required by manufacturer for proper bond to substrate materials.
- D. Prepare joint to achieve proper sealant width/depth ratios as indicated. Install backer rod where required to achieve correct joint profile.

### **3.3 INSTALLATION**

- A. Install sealant in strict accordance with manufacturer's instructions.
- B. Sealant beads shall have a section as detailed in the Drawings.
- C. Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature ranges.
- D. Tool joints concave, unless otherwise indicated. Finish free of air pockets, foreign embedded matter, ridges and sags.
- E. Coat finished and cured sealant joints with coating system specified in the Drawings, see Section 09 97 13.23 – Exterior Steel Coatings.

### **3.4 CLEANUP**

- A. Clean adjacent surfaces free of excess sealant as the work progresses. Use cleaning agents recommended by the sealant manufacturer.
- B. Upon completion, remove and dispose of masking.

**END OF SECTION**



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**SECTION 09 97 13.23**  
**EXTERIOR STEEL COATINGS**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. This section includes surface preparation and external coating requirements for coating touch up to be completed in the field after shop fabrication and field erection.

**1.2 RELATED REQUIREMENT**

- A. Section 07 92 00 – Joint Sealant.

**1.3 GENERAL REQUIREMENTS**

- A. Unless specified herein, the coating manufacturer's printed recommendations and instructions for shelf life, storing, surface preparation, mixing, thinning, handling, applying, curing, ambient conditions during application and curing, and for all other procedures relative to coating shall be strictly observed.
- B. It is the applicator's responsibility to perform work to the requirements of this Specification, and to conduct inspections and tests necessary to ensure compliance.

**1.4 COATING SYSTEMS**

- A. Coating systems shall be as specified in Drawings.

**PART 2 – PRODUCTS**

**2.1 COATING SYSTEM TOUCH UP**

- A. Provide the same products for touch up as the Coating Systems specified in the Drawings.

**PART 3 – EXECUTION**

**3.1 GENERAL**

- A. Out-dated or coatings exceeding the "pot life" of coatings as specified by the coating manufacturer shall not be used.

### **3.2 SAFETY**

- A. It is the responsibility of the Contractor and any subcontractors to perform all Work in a safe manner. Also, it is the responsibility of the Contractor to assure that all applicable health and safety standards and all local, state, and federal safety regulations are met. The omission in this Specification of any applicable safety regulation does not relieve the Contractor of responsibility to comply.
- B. The Contractor shall keep on hand at the worksite copies of all local, state, and federal safety regulations governing the work procedures and copies of the Safety Data Sheets (SDS) for all chemicals at the work site. The Contractor shall brief all workers at the job site of the location of the regulations and SDS.
- C. Provide safe access to the work areas. The work area shall be kept free of debris.
- D. Any ignition source, such as internal combustion engines, welding operations, smoking areas, shall be kept at a safe distance from surfaces during coating application and curing.
- E. Blast nozzles shall be equipped with a “deadman” type shut-off device. Blasting hoses, spray equipment, air movers, and other type equipment shall be grounded.
- F. Inspect protective clothing and personal protective equipment before use to ensure they are in proper, functioning condition.
- G. It is the Contractor’s responsibility to dispose of all materials, both hazardous and non-hazardous. All unused mixed materials shall be disposed of immediately. All cans containing coating materials or thinners, or that were used for mixing materials, and all rags or other items contaminated with coating materials or thinners shall be disposed of according to applicable safety and waste disposal regulations.
- H. Any proposed deviations from this Specification must be brought to the attention of the Engineer prior to implementation of change.

### **3.3 REPAIR OF DAMAGED COATINGS**

- A. Visually inspect surfaces for any damage to coatings. Repair any damaged areas by grinding down to bare metal, feathering, and roughening the surrounding coating. Allow coating to cure. Measure the DFT and correct as necessary.
- B. The primer coating should be applied to the damaged area with a minimum 6-inch radial overlap to the existing coating.

- C. After the coating has cured and before reaching the recoat window, based on climatic conditions and manufacturer's product literature, apply intermediate coat and top coat as specified 6-inches and 12-inches beyond the repair area respectively.

**END OF SECTION**

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**SECTION 10 14 00**  
**SIGNS**

**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. This section covers the furnishing and installation of signs as shown in the Drawings.
- B. The Contractor shall furnish all signs and fasteners.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 33 00 Submittals.
- B. Section 32 31 13 Chain Link Fences and Gates.

**1.3 REFERENCES**

- A. International Fire Code (IFC), Section 3404.
- B. National Fire Protection Association, No. 704.
- C. State of Alaska, Department of Transportation, "Standard Specification for Highway Construction" and "Standard Drawings Manual".

**1.4 SUBMITTALS**

- A. Submit shop drawings of all signs, including height and width as well as sign thickness. Indicate background color and text color, text information (i.e. height and stroke) proposed for each sign.
- B. Submit manufacturer's data and standard colors for vinyl backgrounds and letters.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Signs shall be constructed of 0.08" minimum aluminum plate with either red reflective or black letters on a white non-reflective background, unless otherwise indicated.

- B. Size signs and lay out letters such that no letters touch or overlap, and all words are clearly readable.
- C. Size letters as indicated on the Contract Drawings and adjust size of sign accordingly, or make sign the dimensions indicated and size text appropriately to fit within the available space.
- D. Provide 3M series 255 High Performance vinyl letters on 3M 3650-10 white vinyl background, or Gerber thermal transfer film printed letters on Gerber High Performance vinyl background as indicated on the Drawings, or as appropriate for the application.

## **2.2 SIGNS**

- A. Provide signs as indicated on the Contract Drawings.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Install in accordance with IFC flammable and combustible liquid signage standards, and NFPA.
- B. Signs shall be conspicuously mounted and easily read.
- C. Where signs are fastened to fences, the fasteners used shall be galvanized steel hog rings or stainless wire ties.

**END OF SECTION**





## SECTION 21 13 29.10

### FIRE SUPPRESSION

#### Notes:

- 1) *All paragraphs below shown in light italic text reference work that was performed as part of the prior module assembly contract and are included here for reference only. ATS Alaska was the subcontractor responsible for installation and certification of the module fire suppression system under the module assembly contract.*
- 2) *All paragraphs below shown in standard text are to be performed under this contract.*

#### *PART 1 – GENERAL*

##### *1.1 SCOPE OF WORK*

- A. *The work involves design, installation, testing, and certification of an automatic fire suppression system for a power generation module. The module will contain three diesel engine generators as indicated.*
- B. *The modules will be completely assembled off-site (shop fabricated), not field constructed in the community of Akhiok. All fire suppression system installation, and the initial testing will occur off site and shall include but not be limited to:*
  1. *Design system in accordance with the latest adopted editions of all applicable codes and standards, manufacturer's requirements, these specifications, and the Drawings.*
  2. *Obtain a State of Alaska, Fire Marshal Plan Review Permit.*
  3. *Furnish and install a complete system.*
  4. *Program fire control panel.*
  5. *Acceptance testing and certification of completed system.*
  6. *Preliminary operation training with Authority staff.*
  7. *Preparation for shipping.*
  8. *Operation and Maintenance Manuals including as-built drawings.*
- C. *Upon acceptance of shop fabrication installation and testing by the Authority, the module will be shipped to Akhiok, Alaska, for permanent installation and commissioning under a separate on-site contract. All final system testing, certification, commissioning, and training will occur on-site in Akhiok.*

**1.2 RELATED SECTIONS**

- A. *Division 1.*
- B. *Division 23.*
- C. *Division 26.*

**1.3 QUALITY ASSURANCE**

- A. *All equipment shall be new and shall be listed for the intended application. The entire system shall be designed and fabricated in accordance with recognized and acceptable engineering and industry practices.*
- B. *Design shall be prepared by a registered mechanical engineer or technician with minimum NICET Level 3 certification. Designer shall have an appropriate State of Alaska design permit.*
- C. *The Contractor shall be authorized by the fire suppression system manufacturer to furnish and install the specified system. Field installation shall be performed by technicians certified by the manufacturer to install the specified system.*

**1.4 REFERENCED STANDARDS:**

- A. *National Fire Protection Association (NFPA) 750: Standard on Water Mist Fire Protection Systems.*
- B. *Underwriters Laboratories (UL) UL 864 Control Units for Fire Protective Signaling Systems*
- C. *National Fire Protection Association (NFPA) NFPA 72 National Fire Alarm Code*
- D. *National Electrical Manufacturer's Association (NEMA).*

**1.5 SUBMITTALS**

- A. *Provide submittals in the manner described herein and in Division 1.*
- B. *Provide submittals for all products and systems described in Division 21 specifications and shown on the Drawings to demonstrate compliance with the requirements of the project. Submittal to include:*
  - 1. *Manufacturer, model numbers and quantity of each device.*
  - 2. *Manufacturer and model of control panel, including installed options.*
  - 3. *Agent piping layout including size and quantity of nozzles.*

4. *Calculations.*
5. *Shop drawings shall indicate compliance with all requirements of the specifications and shall contain at a minimum:*
  - a. *Floor Plans and Isometrics for agent piping.*
  - b. *Floor Plans and Diagrams for Wiring complete with circuit designation in accordance with Wire Schedule on the Drawings (A-B-C-D-E).*
  - c. *Panel and device installation details.*
  - d. *Bill of Materials*
  - e. *Installation notes and system Sequence of Operation.*
- C. *Based upon review comments by the Authority issue final revised submittal including final construction drawings.*
- D. *Submit a copy of State of Alaska, Fire Marshal Plan Review Permit to the Authority.*
- E. *Prior to testing, certification, and training provide Operation and Maintenance Manuals. Manuals to include system description, manufacturer's catalog information, programming, instructions, operations and maintenance literature, Material Safety Data Sheets (MSDS) for extinguishing agent, and as-built drawings of completed system. Deliverables to include one bound copy plus 4 CD's with PDF format electronic files of the entire manual.*

## **1.6 SUBSTITUTIONS**

- A. *All substitutions shall be noted on equipment submittals.*

## **1.7 WARRANTY**

- A. *Division 1 - Closeout Requirements: Warranties.*
- B. *Provide a one-year manufacturer's warranty covering all materials and workmanship of all products supplied. Warranty shall commence from the date of system certification.*

## **PART 2 – MATERIALS**

### **2.1 FIRE SUPPRESSION AGENT**

- A. *A high-pressure water mist fire suppression system shall be furnished, Marioff Hi-Fog or approved equal. In order for a substitution of the suppression system to be approved it must have at a minimum the following salient features:*

1. *The system must use water mist as the sole extinguishing agent.*
2. *The system must use high pressure (2,000 PSI nominal) nitrogen as the sole driving agent without the aid of any pumps.*
3. *The system shall be a single pipe system utilizing stainless steel tubing not exceeding 1" outside diameter.*
4. *The complete agent rack including all water and nitrogen storage for one zone of coverage shall not exceed the following dimensions: 4'-6" Long x 1'-4" Wide x 7'-6" High.*

## **2.2 Agent Rack and Water Tank**

- A. *Wall or floor mounted racks shall be provided that contain the agent cylinders, nitrogen cylinder, and piping. Marioff Hi-Fog MAU 150 FS or approved equal.*
- B. *The racks shall be designed for the appropriate seismic code and shall be adequately anchored to the building structure.*

## **2.3 Fire Control Panel**

- A. *The Fire Control Panel shall be a Fike Cheetah XI-50 10-071-R1 or approved equal, and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with, supervise and control the following types of equipment used to make up the system: intelligent self-calibrating smoke and flame detectors, addressable modules, annunciators, and other system controlled devices.*
- B. *Basic equipment to be included with Fire Control Panel shall be main board with display and keypad, door, hardware, and backbox for panel surface mount installation.*
- C. *System Capacity and General Operation*
  1. *The control panel shall be capable of 50 intelligent/addressable devices.*
  2. *The system shall include two Class B (NFPA Style Y) programmable Notification Appliance Circuits. It shall also include three additional programmable Form-C alarm and trouble relays rated at a minimum of 2.0 amps @ 30 VDC.*
  3. *The system shall support up to 99 programmable EIA-485 driven relays for an overall system capacity of 301 circuits.*
  4. *The Fire Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display,*

*individual, color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the fire system.*

5. *All programming or editing of the existing program in the system shall be achieved without special equipment, and without interrupting the alarm monitoring functions of the Fire Control Panel.*
6. *The Fire Control Panel shall provide the following features:*
  - a. *Automatic detect test and drift compensation to extend detector accuracy over life (smoke and flame detectors monitored and automatically calibrated)*
  - b. *Sensitivity Test, meeting requirements of NFPA 72, Chapter 5.*
  - c. *Maintenance Alert to warn of excessive smoke detector dirt or dust accumulation.*
  - d. *System Status Reports to display.*
  - e. *Positive Alarm Sequence pre-signal, meeting NFPA 72 3-8.3 requirements.*
  - f. *Periodic Detector Test, conducted automatically by software.*
  - g. *Pre-alarm for advanced fire warning.*
  - h. *Cross Zoning with the capability of: counting two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.*
  - i. *Walk Test, with check for two detectors set to same address.*
  - j. *Adjustable delay and discharge timers.*
  - k. *The detector software shall meet NFPA 72, Chapter 7 requirements and be certified by UL as a calibrated sensitivity test instrument.*
  - l. *The detector software shall allow manual or automatic sensitivity adjustment.*
  - m. *Event history file in nonvolatile memory.*
  - n. *Panel to have abort option to manually prevent release of extinguishing agent.*
  - o. *Battery back-up in the event of normal AC power failure.*

- p. *Unit to be able to release extinguishing agent in at least two independent hazard zones.*

#### **2.4 SECONDARY POWER SOURCE BATTERIES**

- A. *Secondary power shall be provided by 12-volt, gelled electrolyte batteries. The batteries shall be completely maintenance free. Fluid level checks and refilling shall not be required.*
- B. *Batteries shall have sufficient capacity to power the fire system for not less than twenty-four hours standby operation plus 30 minutes of alarm upon a normal AC power failure. Note that this is in excess of minimum NFPA requirements.*

#### **2.5 HEAT DETECTOR**

- A. *UL Listed, adjustable temperature heat detector. Fike 60-1039 or approved equal. Set to activate at 135°F for normal temperature and 190°F for high temperature.*

#### **2.6 FLAME (OPTICAL) DETECTOR**

- A. *UL Listed, flame detectors shall be multi-spectrum, electro-optical, automatic calibrating, digital fire detectors. Fire Sentry Corporation Model SS4-A2 or approved equal. Install on SM4 swivel mount.*

#### **2.7 SMOKE (PHOTOELECTRIC) DETECTOR**

- A. *UL Listed, automatic calibrating type, photoelectric smoke detector. Detector to be addressable and provide analog signal to the control panel which may be used for maintenance of detector. Fike 63-1052 or approved equal.*

#### **2.8 ANNUNCIATORS**

- A. *Interior Annunciator (Alarm and Discharge) - UL Listed, Horn/strobe combination, minimum 75 candela. Gentex GEC3-24WR or approved equal.*
- B. *Exterior Annunciator (Alarm) - Weatherproof, UL Listed horn/strobe combination, minimum 75 candela. Gentex WGEC24-75WR or approved equal.*
- C. *Exterior Strobe (Discharge) - Weatherproof, UL Listed strobe, minimum 75 candela. Gentex WGEC24-75WR or approved equal.*

#### **2.9 MANUAL PULL STATION**

- A. *Manual pull station(s) shall be UL Listed, addressable, double action, and provide visible indication that station has been operated. Fike 02-3710 or approved equal.*

**2.10 ABORT STATION**

- A. *UL Listed, mushroom button abort station. Station coloring to be highly visible. Label or provide placard. Fike 10-1639 or approved equal.*

**2.11 DEVICE MONITORING MODULES**

- A. *UL Listed modules designed for use with intelligent and addressable equipment as required. Fike Series 55 or approved equal.*

**2.12 PLACARDS**

- A. *Provide placards in compliance with NFPA as required. Provide additional warning placards as indicated on the plan in accordance with the Placard Schedule.*

**2.13 RACEWAYS AND CONDUCTORS**

- A. *Route all wiring in separate dedicated raceways for all fire suppression system wiring at no cost to Contractor. All raceways shall be electrical metallic tubing (EMT). All raceways, junction boxes, pull boxes, and cover plates shall be painted red.*

- B. *All conductors shall be soft drawn copper, Type XHHW insulation; 600V and 75C rated; gauge and color as indicated by service in accordance with the following schedule:*

*120V AC Power - 12 AWG, stranded, color per station service scheme.*

*24V DC Power, Detection, and Alarm Circuits - 14 AWG, color in accordance with the Wire Schedule.*

**2.14 NOZZLES**

- A. *In Total Flooding and Local Application zones nozzles shall be open spray head type, Marioff 4S IMC 8MB 1100 or approved equal.*

**2.15 PIPING**

- A. *Contractor shall furnish, install, and pressure test agent discharge tubing/piping in accordance with manufacturer's recommendations.*

**2.16 SUPPORT**

- A. *Contractor shall furnish and install industry standard hangers for agent discharge piping, raceways, panel and all devices.*

## **2.17 FITTINGS, VALVES, CONTROLS, AND DEVICES**

- A. *Contractor shall furnish and install all required fittings, valves, control devices, and accessories as required to provide the types of coverage required for each zone as indicated on the Drawings.*

## **PART 3 – EXECUTION**

### **3.1 DESIGN**

- A. *Design fire suppression system with two zones of coverage as shown on the Drawings.*
1. *Zone 1 (Generation Room) shall contain agent rack, discharge piping and nozzles. Two flame detectors shall be cross-zoned so that any one detector will set off alarm and shut-down generators. Any second detector will begin a 30 second countdown to agent release. Two high temperature heat detectors shall be cross-zoned in the same sequence as the flame detectors. Exit shall have a manual “Agent Release” pull station which will begin a 30 second countdown to agent release when activated.*
  2. *Zone 2 (Control Room) shall contain the control panel, one smoke detector and one normal temperature heat detector. Either detector will set off alarm and will shut-down generators. Exit shall have a manual “Agent Release” pull station which will begin a 30 second countdown to agent release when activated. An abort station shall be located near the control panel. In the event of a false alarm, pressing and holding the abort button will stop the 30 second countdown to release, and silence audible alarms. Once released, audible alarms will resume and 30 second countdown will restart. The abort will not function in the event of a Manual Agent Release.*
- B. *Provide annunciators and other devices where specifically indicated on the Drawings.*

### **3.2 INSTALLATION - GENERAL**

- A. *The system shall be installed in accordance with the Contract Documents, the approved submittal, and all manufacturer's requirements.*
- B. *Contractor shall perform all work with skilled craftsmen specializing in said work with all required certifications. Install all materials in a neat, orderly, and secure fashion, as required by these specifications, manufacturer’s requirements, and commonly recognized standards of good workmanship.*



**3.3 INSTALLATION – SHOP MODULE ASSEMBLY**

- A. *Upon completion of shop testing, all water shall be drained and/or blown out of the system to prevent freeze damage and the batteries shall be disconnected.*
- B. *Each system shall be left with one fully charged nitrogen cylinder installed in the rack plus one fully charged spare nitrogen cylinder shipped loose with the module.*

**3.4 INSTALLATION – ON SITE**

- A. The final testing and commissioning will occur on site and will include but not be limited to:
  - 1. Filling and charging systems.
  - 2. Final acceptance testing and certification of completed systems.
  - 3. Minimum four hours operation training on site with local operators and Authority staff.
  - 4. Verify that the system has one fully charged nitrogen cylinder installed in the rack plus one fully charged spare nitrogen cylinder.

**END OF SECTION**

## **SECTION 23 05 00**

### **COMMON WORK RESULTS FOR MECHANICAL**

#### **PART 1 - GENERAL**

##### **1.1 SCOPE OF WORK**

- A. The work to be included in these and all other mechanical subsections shall consist of providing, installing, adjusting and setting into proper operation complete and workable systems for all items shown on the Drawings, described in the specifications or reasonably implied. This shall include the planning and supervision to coordinate the work with other crafts and to maintain a proper time schedule for delivery of materials and installation of the work.
- B. Section includes:
  - 1. General mechanical work.
  - 2. Painting and marking.
  - 3. Valve tags, signs, and placards.
  - 4. Flashing and sealing.

##### **1.2 RELATED SECTIONS**

- A. Division 1
- B. All other Division 23 Specifications
- C. Divisions 21 and 26

##### **1.3 PROJECT RECORD DRAWINGS**

- A. In addition to other requirements of Division 1, mark up a clean set of drawings as the work progresses to show the dimensioned location and routing of all mechanical work which will become permanently concealed. Show routing of work in concealed blind spaces within the building.
- B. Provide one set of drawings clearly marked up with all as-built information to the Authority within two weeks of completion.
- C. At completion of project, deliver these drawings to the Authority and obtain a written receipt.

##### **1.4 SUBMITTALS**

- A. Provide submittals for all products and systems described in Division 23 specifications and shown on the Drawings to demonstrate compliance with the requirements of the project. Provide submittals in the manner described herein and in Division 1.
- B. Painting and Marking: Submit manufacturers catalog literature for each product required.
- C. Valve Tags: Submit manufacturers catalog literature for tags as indicated on the Schedule on Sheet M1.2.

- D. Equipment: Submit manufacturers catalog literature for each item indicated on the Mechanical Schedules on the Drawings. Submit under the Division 23 Sections that follow. See specific requirements under each section.
- E. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents. Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provision of a complete and satisfactory working installation of equal quality to system specified is the sole responsibility of the Contractor.

### **1.5 RECEIVING AND HANDLING**

- A. See general conditions and the general requirements in Division 1 regarding material handling.
- B. Deliver packaged materials to the jobsite in unbroken packaging with manufacturer's label, and store to facilitate inspection and installation sequence.
- C. Protect all materials and equipment during the duration of construction work against contamination and damage. Replace or repair to original manufactured condition any items damaged during construction. Immediately report any items found damaged to the Authority prior to commencing construction.

### **1.6 ENVIRONMENTAL REQUIREMENTS**

- A. Division 1 - Material and Equipment: Storage and protection.

### **1.7 QUALITY ASSURANCE**

- A. Division 1 - Quality Control
- B. Perform all work in accordance with the latest adopted editions of the International Fire Code, the International Building Code, and the International Mechanical Code including State of Alaska amendments. Comply with all applicable State and Federal regulations.
- C. Perform work with skilled craftsman specializing in said work. Install all materials in a neat and orderly, and secure fashion as required by specifications and commonly recognized standards of good workmanship.

### **1.8 SCHEDULE OF WORK**

- A. The work must be expedited and close coordination will be required in executing the work. The various trades shall perform their portion of the work at such times as directed so as to meet scheduled completion dates, and to avoid delaying any other trade.
- B. The Authority will set up completion dates. Each Contractor shall cooperate in establishing these times and locations and shall process his work so as to ensure the proper execution of it.

### **1.9 SUBSTANTIAL COMPLETION**

- A. Contact the Authority a minimum of two weeks' prior to completion of all work to schedule substantial completion inspection. The Authority will generate a punchlist of corrective action items during the inspection. Work will not be considered complete until all corrective action items in the Authority's punch list have been satisfactorily completed and photographic or other positive documentation has been provided to the Authority.

### **1.10 COOPERATION AND CLEANING UP**

- A. The Contractor for the work under each section of the specifications shall coordinate his work with the work described in all other sections of the specifications, and shall carry on his work in such a manner that none of the work under any section of these specifications shall be handicapped, hindered or delayed at any time.
- B. At all times during the progress of the work, the Contractor shall keep the premises clean and free of unnecessary materials and debris. The Contractor shall, on direction at any time from the Authority, clear any designated area or areas of materials and debris. On completion of any portion of the work, the Contractor shall remove from the premises all tools and machinery and all debris occasioned by the work, leaving the premises free of all obstructions and hindrances.

### **1.11 SPECIAL CONDITIONS**

- A. Ensure that the appropriate safety measures are implemented and the all workers are aware of the potential hazards from electrical shock, burn, rotating fans, pulleys, belts, hot manifolds, noise, etc. associated with working near power generation and control equipment.

### **1.12 WARRANTY**

- A. Division 1 - Closeout Requirements: Warranties.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS AND EQUIPMENT**

- A. Provide all equipment and materials required for a complete system.
- B. All equipment and materials supplied under this Contract are new unless specifically indicated as existing. Where additional or replacement items are required, provide like items by the same manufacturer to the maximum extent practical.
- C. Install all material and equipment in accordance with manufacturer's installation instructions and recommendations unless specifically indicated otherwise.

### **2.2 PAINTING**

- A. Carbon Steel Pipe - Paint all exposed carbon steel pipe that is not insulated except for engine exhaust. Wire brush and wipe down with solvent. Prime and finish with two coats of direct to metal alkyd enamel, Sherwin Williams DTM or approved equal, color Structural Gray 4031.

- B. Carbon Steel Supports – Paint all new and modified carbon steel fabrications and supports equivalent to fuel pipe.
- C. Touch-Up of Painted Items – Touch up paint on previously coated items to match original.
- D. Touch-up – finish all cut ends and damaged surfaces of galvanized and zinc plated supports and fasteners with spray on Cold Galvanizing Compound, ZRC or approved equal. Touch up paint on fabricated items to match original.

### **2.3 VALVE TAGS**

- A. Specific Function Valve Tags – For all valves marked with a specific function, provide tags color coded and worded as indicated on the Schedule on Sheet M1.2.
- B. Standard Valve Tags – For all valves not marked with a specific function, provide NO/NC tags as indicated on the schedules.
- C. Install all tags as noted.

### **2.4 PIPE MARKING**

- A. Install flow arrows on heat recovery piping. On insulated piping install flow arrows over jackets. Black or white arrows over colored backgrounds, self-adhesive vinyl, Seton arrows on roll or approved equal. Background color scheme to match the Specific Function Valve Tags.

### **2.5 FLASHING AND SEALING**

- A. Caps & Coverings: Steel, 16 gauge minimum.
- B. For penetration of all interior wall penetrations seal with polyurethane caulking.
- C. For penetration of all exterior walls install flashing as indicated on Drawings. Best Materials Multi-Flash Master Flash or approved equal, Black EPDM. Note that the retrofit style may be used for convenience.

## **PART 3 - EXECUTION**

### **3.1 DRAWINGS**

- A. The mechanical Drawings are generally diagrammatic and do not necessarily show all features of the required work. Provide all equipment and materials required for a complete system. Complete details of the building which affect the mechanical installation may not be shown. For additional details, see other Drawings which may include electrical, architectural, structural, and civil. Coordinate work under this section with that of all related trades.
- B. Contractor to field verify all dimensions and conditions prior to start of construction. Immediately contact the Authority for clarification of questionable items or apparent conflicts.

### **3.2 CUTTING, FITTING, REPAIRING, PATCHING, AND FINISHING**

- A. Where previously completed building surfaces or other features must be cut, penetrated, or otherwise altered, such work shall be carefully laid out and patched to the original condition. Perform work only with craftsmen skilled in their respective trades.
- B. Do not cut, drill, or notch structural members unless specifically approved by the Authority. Minimize penetrations and disruption of building features.
- C. Seal all exterior ceiling and wall penetrations as indicated. Where exterior wall penetrations are accessible from the inside seal both interior and exterior surfaces as indicated.

### **3.3 EXAMINATION**

- A. Check materials for damage that may have occurred during shipment. Repair damaged materials as required or replace with new materials.

### **3.4 INSTALLATION OF EQUIPMENT**

- A. Check materials for damage that may have occurred during shipment. Repair damaged materials as required or replace with new materials
- B. Unless otherwise indicated, support all equipment and install in accordance with manufacturer's recommendations and approved submittals.
- C. Maintain manufacturer's recommended minimum clearances for access and maintenance.
- D. Where equipment is to be anchored to structure, furnish and locate necessary anchoring and vibration isolation devices.
- E. Furnish all structural steel, such as angles, channels, beams, etc. required to support all piping, ductwork, equipment and accessories installed under this Division. Use structural supports suitable for equipment specified or as indicated. In all cases, support design will be based upon data contained in manufacturer's catalog.
- F. Openings: Arrange for necessary openings in buildings to allow for admittance and reasonable maintenance or replacement of all apparatus furnished.

**END OF SECTION**

## **SECTION 23 05 29**

### **HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes:
  - 1. Pipe hangers and supports.
  - 2. Hanger rods.
  - 3. Formed steel channel.

##### **1.2 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Requirements for Mechanical
- B. Section 23 21 13 - Hydronic Piping
- C. Section 23 11 13 - Fuel and Lube Oil Piping
- D. Section 23 35 16.10 - Engine Exhaust and Crank Vent Piping
- E. Section 26 05 29 - Hangers and Supports for Electrical Systems

##### **1.3 REFERENCES**

- A. American Society of Mechanical Engineers:
  - 1. ASME B31.1 - Power Piping.
  - 2. ASME B31.9 - Building Services Piping.
- B. ASTM International:
  - 1. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
- C. American Welding Society:
  - 1. AWS D1.1 - Structural Welding Code - Steel.
- D. Manufacturers Standardization Society of the Valve and Fittings Industry:
  - 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
  - 2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
  - 3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

##### **1.4 SUBMITTALS**

- A. Provide submittals for all products and systems described herein. Provide in accordance with the requirements of Section 23 05 00 - Common Work Results for Mechanical and Division 1.
- B. Product Data: Hangers and Supports: Submit manufacturers catalog data including load capacity. Indicate finish for interior and exterior applications.

### **1.5 QUALITY ASSURANCE**

- A. Division 1 – Quality Control
- B. Conform to applicable code for support of coolant and hydronic piping.
- C. Perform Work in accordance with State of Alaska Standards.

### **1.6 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section.

### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

### **1.8 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

## **PART 2 - PRODUCTS**

### **2.1 STRUCTURAL STEEL**

- A. Miscellaneous shapes and plate: ASTM A-36.
- B. Rectangular tubing: ASTM A-500 Grade B.
- C. Structural Pipe: ASTM A-53 or ASTM A-106B.
- D. Paint as indicated.

### **2.2 PIPE HANGERS AND SUPPORTS**

- A. Support equipment and raceways on strut, brackets, trapeze hangers, or as detailed. Anvil, B-Line, Grinnell, Unistrut, or approved equal.

### **2.3 FORMED STEEL CHANNEL**

- A. Strut: Cold formed mild steel channel strut, pre-galvanized finish and slotted back unless specifically indicated otherwise.
- B. Standard Strut: 12 gauge thick steel, 1-5/8" x 1-5/8", B-line B22-SH-Galv or equal.
- C. Double Strut: 12 gauge thick steel, 1-5/8" x 3-1/4", B-line B22A-SH-Galv or equal.
- D. Shallow Strut: 14 gauge thick steel, 1-5/8" x 13/16", B-line B54-SH-Galv or equal.
- E. On all exterior installations provide hot dip galvanized strut and fittings.



## **2.4 FITTINGS AND ACCESSORIES**

- A. Provide fittings, brackets, channel nuts, and accessories designed specifically for use with specified channel strut. Zinc plated carbon steel except for exterior installations provide hot dip galvanized.
- B. Pipe Clamps: Two piece pipe clamp designed to support pipe tight to strut, B-line B20##, or approved equal, as indicated on the Pipe/Tubing Strut Clamp Schedule on Sheet M1.1. Zinc plated carbon steel except for exterior installations provide hot dip galvanized.
- C. Pipe Straps: Two-hole steel pipe strap. Zinc plated carbon steel except for exterior installations provide hot dip galvanized.

## **2.5 FASTENERS**

- A. All interior bolts, nuts, and washers to be zinc plated carbon steel or galvanized.
- B. All exterior bolts, nuts, and washers to be hot dip galvanized.
- C. On exhaust piping flanges provide plain carbon steel (black) or stainless steel bolts, nuts, and washers. Coat with high temperature anti-seize prior to assembly.
- D. Hanger Rods: Continuous threaded rod. Zinc plated carbon steel except for exterior installations provide hot dip galvanized.

## **2.6 EARTHQUAKE ANCHORAGE**

- A. Anchor equipment weighing more than 100 pounds to the building structure to resist lateral earthquake forces.
- B. Total lateral (earthquake) force shall be 1.00 times the equipment weight acting laterally in any direction through the equipment center of gravity. Provide adequate backing at structural attachment points to accept the forces involved.
- C. Provide equipment supported by flexible isolation mounts with earthquake restraining supports positioned as close to equipment as possible without contact in normal operation (earthquake bumpers). The maximum lateral displacement due to the computed earthquake force from above shall not exceed 1.5 inches.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Check materials for damage that may have occurred during shipment. Repair damaged materials as required or replace with new materials.

### **3.2 PREPARATION**

- A. Obtain permission from the Authority before drilling or cutting structural members.

### **3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS**

- A. Support piping and equipment as shown on Drawings using specified supports and fasteners. If not detailed on Drawings, support from structural members with pipe hangers, clamps or pipe straps specifically intended for the application.

- B. Independently support pumps and equipment. Supporting piping from connections to equipment shall not be permitted.
- C. Support horizontal piping as scheduled.
- D. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- E. Place hangers within 12 inches of each horizontal elbow or as indicated.
- F. Use hangers with 1-1/2 inch minimum vertical adjustment.
- G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Design hangers for pipe movement without disengagement of supported pipe.
- J. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 23 07 19.
- K. For specific piping and equipment support details reference Drawings.

**3.4 SCHEDULES**

- A. Copper Tube and Steel Pipe Hanger Spacing:

PIPE SIZE Inches	Copper Tube Maximum Hanger Spacing (Ft)	Steel Pipe Maximum Hanger Spacing (Ft)	Copper Tube Hanger Rod Diameter (In)	Steel Pipe Hanger Rod Diameter (In)
1/2 & 3/4	5	7	3/8	3/8
1 & 1-1/4"	6	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
3	10	10	1/2	1/2
4	12	10	1/2	5/8

**END OF SECTION**

**SECTION 23 07 19**  
**PIPING INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes:
  - 1. Piping insulation, jackets and accessories.
  - 2. Exhaust piping insulation, jackets and accessories.

**1.2 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Requirements for Mechanical.
- B. Section 23 05 29 - Hangers and Supports for Piping and Equipment.
- C. Section 23 21 13 – Hydronic Piping.
- D. Section 23 35 16.10 - Engine Exhaust and Crank Vent Piping.

**1.3 REFERENCES**

- A. ASTM International:
  - 1. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 2. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
  - 3. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
  - 4. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
  - 5. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

**1.4 SUBMITTALS**

- A. Provide submittals for all products and systems described herein. Provide in accordance with the requirements of Section 23 05 00 - Common Work Results for Mechanical and Division 1.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

**1.5 QUALITY ASSURANCE**

- A. Division 1 – Quality Control

- B. Pipe insulation maximum flame spread index of 25 and maximum smoke developed index of 50 in accordance with ASTM E84.
- C. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- D. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

## **1.6 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this section.
- B. Applicator: Company specializing in performing work specified in this section.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

## **1.8 ENVIRONMENTAL REQUIREMENTS**

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

## **1.9 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

## **PART 2 - PRODUCTS**

### **2.1 COOLANT/HEAT RECOVERY PIPE INSULATION**

- A. TYPE P-1: ASTM C547, 1” preformed rigid fiberglass pipe insulation. Thermal Conductivity: 0.23 at 75 degrees F. Operating Temperature Range: 0 to 850 degrees F. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints. Jacket Temperature Limit: minus 20 to 150 degrees F. Johns-Manville “Micro-Lok” or approved equal.

### **2.2 PIPE INSULATION JACKETS**

- A. Pipe Jacket: Seal all joints with tape made specifically for the insulation jacket.
- B. Fittings: Pre-formed PVC covers.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Check materials for damage that may have occurred during shipment. Repair damaged materials as required or replace with new materials.
- B. Verify piping has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

**3.2 INSTALLATION – HEAT RECOVERY PIPING**

A. Install insulation in accordance with manufacturer’s installation instructions.

B. Install insulation where indicated on Drawings.

**3.3 INSTALLATION – EXHAUST PIPING**

A. Re-install exhaust pipe and wall penetration insulation that was furnished with the module.

**END OF SECTION**

**SECTION 23 09 00**  
**INSTRUMENTATION AND CONTROL DEVICES**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section includes:
  - 1. Instrumentation Equipment
  - 2. Pressure gauges.
  - 3. Thermometers.

**1.2 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Requirements for Mechanical.
- B. Section 23 21 16 - Hydronic Equipment and Specialties.
- C. Division 26 - Electrical

**1.3 REFERENCES**

- A. American Society of Mechanical Engineers:
  - 1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
- B. ASTM International:
  - 1. ASTM E1 - Standard Specification for ASTM Thermometers.
  - 2. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

**1.4 SUBMITTALS**

- A. Provide submittals for all products and systems described herein. Provide in accordance with the requirements of Section 23 05 00 - Common Work Results for Mechanical and Division 1.
- B. Note that related Electrical Instrumentation devices are specified under Division 26 and are not included in this section.

**1.5 CLOSEOUT**

- A. Division 1 - Closeout Requirements
- B. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors.

**1.6 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this section.
- B. Installer: Company specializing in performing Work of this section.

### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Accept controls on site in original factory packaging. Inspect for damage.

### **1.8 COORDINATION**

- A. Coordinate installation of control components in work of Division 26.

## **PART 2 PRODUCTS**

### **2.1 PRESSURE GAUGES**

- A. Dry type stainless steel case, tube, and socket, 1/4" NPT bottom connection, 2-1/2" dial size. Range as indicated on Drawings.
- B. Range 0-15 psi: Trerice Model 700SS-25-02-L-A-080 or approved equal.
- C. Range 0-100 psi: Trerice Model 700SS-25-02-L-A-110 or approved equal.

### **2.2 THERMOMETERS**

- A. Digital thermometer, solar powered, LCD display, -50 to +300 F range or dual F/C range, 1% of reading accuracy, variable angle display, 3-1/2" stem length.
- B. Weiss DVU35 or approved equal.
- C. Provide all thermometers with a 3/4" NPT brass thermowell.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Check equipment for damage that may have occurred during shipment. Repair damaged equipment as required or replace with new equipment.
- B. Verify location of thermostats and other exposed control sensors with Drawings before installation.
- C. Verify building systems to be controlled are ready to operate.

### **3.2 INSTALLATION**

- A. Install instrumentation where indicated on the Drawings in accordance with manufacturer's installation instructions.
- B. Install gauges and thermometers in locations where they are clear of valve handles or other obstructions and where they can be easily read from normal operating level. Install vertical to 45 degrees off vertical.
- C. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate.
- D. Isolate hydronic pressure gauges during pressure testing.
- E. Install conduit and electrical wiring in accordance with Division 26.
- F. After completion of installation, test and calibrate all instrumentation.

**END OF SECTION**

**SECTION 23 11 13**  
**FUEL AND LUBE OIL PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Scope: This section applies to all diesel fuel and lube oil (oil) piping systems.
- B. Section includes:
  - 1. Fuel oil piping.
  - 2. Fittings and Valves.

**1.2 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Requirements for Mechanical.
- B. Section 23 05 29 - Hangers and Supports for Piping and Equipment.
- C. Section 23 12 13 - Fuel and Lube Oil Equipment and Specialties.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Minimum Working-Pressure Rating: Unless otherwise indicated, minimum pressure requirement for fuel and lube oil piping is 150 psig.

**1.4 REFERENCES**

- A. American Society of Mechanical Engineers:
  - 1. ASME B31.1 - Power Piping.
  - 2. ASME B31.9 - Building Services Piping.
  - 3. ASME B16.5 Flanges and Flanged Fittings
  - 4. ASME B16.9 Factory-Made Wrought Steel Butt welding Fittings
  - 5. ASME B16.11 Forged Fittings, Socket-Welding and Threaded
  - 6. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
- B. ASTM International:
  - 1. ASTM A106B – Standard Specification for Seamless Carbon Steel Pipe for High Temperature Services.
  - 2. ASME B16.11 Forged Fittings, Socket-Welding and Threaded
- C. Underwriters Laboratories Inc.: UL 142 – Steel Aboveground Tanks for Flammable and Combustible Liquids.

**1.5 SYSTEM DESCRIPTION**

- A. Provide piping of material as specified in PART 2.



- B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded connections to valves, equipment.
- C. Provide pipe hangers and supports per Drawings and specifications.

### **1.6 SUBMITTALS**

- A. Provide submittals for all products and systems described herein. Provide in accordance with the requirements of Section 23 05 00 - Common Work Results for Mechanical and Division 1.
- B. Product Data:
  - 1. Piping: Submit manufacturers catalog information for pipe materials, fittings, and accessories.
  - 2. Valves: Submit manufacturer's catalog information with data and ratings for each service.
- C. Welders' Certificate: Include welders' certification of compliance in accordance with Quality Assurance below.

### **1.7 CLOSEOUT**

- A. Division 1 - Closeout Requirements.

### **1.8 QUALITY ASSURANCE**

- A. Division 1 – Quality Control.
- B. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- C. Perform pipe welding with experienced welder with current API or equivalent certification for pipe welding in all positions.

### **1.9 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this section.
- B. Installer: Company specializing in performing Work of this section with current certification.

### **1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation.

### **1.11 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Materials shall be new unless otherwise specified. All items of the same type shall be of the same manufacturer.
- B. Oil pipe shall have welded joints except for threaded connections to equipment and valves as required and shown. Provide flanged joints where indicated on Drawings to allow removal of individual components.
- C. Provide butt weld joints for all pipe 1-1/2 inches in diameter and larger and on smaller pipe where specifically indicated on Drawings. Provide socket weld or threaded joints for all piping smaller than 1-1/2 inches in diameter unless indicated otherwise.
- D. Vent piping shall be galvanized with threaded joints.

### **2.2 PIPE**

- A. Oil Pipe (DFS, DFR): ASTM A106B seamless black steel pipe, Schedule 80.
- B. Vent Pipe: ASTM A53B ERW welded galvanized steel pipe, Schedule 40.

### **2.3 PIPE FITTINGS**

- A. Fittings: ASTM A234 seamless carbon steel butt weld fittings for all pipe 1-1/2 inches in diameter and larger and on smaller pipe where specifically indicated on Drawings. Provide socket weld or threaded joints for all piping smaller than 1-1/2 inches in diameter using ASTM 105, forged steel fittings, minimum 3000 lb.
- B. Flanges: ASTM A105 forged steel, ANSI 150# raised face unless indicated otherwise. Butt or socket weld as indicated.
- C. Flange Gaskets: Spiral wound metallic gaskets, Flexitallic or approved equal. Coat with anti-seize prior to assembly.
- D. Flange Bolts: On all exterior piping provide stainless steel bolts, nuts, and washers. Coat with anti-seize prior to assembly.
- E. Vent pipe shall have threaded joints with minimum 300# galvanized threaded fittings.

### **2.4 BALL VALVES**

- A. Flanged Ball Valves: Reduced port, carbon steel uni-body, ANSI 150# raised face flanged ends, stainless steel ball and trim, TFM seat and PTFE seals for NACE MR0175 service, lockable handle, 150 psig minimum working pressure. PBV C-5410-31-2236-FTNL or approved equal. Note that for a substitute valve to be approved it must be a domestic manufactured high quality industrial valve such as Apollo or Nibco.
- B. Threaded Ball Valves: Carbon steel body, threaded ends, stainless steel ball and trim, PTFE seat and Graphite/PTFE seals for NACE MR0175 service, lockable handle, 150 PSIG minimum working pressure. PBV C-5312-38-2236-TL-NC, PBV C-5322-38-2236-TL-NC or approved equal. Note that for a substitute valve to be approved it must be a domestic manufactured high quality industrial valve such as Apollo or Nibco.

## **2.5 CHECK VALVES**

- A. Threaded Check Valves: Brass or bronze body, threaded ends, swing check style, 150 psig minimum working pressure. Domestic only. Hammond, Milwaukee, Nibco, or approved equal.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Check materials for damage that may have occurred during shipment. Repair damaged materials as required or replace with new materials.

### **3.2 PREPARATION**

- A. Ream threaded pipe ends and remove burrs. Remove scale and dirt, on inside and outside, before assembly.
- B. Thoroughly coat male pipe ends with Teflon tape and Teflon pipe joint compound prior to assembling.
- C. Coat flange gaskets and bolts with anti-seize compound prior to assembling joints.

### **3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS**

- A. Install pipe hangers and supports in accordance with Drawings and Section 23 05 29.

### **3.4 INSTALLATION - PIPING**

- A. Route piping in orderly manner and maintain gradient.
- B. Install piping to conserve building space and not interfere with use of space. Group piping whenever practical at common elevations.
- C. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Install valves with stems upright or horizontal, not inverted. Provide access where valves are not exposed.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- F. Prepare and paint pipe, fittings, supports, and accessories not pre-finished in accordance with Section 23 05 00.
- G. Install identification on piping systems in accordance with Section 23 05 00.

### **3.5 FUEL OIL PIPING TESTING AND REPORTING**

- A. Division 1 – Quality Control
- B. Test all oil piping with minimum 125 psig air. Test 100% of welds visually for leaks with each joint soaked in a foaming soapy water solution, and visually inspect each joint for leaks. Isolate and pressure test each run of piping for a minimum of one hour. Provide blind flanges, threaded caps or plugs at each end of the test section as needed. Do not conceal pipe joints before pressure testing is complete. Isolate equipment and components rated for lesser pressures so as not to damage these items.

- C. Pressure test piping system again after all equipment is installed at 50 psi for a minimum of one hour, or the maximum rated pressure of the weakest component, whichever is less.
- D. Submit written procedures for testing, including test pressures, equipment to be used and items to be tested.
- E. Notify the Authority in writing seven (7) days in advance of pressure tests. The Authority shall be present at all testing. Pressure testing performed without the Authority present will be rejected, unless prior written approval is received from the Authority.
- F. Cut out or disassemble all leaking joints. Repair and re-test until system proves leak-free. Retesting after the repair of defects shall be performed at no cost to the Authority.
- G. Submit certified test results to the Authority for approval. Test certification shall include gauge pressure, air temperature, time, date, witness, and item or system identification.

### **3.6 SYSTEM STARTUP**

- A. Prime equipment and piping prior to testing and verify operation as indicated in 23 12 13.

**END OF SECTION**

## **SECTION 23 12 13**

### **FUEL AND LUBE OIL EQUIPMENT AND SPECIALTIES**

#### **PART 1 – GENERAL**

##### **1.1 SUMMARY**

- A. Scope: This section applies to all fuel and lube oil (oil) piping systems.
- B. Section Includes:
  - 1. Fuel Oil System Equipment.

##### **1.2 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Requirements for Mechanical.
- B. Section 23 05 29 - Hangers and Supports for Piping and Equipment.
- C. Section 23 11 13 - Fuel and Lube Oil Piping
- D. Division 26 - Electrical

##### **1.3 SUBMITTALS**

- A. Provide submittals for all products and systems described herein. Provide in accordance with the requirements of Section 23 05 00 - Common Work Results for Mechanical and Division 1.
- B. Product Data: Submit manufacturers catalog literature for each item indicated on the Fuel System Equipment Schedule on Sheet M1.4.

##### **1.4 CLOSEOUT**

- A. Division 1 - Closeout Requirements.

#### **PART 2 – PRODUCTS**

##### **2.1 DIESEL FUEL SYSTEM EQUIPMENT**

- A. Provide actuated ball valve as indicated on the Fuel System Equipment Schedules on Sheet M1.4.

#### **PART 3 – EXECUTION**

##### **3.1 EXAMINATION**

- A. Check equipment for damage that may have occurred during shipment. Repair damaged equipment as required or replace with new equipment.

##### **3.2 PREPARATION**

- A. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.

##### **3.3 INSTALLATION**

- A. Install equipment in accordance with Drawings and manufacturer's installation instructions.
- C. Electrical installation shall be in accordance with Division 26 Specifications.

### **3.4 SYSTEM STARTUP**

- A. Prior to starting fuel and oil pumps, prime cavities with lube oil then energize momentarily to verify proper rotation.
- B. Fuel Piping: Prime all piping, fill filters with diesel fuel, and bleed off air prior to starting pumps.
- C. Verify operation of all day tank and blender controls including timers and level alarms.

**END OF SECTION**

**SECTION 23 21 13**  
**HYDRONIC PIPING**

**Notes:**

- 1) All paragraphs below shown in light italic text reference work that was performed as part of the prior module assembly contract and are included here for reference only.*
- 2) All paragraphs below shown in standard text are to be performed under this contract.*

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Scope: This section applies to all hydronic (glycol) piping systems.
- B. Section includes:
  1. Coolant (engine cooling) piping.
  2. Heat recovery piping.
  3. Unions and flanges.
  4. Valves and strainers.
  5. Engine coolant (ethylene glycol).
  6. Heat recovery fluid (propylene glycol).

**1.2 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Requirements for Mechanical.
- B. Section 23 05 29 - Hangers and Supports for Piping and Equipment.
- C. Section 23 07 19 - Piping Insulation
- D. Section 23 21 16 - Hydronic Specialties.
- E. Section 33 61 14 PEX Hydronic Energy Distribution.
- F. Section 33 61 24 Steel Hydronic Energy Distribution.

**1.3 REFERENCES**

- A. American Society of Mechanical Engineers:
  1. ASME B16.3 - Malleable Iron Threaded Fittings.
  2. ASME B16.4 - Gray Iron Threaded Fittings.
  3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
  4. ASME B31.1 - Power Piping.
  5. ASME B31.9 - Building Services Piping.

6. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
- B. ASTM International:
  1. ASTM A53B - Standard Specification for Pipe, Steel, Black and Hot-Dipped.
  2. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
- C. American Welding Society:
  1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
  2. AWS D1.1 - Structural Welding Code - Steel.
- D. Manufacturers Standardization Society of the Valve and Fittings Industry:
  1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
  2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

#### **1.4 SYSTEM DESCRIPTION**

- A. Where more than one piping system material is specified, provide compatible system components and joints.
- B. Provide flanges, unions, and couplings at locations requiring servicing. Use unions, flanges, and couplings downstream of valves and at equipment connections.
- C. Provide pipe hangers and supports in accordance with Drawings and specifications.
- D. Use ball valves or butterfly valves for shut-off and to isolate equipment where indicated.
- E. Use gauge cock isolation valves to isolate instrumentation and small devices where indicated.
- F. Use hose end drain valves with cap for drains where indicated.

#### **1.5 SUBMITTALS**

- A. Provide submittals for all products and systems described herein. Provide in accordance with the requirements of Section 23 05 00 - Common Work Results for Mechanical and Division 1.
- B. Product Data:
  1. Piping: Submit manufacturers catalog information for pipe materials, fittings, and accessories.
  2. Valves and strainers: Submit manufacturer's catalog information with data and ratings for each service.

#### **1.6 CLOSEOUT**

- A. Division 1 - Closeout Requirements

#### **1.7 QUALITY ASSURANCE**

- A. Division 1 – Quality Control



- B. Perform Work in accordance with ASME B31.1 and ASME B31.9 code for installation of piping systems.
- C. Perform pipe welding with experienced welder with current API or equivalent certification for pipe welding in all positions.

### **1.8 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this section.
- B. Fabricator or Installer: Company specializing in performing Work of this section with current certification.

### **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

### **1.10 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

## **PART 2 - PRODUCTS**

### **2.1 PIPING**

- A. Provide copper tube mains and branch piping as indicated on Drawings.
  - 1. Copper Tubing: ASTM B88, Type L drawn.
  - 2. Fittings: ASME B16.22 solder wrought copper.
  - 3. Joints: soldered with 95-5 tin-antimony solder or silver solder except on tee drill connections use copper brazing rod.

### **2.2 UNIONS AND FLANGES**

- A. Unions:
  - 1. Copper Piping: Bronze unions with solder ends except where specifically indicated as fitting unions provide solder by NPT bronze unions.
- B. Flanges:
  - 1. Copper Piping: Provide ANSI 150# companion flanges for transition to steel piping or flanged valves and equipment. Flanges to be two-piece with powder coated steel flange and solder copper tube adapter, Nibco 672 or approved equal.
  - 2. Flange Gaskets: Spiral wound metallic gaskets, Flexitallic or approved equal. Coat with anti-seize compound.

3. Flange Bolts: On all exterior piping provide stainless steel bolts, nuts, and washers. On all interior piping bolts may be black or stainless steel. Coat with anti-seize prior to assembly.

### **2.3 BUTTERFLY VALVES**

- A. Lug style ductile or cast iron body, ANSI 150# flange pattern ends, stainless steel stem with bronze bushing, bronze or nylon coated ductile iron disc, EPDM seats, locking handle. Milwaukee ML-233E, Bray Series 31, or approved equal.

### **2.4 BALL VALVES**

- A. Threaded or soldered end as indicated and required, bronze body, chrome plated bronze or brass ball, full port, TFE or Viton packing and seat ring, minimum 200 psig WOG rating. Domestic only. Apollo, Hammond, Milwaukee, Nibco, or approved equal.

### **2.5 CHECK VALVES**

- A. Threaded or soldered end as indicated and required, bronze body, swing check style, minimum 200 psig WOG rating. Domestic only. Hammond, Milwaukee, Nibco, or approved equal.

### **2.6 DRAIN VALVES**

- A. Bronze body, 1/2" or 3/4" size and solder cup or MPT connection to match associated pipe connection, 3/4" male hose end with cap and jack chain. FNW 426D, 426F, 427D, or 427F or approved equal.

### **2.7 GAUGE COCK ISOLATION VALVE**

- A. Brass body, MPT by FPT ends, T-handle, Legend Valve item 101-531 (1/4") or Item 101-532 (3/8"), or approved equal.
- B. Install on all pressure gauges, small hose connections, and where indicated on Drawings.

### **2.8 STRAINERS**

- A. Type Y pattern, bronze body, solder ends, gasketed cap, 20 mesh stainless steel screen. 200 psig minimum working pressure, Mueller No. 358S or approved equal.

### **2.9 ENGINE COOLANT (ETHYLENE GLYCOL)**

*(Note: Glycol under this paragraph, including spare, was furnished as part of the module assembly contract and is included here for reference.)*

- A. *Glycol Solution for Engine Cooling Service: The glycol shall be extended life (heavy duty) ethylene glycol, Shell Rotella ELC, or approved equal. Note that standard life coolant will not be accepted.*
- B. *The solution shall be premixed to a ratio of 50% ethylene glycol to 50% water. The water shall be treated in accordance with glycol manufacturer's recommendations. The mixed solution shall be dyed bright pink, no exceptions.*
- C. *The solution shall be packaged in sealed 55-gallon drums and labeled "Ethylene Glycol" with pink lettering.*

## **2.10 HEAT RECOVERY FLUID (PROPYLENE GLYCOL)**

- A. Glycol Solution for Heat Recovery Service: The glycol shall be extended life (heavy duty) propylene glycol, Safe-T-Therm HD, Dowfrost HD, or approved equal. Note that standard life propylene glycol will not be accepted.
- B. The solution shall be premixed to a ratio of 50% propylene glycol to 50% water. The water shall be treated in accordance with glycol manufacturer's recommendations. The mixed solution shall be dyed bright orange, no exceptions.
- C. The solution shall be packaged in sealed 55-gallon drums and labeled "Propylene Glycol" with orange lettering.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Check materials for damage that may have occurred during shipment. Repair damaged materials as required or replace with new materials.

### **3.2 PREPARATION**

- A. Ream pipe ends and remove burrs. Remove scale and dirt, on inside and outside, before assembly.
- B. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- C. On copper tube and solder fittings mechanically clean to bright metal and flux prior to assembling.
- D. On threaded pipe and fittings thoroughly coat male threads with Teflon tape and Teflon based pipe joint compound prior to assembling.
- E. Coat flange gaskets and bolts with anti-seize compound prior to assembling joints.

### **3.3 INSTALLATION - PIPE HANGERS AND SUPPORTS**

- A. Install pipe hangers and supports in accordance with Section 23 05 29.

### **3.4 INSTALLATION - PIPING SYSTEMS**

- A. Route piping in orderly manner and slope to drain at low points and vent at high points.
- B. Install piping to conserve building space and not interfere with use of space. Group piping whenever practical at common elevations.
- C. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Install valves with stems upright or horizontal, not inverted. Provide access where valves are not exposed.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

- F. Insulate piping in accordance with Section 23 07 19.
- G. Install identification on piping systems in accordance with Section 23 05 00.

### **3.5 HYDRONIC PIPING SYSTEM TESTING AND REPORTING**

- A. Division 1 – Quality Control.
- B. Hydrostatically test all cooling and heat recovery piping as indicated.
- C. Submit written procedures for testing, including test pressures, equipment to be used and items to be tested.
- D. Notify the Authority in writing seven (7) days in advance of pressure tests. The Authority shall be present at all testing. Pressure testing performed without the Authority present will be rejected, unless prior written approval is received from the Authority.
- E. Cut out or disassemble all leaking joints. Repair and re-test until system proves leak-free. Retesting after the repair of defects shall be performed at no cost to the Authority.
- F. Submit certified test results to the Authority for approval. Test certification shall include gauge pressure, air temperature, time, date, witness, and item or system identification.

### **3.6 COOLING SYSTEM SHOP TESTING AND FLUSHING**

*(Note: Work under this paragraph was performed as part of the module assembly contract and is included here for reference.)*

- A. *Install conical “witch hat” strainers on inlets to radiators. Orient “witch hat” to collect debris inside cone.*
- B. *Fill the entire system with potable water and hydrostatically test all piping at 100 psig minimum for one hour with no noticeable water leaks or pressure drops except as caused by temperature change. Isolate engines and radiators prior to pressure testing.*
- C. *Flush the entire system with potable water. Run engines briefly with limited load as required to obtain circulation through the entire system. To ensure engines are not damaged, do not run under high load or for extended periods of time with potable water.*
- D. *Drain system completely. Remove “witch hat” strainers.*

### **3.7 COOLING SYSTEM SHOP FILLING AND CHARGING**

*(Note: Work under this paragraph was performed as part of the module assembly contract and is included here for reference.)*

- A. *After pressure testing and flushing, fill entire system with ethylene glycol solution. Perform all functional testing of the module required by the Contract Documents. Ensure that engines are operated long enough with adequate load to get thermostats fully open and to circulate glycol through all piping and accessories.*
- B. *Operate control room heating system to ensure it is fully charged with glycol.*
- C. *Verify proper function of all instrumentation and calibrate all devices.*
- D. *All excess glycol solution shall be left with the modules in the original*

*drums and sealed for shipping with the module.*

### **3.8 HEAT RECOVERY SYSTEM SHOP TESTING AND FLUSHING**

*(Note: Work under this paragraph was performed as part of the module assembly contract and is included here for reference.)*

- A. *Install temporary pipe or hose jumper between flanges where module heat recovery pipe terminates.*
- B. *Hydrostatically test all piping at 100 psig minimum for one hour with no noticeable water leaks or pressure drops except as caused by temperature change.*
- C. *Fill the entire system with potable water and flush thoroughly. Run pumps as required to obtain circulation through the entire system.*
- D. *Operate heat recovery system with engines under load and engine cooling system up to normal temperature. Verify proper function of all instrumentation and calibrate all devices.*
- E. *Upon completion of testing allow system to cool down to ambient temperature. Drain system completely. Blow out with air as required to ensure freeze protection.*

### **3.9 COOLING SYSTEM ON SITE FILLING AND TESTING**

- A. Upon completion of on-site radiator piping installation, add Owner furnished ethylene glycol solution to the cooling system as required to top off and bring the level in the expansion tank to approximately 50%.
- B. Isolate engines and radiators prior to pressure testing and hydrostatically test coolant piping mains at 100 psig minimum for one hour with no noticeable water leaks or pressure drops except as caused by temperature change.
- C. After pressure testing, perform all functional testing of the module required by the Contract Documents. Ensure that engines are operated long enough with adequate load to get thermostats fully open and to circulate glycol through all piping and accessories.
- D. Operate control room heating system to ensure it is fully charged with glycol.
- E. Verify proper function of all instrumentation and calibrate all devices.
- F. Transfer excess ethylene glycol solution into glycol storage tank until 95% full. Store any excess ethylene glycol solution with the modules in the original drums sealed for long-term storage.

### **3.10 HEAT RECOVERY SYSTEM ON SITE FILLING AND TESTING**

- A. Upon completion of arctic pipe installation and prior to insulating and covering joints, pressure test all PEX crimp joints and steel weld joints. Pressurize arctic pipe with minimum 20 psig air, soak each joint with a foaming soapy water solution, and visually inspect each joint for leaks.
- B. After testing arctic pipe, isolate arctic pipe from piping in the end user buildings. Fill

above grade piping and equipment in the end user buildings with potable water and hydrostatically test all piping at 100 psig minimum for one hour with no noticeable water leaks or pressure drops except as caused by temperature change.

- C. Flush above grade piping and equipment in the end user buildings system with potable water and drain or blow out with air to remove all water.
- D. After pressure testing and flushing, bleed air reservoir on the expansion tank in the module as required to maintain 10 psig residual with the system empty. Fill the entire heat recovery system including module piping, arctic pipe, and end user building piping with propylene glycol solution to 20 psig minimum with system cold. Vent air from all high point vents prior to starting circulating pumps.
- E. Cycle pumps on and off and vent high points until all air has been purged from the piping. Add propylene glycol solution as required to maintain 20 psig minimum with system cold. When the system comes up to normal temperature (170°F minimum) add propylene glycol solution as required to bring system pressure to 30 psig minimum at expansion tank.
- F. Verify proper function of all instrumentation and calibrate all devices.
- G. Perform complete functional testing of the heat recovery system including control devices and panels.
- H. Clean all piping strainers after the first 24 hours of operation. Clean strainers and bleed air at least one more time prior to leaving the project site.
- I. All excess propylene glycol solution shall be left with the modules in the original drums sealed for storage.

**END OF SECTION**

**SECTION 23 21 16**  
**HYDRONIC EQUIPMENT AND SPECIALTIES**

**PART 1 – GENERAL**

**1.1 SUMMARY**

- A. Scope: This section applies to all hydronic (glycol) piping systems.
- B. Section includes: Heat Recovery and End User Building Heating Equipment.

**1.2 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Requirements for Mechanical.
- B. Section 23 05 29 - Hangers and Supports for Piping and Equipment.
- C. Section 23 21 13 - Hydronic Piping.
- D. Division 26 – Electrical.
- E. Section 33 61 14 PEX Hydronic Energy Distribution.
- F. Section 33 61 24 Steel Hydronic Energy Distribution.

**1.3 SUBMITTALS**

- A. Provide submittals for all products and systems described herein. Provide in accordance with the requirements of Section 23 05 00 - Common Work Results for Mechanical and Division 1.
- B. Product Data: Submit manufacturers catalog literature including manufacturer's installation instructions for each item indicated on the Heat Recovery Equipment Schedule on Sheet M8.1.

**1.4 CLOSEOUT**

- A. Division 1 - Closeout Requirements.

**1.5 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this section.
- B. Installer: Company specializing in performing Work of this section.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Accept material on site in shipping containers with labeling in place. Inspect for damage.
- B. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

**1.7 ENVIRONMENTAL REQUIREMENTS**

- A. Division 1 – Material and Equipment: Storage and Protection.

### **1.8 FIELD MEASUREMENTS**

- A. Verify field measurements before fabrication.

## **PART 2 - PRODUCTS**

### **2.1 HEAT RECOVERY SYSTEM EQUIPMENT**

- A. Provide all equipment as indicated in the Heat Recovery Equipment Schedule on Sheet M8.1.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Check equipment for damage that may have occurred during shipment. Repair damaged equipment as required or replace with new equipment.

### **3.2 INSTALLATION**

- A. Install equipment and accessories in strict compliance with manufacturer's instructions.
- B. Install piping system and appurtenances as indicated on Drawings.

### **3.3 CLEANING**

- A. Clean and flush glycol system before adding glycol solution. See Section 23 21 13 - Hydronic Piping.

**END OF SECTION**



**SECTION 23 31 13**  
**METAL DUCTS AND VENTILATION EQUIPMENT**

**Notes:**

*All ventilation system fabrications were furnished and some items were installed as part of the prior module assembly contract. Installation of exterior exhaust hoods and the intake duct system as described below is to be performed under this contract.*

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes:
  - 1. Exhaust Hoods & Intake Ducting Installation.

**1.2 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Requirements for Mechanical.
- B. Section 23 05 29 - Hangers and Supports for Piping and Equipment.
- C. Division 26 – Electrical.

**1.3 REFERENCES**

- A. National Fire Protection Association: NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
- B. Sheet Metal and Air Conditioning Contractors: SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

**1.4 NO SUBMITTALS REQUIRED THIS SECTION.**

**1.5 CLOSEOUT**

- A. Division 1 - Closeout Requirements.
- B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

**1.6 QUALITY ASSURANCE**

- A. Division 1 – Quality Control
- B. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible and International Mechanical Code.

**1.7 QUALIFICATIONS**

- A. Installer: Company specializing in performing work of this section.

### **1.8 ENVIRONMENTAL REQUIREMENTS**

- A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealant.

### **1.9 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication as required.

### **PART 2 - NO PRODUCTS REQUIRED THIS SECTION.**

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Check equipment for damage that may have occurred during shipment. Repair damaged equipment as required or replace with new equipment.

#### **3.2 INSTALLATION**

- A. Fabricate and install ducts as indicated on Drawings and in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Verify proper operation of fans and dampers.
- C. Install air filters provided with module in all intake ducts and deliver spare filters to utility.

**END OF SECTION**

**SECTION 23 35 16.10**  
**ENGINE EXHAUST AND CRANK VENT PIPING**

**Notes:**

*All exhaust and crank vent piping systems were furnished and partially installed as part of the prior module assembly contract. Installation of exhaust and crank vent piping through the module exterior wall as described below is to be performed under this contract.*

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Scope: Re-installation of exhaust and crank vent piping, insulation, jacket and cover plates.
- B. Section includes:
  - 1. Flange Gaskets.
  - 2. Wall Penetration Insulation.

**1.2 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Requirements for Mechanical.
- B. Section 23 05 29 - Hangers and Supports for Piping and Equipment.
- C. Section 23 07 19 - Piping Insulation.

**1.3 SYSTEM DESCRIPTION**

- A. All fabrications and materials provided with module under assembly contract except as indicated below in Part 2 – Products.

**1.4 SUBMITTALS**

- A. Provide submittals for all products and systems described herein. Provide in accordance with the requirements of Section 23 05 00 – Common Work Results for Mechanical and Division 1.
- B. Product Data:
  - 1. Gaskets: Submit manufacturer's catalog information with data and ratings for high temp exhaust service.
  - 2. Wall penetration insulation: Submit manufacturer's catalog information with data.

**1.5 QUALITY ASSURANCE**

- A. Division 1 – Quality Control

**1.6 QUALIFICATIONS**

- A. Fabricator or Installer: Company specializing in performing Work of this section.

### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Division 1 - Material and Equipment: Transportation and Handling.
- B. Accept piping and materials on site in shipping containers with labeling in place. Inspect for damage.
- C. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation.

### **1.8 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

## **PART 2 - PRODUCTS**

### **2.1 FLANGED JOINTS**

- A. Flange Gaskets: High temperature, full face, for ANSI 150# type flange, Frenzelit Novatec 925°F or approved equal.

### **2.2 WALL PENETRATION INSULATION**

- A. Type 1 mineral wool fiber batt insulation. Rockwool Safe-N-Sound or approved equal.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Check materials for damage that may have occurred during shipment. Repair damaged materials as required or replace with new materials.

### **3.2 REINSTALLATION – PIPING**

- A. See Exhaust and Crank Vent Shop/On-Site Notes, Sheet M6 for installation of exhaust piping, crank vent piping, insulation, jacketing and cover plates.
- B. Install all new flange gaskets.
- C. Coat all exhaust flange bolts and gaskets with high temperature anti-seize.
- D. Re-tighten all exhaust flange bolts after minimum one engine run/cool cycle prior to applying insulation.

### **3.3 PIPE AND WALL PENETRATION INSULATION**

- A. Install pipe hangers and supports in accordance with Drawings and specifications. Refer to Section 23 05 29.

### **3.4 INSTALLATION - PIPING**

- A. Reinstall pipe insulation and jacket as indicated.
- B. Fill entire wall penetration void with mineral wool insulation.
- C. Install cover plates and seal as indicated.

**END OF SECTION**

## **SECTION 26 05 00**

### **COMMON WORK RESULTS FOR ELECTRICAL**

#### **PART 1 – GENERAL**

##### **1.1 SCOPE OF WORK**

- A. Provide the labor, materials, equipment and test equipment necessary to furnish, install, and place into operation the power, motor, lighting, control, alarm, and associated electrical systems of this Contract. Connect motors, meters, panels, sensors, switches, and outlets or any other electrical device installed or provided as part of the project. Mark and identify circuits, terminal boards, equipment, enclosures, etc. with identification numbers, wire numbers, nameplates, and warning signs. Test, adjust and calibrate equipment and start-up all electrical equipment and its associated mechanical attachments as necessary to place the project into operation.
- B. Provide and install all control equipment and wiring to instruments and devices installed by others.
- C. Where the work of several crafts is involved, coordinate all related work to provide each system in complete and in proper operating order.
- D. Cooperate with all others involved in the project, with due regard to their work, to promote rapid completion.
- E. Local Conditions: The Contractor shall thoroughly familiarize himself with the work as well as the local conditions under which the work is to be performed. Schedule work with regard to seasons, weather, climate conditions, and all other local conditions which may affect the progress and quality of work.
- F. See Division 1 of which contain information and requirements that apply to work specified herein.
- G. The Contractor shall provide electrical service to, connection and/or interconnection of various units of equipment supplied by others. The Contractor shall not be required to set in place or align motors or calibrate devices supplied as an integral part of equipment provided by others.

##### **1.2 RELATED REQUIREMENTS**

- A. This section applies to all Division 26 work.
- B. See Divisions 1, 21, 23, and 26 which contain information and requirements that apply to work specified herein.

### **1.3 TELEPHONE SERVICE**

- A. Telephone service is not a part of this project.

### **1.4 CODES AND STANDARDS**

- A. Codes: Perform all work in strict accordance with all applicable national, state, and local codes; including, but not limited to the latest legally enacted editions of the following specifically noted requirements:

1. NFPA 70, National Electric Code - NEC;
2. ANSI-C2, National Electrical Safety Code - NESC;
3. International Building Code - IBC; and
4. International Fire Code - IFC.

- B. Standards: Reference to the following standards infers that installation, equipment, and materials shall be within the limits for which it was designed, tested, and approved, in conformance with the current publications and standards of the following organizations:

1. American National Standards Institute - ANSI;
2. American Society for Testing and Materials - ASTM;
3. American Society of Heating, Refrigerating and Air Conditioning Consultants - ASHRAE (Standard 90-75);
4. Factory Mutual – FM;
5. Institute of Electrical and Electronics Consultants - IEEE;
6. National Electrical Contractors Association - NECA;
7. National Electrical Manufacturers' Association - NEMA;
8. National Fire Protection Association - NFPA, and
9. Underwriters Laboratory - UL

### **1.5 SPECIFIC TERMINOLOGY**

- A. Streamlining: In many instances, the products, reference standards, and other itemized specifications have been listed without verbiage. In these cases, it is implied that the Contractor shall provide the products and perform in accordance with the references listed.

- B. The word "Contractor" as used in Division 26 specifications shall mean "Electrical Contractor."
- C. The word "General Contractor" as used in Division 26 specifications shall mean the Contractor responsible for the project.
- D. "Furnish" means to purchase material as shown and specified, and cart the material to an approved location at the site or elsewhere as noted or agreed to be installed by supporting crafts.
- E. "Install" means to set in place and connect, ready for use and in complete and properly operating finished condition, material that has been furnished.
- F. "Provide" means furnish all products, labor, sub-contracts, and appurtenances required and install to a complete and properly operating, finished condition.
- G. "Rough-in and Connect" means provide an appropriate system connection such as conduit with "J" boxes, wiring, switches, disconnects, etc., and all wiring connections. Equipment furnished is received, uncrated, assembled and set in place under the Division in which it is specified.
- H. "Accessible" means arranged so that an appropriately dressed man 6-foot 2 inches tall, weighing 250 pounds, may approach the area in question with the tools and products necessary for the work intended, and may then position himself to properly perform the task to be accomplished, without disassembly or damage to the surrounding installation.
- I. "Serviceable" means arranged so that the component or product in question may be properly removed and replaced without disassembly, destruction, or damage to the surrounding installation.
- J. "Product" is a generic term which includes materials, equipment, fixtures, and any physical item used on the project.

## **1.6 DRAWINGS, SPECIFICATIONS & SYMBOLS**

- A. The Drawings and Specifications are complementary; what is shown on one is as binding as if called for in both. Do not scale the Drawings. Locations of devices, fixtures, and equipment are approximate unless dimensioned.
- B. The Drawings are partly diagrammatic and do not show precise routing of conduits or exact location of all products, and may not show in minute detail all features of the installation; however, provide all systems complete and in proper operating order.
- C. Drawing symbols used for basic materials, equipment and methods are commonly used by the industry and should be universally understood. Special items are

identified by a supplementary list of graphical illustrations, or called for on the Drawings or in the specifications.

## 1.7 SUBMITTALS

- A. Provide submittals for all products and systems described in Division 26 specifications and shown on the Drawings to demonstrate compliance with the requirements of the project. Provide submittals in the manner described herein and in Division 1 with an index following specification format and with item by item identification.
- B. Under this specification section provide submittals for all products and systems listed below. Identify by the schedule reference or drawing.
  - 1. All materials in the Electrical Equipment Schedules on the Drawings.
  - 2. All materials in the Electrical Instrumentation Schedules on the Drawings.
  - 3. All materials in the Electrical Conductor Schedules on the Drawings.
  - 4. All panels shown on the Drawings.
- C. Provide submittals for all materials in the Division 26 specification sections which follow and submit under that specification section.
- D. Submittals shall demonstrate compliance with the requirements of the project. Furnish all relevant data as appropriate including but not limited to:
  - 1. Manufacturer's name and address, and supplier's name, address, and phone number.
  - 2. Catalog designation or model number with rough-in data and dimensions.
  - 3. Operation characteristics.
  - 4. Complete customized listing of characteristics required. Indicate whether item is "As Specified" or "Proposed Substitution." Indicate any deviations on submittal. Mark out all non- applicable items. The terminology "As Specified" used without this customized listing is not acceptable.
  - 5. Wiring diagrams for the specific system.
  - 6. Coordination data to check protective devices.
  - 7. Shop Drawings.
- E. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents.



Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provision of a complete and satisfactory working installation of equal quality to system specified is the sole responsibility of the Contractor.

## 1.8 TESTS

- A. Division 1 - Closeout Requirements.
- B. In addition to field testing, the Contractor shall perform all shop tests for fabricated items as required by the Division 26 specification sections which follow.
- C. The Contractor shall be responsible for field testing all station service and other electrical systems and equipment shown on the drawings. Testing of the generators and switchgear will be performed by the Authority after substantial completion.
- D. The Contractor shall prepare and submit a test plan for review and approval by the Authority.
  - 1. Field testing cannot take place without an approved test plan.
    - a. The Test Plan shall outline the tests planned for each item of equipment.
    - b. The Test Procedures shall identify the test equipment to be utilized, the action of each test step and the expected result so that a test technician who has no knowledge of the details of the equipment design shall be able to successfully conduct the test.
  - 2. In the presence of the Authority,
    - a. Test the equipment and electrical circuits for proper connection, continuity, and absence of undesirable shorts and grounds.
    - b. Test wire and cable installation, when complete.
    - c. Check for continuity, visual damage, marking, and proper phase sequence before performing insulation testing.
      - 1) Megger bus work, switches, breakers and circuits phase-to-phase and phase-to-ground disconnecting and reconnecting equipment which cannot be meggered otherwise.

- 2) The minimum acceptable steady-state value is 50 megohms. Ambient temperature and humidity during testing shall be recorded.
  3. Verify operation, calibration, and settings of the meters, relays and indicating devices.
  4. Check all auxiliary equipment, i.e., heaters, thermostats, lights, and all illuminated indicating devices and lamps, and all audible alarm devices to verify that they function properly.
  5. Take station service equipment test load readings after all loads are connected. Obtain the maximum reading for each phase and neutral with all lighting, appliances, motors (as applicable use largest combination), and other loads connected to the panels in service.
  6. Check fuses with an ohmmeter; ring out wiring and busing; check operation of control and safety interlocks.
  7. Test motor driven equipment motors before energization. Insulation test shall consist of megohmmeter check phase-to-ground, per IEEE Standard 43 or manufacturer's recommendations.
  8. Load test each motor of motor driven equipment showing the following:
    - a. Nameplate ratings (horsepower), (speed), (voltage), (phase), (ampere rating of motor at full load).
    - b. Measured load in amperes on lines 1-2.
  9. Load test pump motors, noting the operating conditions at the time of the test. Motor test data shall show suction and discharge conditions (pressure, temperature, humidity, to where such conditions affect load).
  10. Overload heaters shall be checked and the size on each phase shall be noted at this time on the test sheet.
- E. Report all test results in writing. Where tests disclose problem areas, retest after the defect has been corrected.
- F. Demonstrate that the electrical installation is working by operating all electrical systems and equipment. Simulate control inputs, responses to outputs and alarm conditions and their acknowledgement, artificially where necessary, for complete system tests.
- G. Operate the electrical systems until acceptance of the work. Instruct operators in the correct operation of all electrical and control systems under your jurisdiction.

- H. Any rework or repair of equipment required during or as a result of the testing shall be done by the Contractor at no additional expense to the Authority.
- I. The Contractor shall furnish to the Authority at the time the project is accepted, any special tools, calibration equipment, and testing apparatus specified or furnished by the equipment manufacturer for the proper adjustment and maintenance of the electrical equipment provided.

## **1.9 CODES AND INSPECTIONS**

- A. Electrical work shall be installed in accordance with the latest edition of the National Electric Code and local and state codes in legal force in the project area.
  - 1. If the Contractor observes that the Drawings and/or Specifications are at variance with such codes and regulations, he shall promptly notify the Authority in writing.
  - 2. Should the Contractor perform any work in non-compliance with the above-mentioned codes and regulations without such notice to the Authority, the Contractor shall bear all costs arising therefrom.
- B. The above codes are referenced to establish minimum requirements and wherever this specification requires higher grades of material or workmanship than required by the codes, this specification shall prevail.
- C. All electrical work shall be performed by Alaska licensed Journeyman Electricians or licensed Apprentice Electricians under the direct supervision of a licensed Electrical Administrator.
- D. Submit written proof of all Journeyman and Apprentice Electricians' current licenses.
- E. Submit certification for tests and inspections required by the electrical inspector having jurisdiction. Certificates of approval that are issued shall be transmitted to the Authority.
- F. The Contractor shall pay all costs and fees required by inspecting and other agencies required for his work.
- G. Cooperate with the Authority and provide assistance at all times for the inspection of the electrical work performed under this Contract. Remove covers, operate machinery, or perform any reasonable work which, in the opinion of the Authority, will be necessary to determine the completeness, quality, or adequacy of the work.

### **1.10 COORDINATION**

- A. Electrical Drawings are partly diagrammatic and it is not the intent to show in detail all features of work or exact physical arrangement of equipment. The location of outlets and equipment are approximate unless dimensioned. The exact locations and routing of conduits shall be governed by structural conditions and physical interferences and by the location of electrical terminations on equipment. Equipment shall be located and installed so that it will be readily accessible for operation and maintenance.
- B. If conduit is placed incorrectly with respect to equipment connections or if equipment connections are relocated without appropriate changes in the electrical work, and the resulting work is not coordinated, the work affected shall be removed and re-installed at the Contractor's expense, even if removal and replacement of structural and/or mechanical parts of the work are necessary.
- C. The Contractor shall schedule his work to coordinate through the General Contractor and with all other subcontractors, power and telephone utilities in order to maintain job progress and to avoid conflicts with equipment installation or work done by the various trades.
- D. The Contractor is responsible for maintaining required clearance. Should the Contractor become aware of a clearance violation or if the installation of electrical equipment as shown produces a clearance violation, notify the Authority in writing before proceeding with the installation.

### **1.11 LOCATIONS**

- A. If hazardous location boundaries exist, they will be shown on the drawings. Locations for seal-off fittings shall be field determined by the Contractor.
- B. Wet Locations: Wet locations shall include all areas underground (below grade), in direct contact with the earth, areas subject to saturation with water or other liquids from splashing, surface water, exposed to the weather and unprotected.

### **1.12 RECORD DRAWINGS**

- A. Division 1 – Project Record Documents.
- B. Reference requirements stated elsewhere in these specifications.
- C. In addition to other requirements, mark up a clean set of Drawings as the work progresses, to show the dimensioned location and routing of all electrical work which will become permanently concealed. Show routing or work in permanently concealed blind spaces within the facility. Show complete routing and sizing of any significant revisions to the systems shown.

- D. Maintain Record drawings in an up-to-date fashion in conjunction with the actual progress of installation. "Record" progress mark-ups shall be available on-site for examination by the Authority at all times.
- E. Prepare wiring diagrams on reproducible media using AutoCAD V.2012 or later for all individual special systems as installed. Identify all components and show all wire and terminal numbers and connections.
- F. Prior to substantial completion, deliver these drawings and their electronic files in full size PDF format to the Authority and obtain a written receipt.

### **1.13 OPERATING INSTRUCTIONS**

- A. Prior to final acceptance, instruct operators on the proper operation and maintenance of all electrical systems and equipment under this contract.
- B. Provide services of qualified technicians familiar with each item or system to instruct operators in operation and maintenance of item or system.
- C. Have approved operating and maintenance data, and parts lists for all equipment on hand at the time of instruction.

### **1.14 OPERATION AND MAINTENANCE MANUALS NOT REQUIRED**

### **1.15 PROJECT COMPLETION AND DEMONSTRATION**

- A. Division 1 - Closeout Requirements.
- B. Tests: During Substantial Completion inspection, conduct operating tests for approval.
- C. Demonstrate installation to operate satisfactorily in accordance with requirements of Contract Documents. Should a portion of installation fail to meet requirements of Contract Documents, repair or replace items failing to meet requirements until items can be demonstrated to comply.
- D. Have instruments available for measuring, voltage and current values and for demonstration of continuity, ground, or open circuit conditions. Furnish personnel to assist in taking measurements and making tests.
- E. In the event that systems are not complete and fully operational at the time of Final Inspection, all costs of any subsequent inspections shall be borne by the Contractor at no additional cost to the Authority.

### **1.16 WARRANTY**

- A. Division 1 - Closeout Requirements: Warranties.

- B. Unless otherwise specified, the Warranty starts on the date Written Notice is given that the project is complete and all required corrections have been made. Warranty shall certify that all defects in products or workmanship shall be promptly repaired or replaced by the Contractor, to the satisfaction of the Authority, for a period of one year, except when, in the opinion of the Authority such failure is due to neglect or carelessness by the Authority.

### 1.17 CERTIFICATE OF COMPLETION

- C. Submit, at time of request for Final Inspection, a completed letter in the following format:

I, \_\_\_\_\_(Name), of \_\_\_\_\_(Firm), certify that the Electrical Work is complete in accordance with Contract Drawings and Specifications, and authorized change orders (copies of which are attached hereto), and will be ready for Final Inspection as of \_\_\_\_\_(Date). I further certify that the following Specification requirements have been fulfilled:

1. Megger readings performed, \_\_\_\_ copies of log attached.
2. Instructions of operating personnel performed \_\_\_\_\_(Date).  
\_\_\_\_\_(Signed)  
Alaska Energy Authority
3. Record drawings up-to-date and ready to deliver to the Authority.
4. Emergency systems tested and fully operational.
5. All other tests required by Specifications have been performed.
6. All systems fully operational. Project is ready for Final Inspection.

SIGNED: \_\_\_\_\_ DATE: \_\_\_\_\_

TITLE: \_\_\_\_\_

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**END OF SECTION**

## **SECTION 26 05 02**

### **BASIC ELECTRICAL MATERIALS AND METHODS**

#### **PART 1 – GENERAL**

##### **1.1 SCOPE OF WORK**

- A. This Section describes specific requirements, products, and methods of execution which are typical throughout the Electrical Work of this Project. Additional requirements for the specific systems will be found in the Division specifying those systems.

##### **1.2 RELATED REQUIREMENTS**

- A. Division 1
- B. Divisions 21 and 23
- C. Section 26 05 00 Common Work Results for Electrical
- D. All other Division 26 Specifications

##### **1.3 COORDINATION**

- A. Layout all the work in advance and avoid conflict with other Work in progress. Physical dimensions shall be determined from Civil and Structural Drawings. Verify locations for junction boxes, disconnect switches, stub-ups, etc., for connection to equipment furnished by others, or in other Divisions of this Work.

##### **1.4 SERVICEABILITY OF PRODUCTS**

- A. Furnish all products to provide the proper orientation of serviceable components to access space provided.
- B. Coordinate installation of all products to allow proper service areas for any items requiring periodic maintenance inspection or replacement.
- C. Replace or relocate all products incorrectly ordered or installed.

##### **1.5 ACCESSIBILITY OF PRODUCTS**

- A. Arrange all work to provide access to all serviceable and/or operable products. Layout work to optimize net usable access space within confines of space available. Advise the Authority, in a timely manner, of areas where proper access or required clearspace cannot be maintained. Furnish Layout Drawings to verify this claim, if requested.
- B. Provide access doors in ceilings, walls, floors, etc., for access to j-boxes, automatic devices, and all serviceable or operable equipment in concealed spaces.

#### **PART 2 – PRODUCTS**

##### **2.1 PRODUCTS FURNISHED IN DIVISION 26**

- A. All products furnished and installed in permanent construction shall be new, full-weight, standard in every way, and in first class condition.

- B. All equipment furnished by the Contractor shall be listed by and shall bear the label of Underwriters' Laboratories, Incorporated (UL) or of an independent testing laboratory acceptable to the local Code- enforcement agency having jurisdiction.
- C. Products shall be identical with apparatus or equipment which has been in successful operation for at least two years. All products of similar class or service shall be of one manufacturer.
- D. Capacities, sizes, and dimensions given are minimum unless otherwise indicated. All systems and products proposed for use on this project shall be subject to review for adequacy and compliance with Contract Documents.

## **2.2 PRODUCTS FURNISHED IN OTHER DIVISIONS**

- A. Controls, including conduit, wiring, and control devices required for the operation of systems furnished in other Divisions shall be installed in accordance with Division 26 Specifications.
- B. All equipment furnished by the Contractor shall be listed by and shall bear the label of Underwriters' Laboratories, Incorporated (UL) or of an independent testing laboratory acceptable to the local Code-enforcement agency having jurisdiction.
- C. All work on the project that falls under the jurisdiction of the electrical trade shall be performed by Licensed Electricians in possession of Alaska State Fitness Cards in conformance with the Electrical Specifications.
- D. Provide complete power connections to equipment including but not limited to feeders, connections, disconnects and motor running overcurrent protection. Where starters are provided as part of a packaged product, overcurrent heaters shall be provided.

## **2.3 IDENTIFICATION**

- A. Equipment Labels and Nameplates:
  - 1. Provide rigid engraved labels and nameplates of laminated plastic 1/16-inch thick with white letters on a black or gray background. Label for emergency equipment shall be red with white letters.
    - a. Securely attach labels with two screws, minimum, per label, unless rating of panel is affected, use epoxy.
    - b. Temporary markings not permitted on equipment. Repaint trims housings, etc., where markings cannot be readily removed. Refinish defaced surfaces.
    - c. No labeling abbreviations will be permitted without prior approval.
  - 2. Label and Nameplate Locations:
    - a. Provide 1/2-inch minimum height letters on following equipment:
      - 1) Service disconnects (red background).
      - 2) Secondary feeder breakers in distribution equipment. Designation as required by load served.



- 3) Special equipment housed in cabinets, as designated on Drawings, on outside of door.
- b. Provide 1/4-inch minimum height letters on:
  - 1) Disconnects and starters for motors or fixed appliances - (include item designation and branch feeder circuit number); and
  - 2) Designated electrical equipment.
- B. Branch Circuit Panelboard Schedules: Provide neatly typed schedule (odd numbered circuits on left side or top, even on right side or bottom) under plastic jacket or protective cover to protect the schedule from damage or dirt. Securely mount on inside face of panelboard door. Define briefly, but accurately, nature of connected load (i.e., Lighting, interior; receptacles, work bench; etc.) as approved.
- C. Empty Conduits: Provide tags with typed description of purpose, and location of opposite end, wired to each end of conduits provided for future equipment.
- D. Conduits: Mark all conduits entering or leaving panels with indelible black marker with the circuit numbers of the circuits contained inside.
- E. Junction Boxes: Mark the circuit numbers of wiring on all junction boxes with steel covers. Mark with indelible black marker.
- F. Conductors:
  1. Conductors shall be color coded as indicated on the Electrical Conductor Schedule on the Drawings.
  2. Control and alarm circuit conductors
    - a. Field conductors shall be identified by destination panel and terminal block designations.
    - b. Internal (Control Panel) numbering system shall be provided by the Contractor. The numbering system shall assign each logical conductor set a unique identification number that will be reflected on the as-built drawings.

## **PART 3 – EXECUTION**

### **3.1 STORAGE AND HANDLING**

- A. Division 1 – Material and Equipment.
- B. All items shall be delivered and stored in original containers, which shall indicate manufacturer's name, the brand, and the identifying number.
- C. Items subject to moisture and/or thermal damage shall be stored in a dry, heated place.
- D. All items shall be covered and protected against dirt, water, chemical and/or mechanical damage.

### **3.2 PROTECTION OF PRODUCTS**

- A. The Contractor shall be held responsible for products to be installed under this Contract.
- B. The Contractor will be required to make good, at his own cost, any injury or damage which said products may sustain before Final Acceptance.

### **3.3 INSTALLATION**

- A. All products shall be installed by skilled craftsmen. The norms for execution of the work shall be in conformity with NEC Chapter 3 and the NECA "Standards of Installation," which herewith is made part of these Specifications.
- B. Provide working space in accordance with NEC 110.26 to permit ready and safe operation and maintenance of equipment.
- C. Repair all surfaces and furnish all required products and labor to maintain fire-proof, air-tight and water- proof characteristics of the construction.
- D. Installation of all equipment shall be in accordance with manufacturer's instructions.

### **3.4 SUPPORT SYSTEMS**

- A. All interior materials used shall be galvanized or zinc plated.
- B. All exterior materials used shall be hot dip galvanized. Where support elements are field cut, exposed metal shall be coated with spray-on galvanizing.
- C. Support from structure only.
- D. Conduits shown to be run at grade shall be supported as shown on the drawings. Conduits may share fuel piping supports if installed such that neither system will require removal during maintenance or replacement.

### **3.5 MOUNTING HEIGHTS**

- A. Mounting heights shall be above finished floor (AFF) or above finished grade as noted below, unless otherwise shown or indicated.
  - 1. Lighting Switches, 48 inches to center
  - 2. Receptacles shall be mounted as indicated on the Drawings.
- B. Other mounting heights are indicated on the Drawings by detail.

### **3.6 CUTTING AND PATCHING**

- A. Where previously completed building surfaces or other features must be cut, penetrated, or otherwise altered, such work shall be carefully laid out and patched to the original condition. Perform work only with craftsmen skilled in their respective trades.
- B. Do not cut, drill, or notch structural members unless specifically approved by the Authority. Minimize penetrations and disruption of building features

**3.7 FLASHING AND SEALING**

- A. Seal all interior and exterior ceiling and wall penetrations with polyurethane caulking. Seal both sides of walls where accessible.

**3.8 PROTECTIVE FINISHES**

- A. Take care not to scratch or deface factory finish on electrical apparatus and devices. Repaint all marred or scratched surfaces.
- B. Provide hot dip galvanized components for ferrous materials exposed to the weather.

**3.9 CLEAN-UP AND COMMISSIONING**

- A. Throughout the Work, the Contractor shall keep the work area reasonably neat and orderly by periodic clean-ups.
- B. As independent parts of the installation are completed, they may be commissioned and utilized during construction.

**END OF SECTION**

## **SECTION 26 05 26**

### **GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

#### **PART 1 – GENERAL**

##### **1.1 SCOPE OF WORK**

- A. This section describes general requirements, products, and methods of execution relating to the furnishing and installation of a complete grounding system as required for this project.

##### **1.2 RELATED REQUIREMENTS**

- A. Section 26 05 00 Common Work Results for Electrical
- B. Section 26 05 02 Basic Materials and Methods

##### **1.3 MINIMUM REQUIREMENTS**

- A. The minimum requirement for the system shall conform to Article 250 of the NEC.

##### **1.4 SUBMITTALS**

- A. Shop Drawings and Product Data: Provide in accordance with Section 26 05 00 Common Work Results for Electrical and Division 1.

#### **PART 2 – PRODUCTS**

##### **2.1 GENERAL**

- A. Install types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications shall govern.
- B. Material: Copper only. Aluminum is not acceptable for use in any location.

##### **2.2 GROUNDING ELECTRODES**

- A. Copper clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core. Size as indicated on the Drawings.

##### **2.3 WIRE AND CABLE CONDUCTORS**

- A. Ground Grid or Grounding Electrode Conductors shall be bare copper conductors conforming to the following:
  - 1. Solid Conductors: ASTM B-3.
  - 2. Stranded Conductors: ASTM B-8.
  - 3. Tinned Conductors: ASTM B-33.
- B. Station Service Circuit Grounding Conductor: General use conductors in accordance with the conductor schedule, green insulated. Minimum No. 12 AWG.
- C. Generator and Feeder Circuit Grounding Conductor: Extra flexible conductors in accordance with the conductor schedule, size as indicated.

## **2.4 MISCELLANEOUS CONDUCTORS**

- A. Ground Bus: Bare annealed copper bars of rectangular cross section.
- B. Braided Bonding Jumpers: Copper tape, braided No. 30 gauge bare copper wire, terminated with copper ferrules.
- C. Bonding Strap Conductor/Connectors: Soft copper, 0.05-inch-thick and 2 inches wide, except as indicated

## **2.5 GROUND CONNECTIONS**

- A. All underground ground connections shall be made with exothermic welds.
- B. Wherever the ground rod crosses the ground grid it shall be connected.
- C. Grounding conductor connections to building structure and to equipment skids shall be made with mechanical lugs or compression lugs as indicated. Drill and tap steel structure and equipment as required for positive bond.

## **PART 3 – EXECUTION**

### **3.1 SERVICE AND STRUCTURE GROUND**

- A. Create a Grounding Electrode System (GES) for this project by connecting the following:
  - 1. Generators, switchgear, and transformers grounded as shown on the Drawings.
  - 2. The neutral conductors grounded only where specifically indicated on the Drawings.
  - 3. Other items or equipment as indicated on the Drawings.
  - 4. Current carrying capacity of the grounding and bonding conductors shall be in conformity with Tables 250.66 and 250.122 of the NEC.
- B. All structure bonding shall be in accordance with manufacturer's recommended practice.

### **3.2 EQUIPMENT GROUND**

- A. The raceway system shall be bonded in conformity with NEC requirements to provide a continuous ground path. Where required by code or where called for on the Drawings, an additional grounding conductor shall be sized in conformity with Table 250.122 of the NEC.
- B. Provide a separate copper equipment grounding conductor for each feeder and for each branch circuit indicated. Install the grounding conductor in the same raceway with the related phase and neutral conductors, and connect the grounding conductor to pull boxes or outlet boxes at intervals of 100 feet or less. Where paralleled conductors in separate raceways occur, provide a grounding conductor in each raceway. Connect all grounding conductors to bare grounding bars in panel boards, and to ground buses in service equipment to the end that there will be an uninterrupted grounding circuit from the point of a ground fault back to the point

of connection of the equipment ground and system neutral. All grounding conductors shall be sized in conformity with Table 250.122 of the NEC.

- C. Provide separate grounding conductor securely bonded and effectively grounded to both ends of all non-metallic raceways and all flexible conduit.
- D. If non-metallic enclosures are provided, all metal conduits terminating or entering the enclosure shall be bonded together with approved bonding bushings and minimum #6 AWG copper cable.

**END OF SECTION**

## **SECTION 26 05 29**

### **HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

#### **PART 1 – GENERAL**

##### **1.1 SCOPE OF WORK**

- A. Support and align raceways, cabinets, boxes, fixtures, etc., in an approved manner and as specified.

##### **1.2 RELATED REQUIREMENTS**

- A. Section 26 05 00 Common Work Results for Electrical
- B. Section 26 05 02 Basic Materials and Methods
- C. Section 26 05 33 Raceway and Boxes for Electrical Systems

##### **1.3 SUBMITTALS**

- A. Shop Drawings and Product Data: Provide in accordance with Section 26 05 00 Common Work Results for Electrical and Division 1.

#### **PART 2 – PRODUCTS**

##### **2.1 HANGERS AND SUPPORTS**

- A. Support equipment and raceways on strut, brackets, trapeze hangers, or as detailed. Anvil, B-Line, Grinnell, Unistrut, or approved equal.

##### **2.2 FORMED STEEL CHANNEL**

- A. Strut: Cold formed mild steel channel strut, pre-galvanized finish and slotted back unless specifically indicated otherwise.
- B. Standard Strut: 12 gauge thick steel, 1-5/8" x 1-5/8", B-line B22-SH-Galv or approved equal.
- C. Double Strut: 12 gauge thick steel, 1-5/8" x 3-1/4", B-line B22A-SH-Galv or approved equal.
- D. Shallow Strut: 14 gauge thick steel, 1-5/8" x 13/16", B-line B54-SH-Galv or approved equal.
- E. On all exterior installations provide hot dip galvanized strut and fittings.

##### **2.3 FITTINGS AND ACCESSORIES**

- A. Hanger Rods: Continuous threaded rod. Zinc plated carbon steel except for exterior installations provide hot dip galvanized.
- B. Provide fittings, brackets, channel nuts, and accessories designed specifically for use with specified channel strut. Zinc plated carbon steel except for exterior installations provide hot dip galvanized.

- C. Pipe Clamps: Two piece pipe clamp designed to support pipe tight to strut, B-line B20##, or approved equal. Zinc plated carbon steel except for exterior installations provide hot dip galvanized
- D. Fasteners: All bolts, nuts, and washers to be zinc plated carbon steel except on exterior installations provide hot dip galvanized or stainless steel.

#### **2.4 EARTHQUAKE ANCHORAGE**

- A. Anchor equipment weighing more than 100 pounds to the building structure to resist lateral earthquake forces.
- B. Total lateral (earthquake) force shall be 1.00 times the equipment weight acting laterally in any direction through the equipment center of gravity. Provide adequate backing at structural attachment points to accept the forces involved.
- C. Provide equipment supported by flexible isolation mounts with earthquake restraining supports positioned as close to equipment as possible without contact in normal operation (earthquake bumpers). The maximum lateral displacement due to the computed earthquake force from above shall not exceed 1.5 inches. Floor mounted equipment weighing less than 2000 pounds may have one 6-inch by 6-inch by 3/8-inch by 18-inch steel angle bolted to the floor with four 5/8-inch diameter bolts placed on each of four sides of the equipment.

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION**

- A. Conduits and equipment shall be mounted using strut or similar supports unless otherwise noted.
- B. Do not strap conduits to piping. When run in parallel with piping maintain adequate separation to allow maintenance to take place on either piping or conduit system so that the other does not have to be removed when maintenance is required.

**END OF SECTION**



**SECTION 26 05 33**  
**RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 – GENERAL**

**1.1 SCOPE OF WORK**

- A. This section describes specific requirements, products, and methods of execution relating to conduit and conduit fittings approved for use on this project. Type, size and installation methods shall be as shown on the Plans, required by Code and specified in these specifications.

**1.2 RELATED REQUIREMENTS**

- A. Section 26 05 00 Common Work Results for Electrical
- B. Section 26 05 02 Basic Materials and Methods
- C. Section 26 05 26 Grounding and Bonding for Electrical Systems

**1.3 QUALITY ASSURANCE**

- A. Conduit and conduit fittings shall be standard types and sizes as manufactured by a nationally recognized manufacturer of this type of materials and be in conformity with applicable standards and UL listings.

**1.4 SUBMITTALS**

- A. Shop Drawings and Product Data: Provide in accordance with Section 26 05 00 Common Work Results for Electrical and Division 1.

**PART 2 – PRODUCTS**

**2.1 GALVANIZED RIGID CONDUIT (GRC)**

- A. Galvanized rigid conduit shall be mild steel with continuous welded seam, hot-dip galvanized complying with ANSI C80.1 and shall be UL listed.
- B. Elbows, bends, and fittings shall be made of full weight materials complying with the above and shall be coated and threaded the same as conduit.
- C. Threads for conduit shall be tapered and clean cut. All threads shall be hot dip galvanized after cutting.
- D. Conduit shall be 1/2-inch trade size or larger.

**2.2 ELECTRICAL METALLIC TUBING (EMT)**

- A. Steel tubing, galvanized outside and provided with a slick corrosion resistant interior coating; UL listed and labeled according to Standard 797; conforming to ANSI Standard C80.3.

### **2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT**

- A. Liquidtight flexible conduit shall be manufactured from galvanized steel strip, sealed with a polyvinyl outer jacket and shall be UL listed.
- B. Fittings shall be designed for use with liquidtight flexible conduit and shall maintain electrical continuity throughout fittings and conduit.
- C. Liquidtight flexible metal conduit shall be 1/2-inch trade size or larger and shall be manufactured by O-Z/Gedney Co., Southwire Co., or approved equal.

### **2.4 RIGID PVC CONDUIT**

- A. Rigid nonmetallic conduit shall be NEMA TC2, type EPA-80-PVC high impact, polyvinylchloride (PVC). Fittings used with PVC conduit shall be PVC solvent-weld type. Nonmetallic conduits shall be UL listed for their respective applications.

### **2.5 FITTINGS**

- A. Conduit bodies shall be factory made with threaded hub connections and weather tight screw type covers. For all exterior locations provide malleable iron conduit bodies with hot dipped galvanized finish.
- B. Fittings utilized with rigid steel shall be galvanized steel. Conduit bushings shall be of the insulated type. Where grounding bushings are required, insulated grounding bushings with pressure type lugs shall be provided. Lock rings shall be of the sealing gland type. Provide conduit bushings on all penetrations without hubs.
- C. Couplings and Terminations for Electrical Metallic Tubing (EMT): Join lengths of EMT with steel compression type couplings and connectors. The connectors shall have insulated throats or a smooth interior so as not to damage the insulation during pulling operations.
- D. Fittings for liquid-tight flexible conduit shall be steel or malleable iron, of a type incorporating a threaded grounding cone, nylon or plastic compression ring, and a tightening gland, providing a low resistance ground connection. All throats shall be insulated.

### **2.6 JUNCTION BOXES AND ENCLOSURES**

- A. Metallic device/junction boxes for interior use with Electrical Metallic Tubing (EMT) shall be minimum .0625" thick SAE 1008 pressed steel with galvanized finish, 2-1/8" deep welded or drawn construction with 1/2" and 3/4" knockouts. Provide with 1/2" raised face metal covers.
- B. For interior electrical junction boxes larger than 4" square provide NEMA 1 steel wall mount screw cover enclosures. Minimum 12-gauge steel with color ANSI 61 gray powder coated finish. Hoffman, B-Line or approved equal. Provide with plated or stainless-steel cover screws.

- C. Weatherproof gang boxes for exterior use and where specifically indicated shall be die cast zinc metal with powder coated finish and threaded hubs. Provide with matching weatherproof gasketed covers and mounting hardware.

### **PART 3 – EXECUTION**

#### **3.1 CONDUIT USAGE**

- A. INTERIOR - All interior locations shall be electrical metallic tubing (EMT) except where specifically indicated as wireway.
- B. EXTERIOR - All exterior above grade locations shall be galvanized rigid conduit (GRC).
- C. BURIED – All exterior below grade locations shall be liquid tight flexible metal conduit, rigid PVC conduit, or galvanized rigid conduit (GRC) duct as specifically indicated on the Drawings.
- D. Liquidtight flexible metal conduit shall be used in lengths 18 to 24 inches for connections to motors or equipment subject to vibration and where indicated on the Drawings. Longer lengths may be used for equipment connection if grounding conductor is installed through conduit.

#### **3.2 CONDUIT INSTALLATION, GENERAL**

- A. Conduit field joints shall be cut square and reamed smooth. Threads shall be cleanly cut and joints drawn up tight. Running threads shall not be permitted.
- B. After cutting and threading exterior GRC, threads shall be cleaned and degreased and shall receive two coats of cold galvanizing compound.
- C. Offsets and bends shall be made carefully, without reducing cross sectional area, and shall not be less than the radius of standard elbows.
- D. Convenience outlets, switches, and other devices located on walls shall be serviced from above, unless otherwise indicated.
- E. Raceways penetrating vapor barriers or traversing from warm to cold areas shall be sealed (at the penetration point) with a non-hardening duct sealing compound to prevent the accumulation of moisture.
- F. All metal conduits shall have insulating bushings and shall have locknuts inside and outside of enclosure box, etc. Conduits smaller than 1-1/4-inch trade size shall be equipped with bushings and shall have locknuts inside and outside of enclosure.
- G. All conduit runs shall be grounded in an effective and approved manner at point of origin and shall maintain a continuous ground throughout all runs, cabinets, pull boxes, and fittings from point of service to all outlets.
- H. Conduit Supports:

1. Support conduits by wall brackets, pipe straps and strut sections, or trapeze hangers spaced not more than 10 feet on center.
  2. Conduits shall be supported from the structural system. Provide additional support as required for junction and pull boxes.
- I. All conduit runs shall be completed and cleaned free from foreign matter inside before conductors are drawn in. After installation conduit ends shall be plugged or capped to prevent the entrance of foreign materials.
  - J. All conduits not used by this Contract shall have a pull wire installed and securely tied off at each end for future conductor installation.

**END OF SECTION**

**SECTION 31 11 00**  
**CLEARING AND GRUBBING**

**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. This item consists of furnishing all labor, equipment, supplies, and material in performance of all operations required for site clearing, grubbing and clean-up operations.

**1.2 RELATED REQUIREMENTS**

- A. Section 31 23 19 Dewatering and Control of Surface Water.
- B. Section 31 23 00 Excavation and Fill.

**1.3 DEFINITIONS**

- A. Clearing: Includes cutting all brush, trees and stumps, to within 6 inches of natural ground, chipping and disposing of the cuttings. Clearing also includes the removal of all snow and ice in the project area.
- B. Grubbing: Includes the removal and disposal of all stumps, roots, organics, buried logs, brush and other objectionable material or debris not otherwise indicated to remain.

**PART 2 - PRODUCTS**

Not used.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Contractor shall perform all clearing and grubbing operations where designated on the Contract Drawings and as specified herein or as directed by the owner.
  - 1. Locate, identify and protect utilities from damage.
  - 2. Verify with the Owner any vegetation to remain.

- B. The project site may contain miscellaneous debris including connexes, inoperable construction equipment, construction material, and other debris. Contractor must coordinate with the appropriate owner or governing authority as necessary to relocate all materials, waste, and equipment that interfere with proposed improvements to approved offsite location.

### **3.2 PROTECTION**

- A. Provide protection as necessary to prevent damage to existing improvements and utilities indicated to remain.
  - 1. Protect improvements on adjoining properties and on project site.
  - 2. Protect trees, plant growth and features designated to remain. Protect survey benchmarks, property corners, survey monuments and existing work from damage or displacement.
- B. All property corners, benchmarks or other permanent survey marker disturbed during construction shall be removed and recorded. The contractor shall be responsible for the resurvey and resetting of any disturbed property corners, benchmarks or other permanent survey markers by a professional land surveyor, licensed by the State of Alaska.

### **3.3 USE AND DISPOSAL OF GRUBBED MATERIAL**

- A. Cleared and grubbed material shall be disposed of at a Contractor furnished disposal area.
- B. Except as otherwise stated, the Contractor shall make his/her own arrangements and assume all cost in connection with disposal sites. Disposal sites shall be located and maintained in such a manner as to prevent a public nuisance.
- C. If the disposal site is located on private land, the Contractor shall obtain written permission from the property owner or owners for such disposal sites and shall furnish the Owner with a copy of this permission. The written permission shall specifically provide that the property owner will not hold the Owner, its employees, agents, or engineers liable for use or damage to this property. The Contractor shall be held liable for any trespass and property damage incurred outside of the disposal site.

**END OF SECTION**

**SECTION 31 23 00**  
**EXCAVATION AND FILL**

**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. This item consists of furnishing all labor, equipment, supplies, and material in performance of all earthwork operations including excavation, construction of access road(s), gravel pads, etc.
- B. Important Notes:
  - 1. Contractor shall make his own determination of the adequacy of the site to support equipment and other construction loads.

**1.2 RELATED REQUIREMENTS**

- A. Division 01 Specifications.
- B. Section 02 32 00 Geotechnical Investigations.

**1.3 QUALITY CONTROL ASSURANCE**

- A. Testing Procedures and Methods:
  - 1. Moisture-Density test standard: ASTM D1557 or AASHTO T-180, Method D.
  - 2. In-place Density Determination: Nuclear Method ASTM D2922 or AASHTO T-238.
  - 3. Gradation Analysis: ATM T-7, ASTM C136 or AASHTO T-27.
  - 4. Other testing procedures and methods referenced in individual specification sections.
- B. Quality Control Monitoring:
  - 1. Contractor shall secure and pay for all required quality control monitoring. Contractor shall utilize Engineer approved, certified, independent laboratory and field personnel for all required testing.

2. Provide certified test results as required in Section 1.4, Submittals.
  3. Fill material placed prior to Engineer Approval of test results is at the sole risk of the Contractor. Material not meeting requirements shall be removed and replaced at Contractor's expense.
- C. Minimum testing requirements are indicated below.
1. Moisture Density and Gradation Analysis:
    - a. Classified Fill: Two (2) samples shall be taken at each Classified Fill material source to be used in the work. One (1) additional sample shall be taken when any change in material occurs which, in the opinion of the Engineer, may significantly affect the optimum moisture content or maximum laboratory dry density.
    - b. If laboratory tests indicate that the fill material does not meet the specification requirements, the Contractor shall provide additional certified tests for alternative fill material sources at no additional cost to the Owner.
  2. In-Place Density:
    - a. One (1) test for every 200 cy of embankment fill placed (Minimum of one test per lift is required regardless of fill quantity).
    - b. The results of each density test shall be recorded on a test sheet. The following information shall be recorded.
      - 1) Horizontal and vertical location.
      - 2) Density and percent of referenced standard compaction.
      - 3) Material description and appropriate compaction control standard.
    - c. If test results indicate insufficient compaction, Contractor shall cease placement of fill and provide additional compaction effort and/or moisture conditioning until subsequent in-place density testing indicates proper compaction has been achieved.
    - d. All costs associated with additional in-place density testing as a result of failed tests shall be borne by the Contractor.

#### **1.4 SUBMITTALS**

- A. Submittals shall be made in accordance with the General Conditions, Division 1, and this Section.
- B. Provide the following submittals:



1. Name of proposed independent certified testing laboratory and field testing sub-consultant.
  2. Format of proposed laboratory and field test forms.
  3. Laboratory results of gradation and moisture density tests for each fill type to be used on the project.
  4. If the Contractor changes the source and/or stockpile from which materials are obtained, Gradation Analysis and Moisture-Density test reports for these new sources shall be submitted to the Project Manager.
  5. Results of all in-place density field tests.
  6. Catalog and manufacturer's data sheets for proposed compaction equipment.
  7. Disposal plan for unusable excavation.
- C. Additional Testing:
1. All testing necessary for the Contractor to locate acceptable sources of classified or unclassified fill material for the project shall be provided by the Contractor at no additional cost to the Owner.
  2. During construction, the owner may elect to have further gradation and compaction testing completed on the materials being furnished by the Contractor. This testing shall be at the expense of the Owner. The Contractor shall provide material samples as may be necessary to complete this testing and these material samples shall be furnished from material available on the Project site or from the Contractor's source and/or supplier.

## 1.5 MATERIAL SOURCES

- A. The borrow source in the community is reportedly operated by the City of AKhiok and is located approximately 0.3 miles north of town. The material is coarse broken rock fragments. Available fill quantities should be verified by the Contractor.

Imported gravel is available via barge from Homer or other local ports.

- B. It is the responsibility of the contractor to select a material source for the project and supply material that meets the requirements for Classified Fill materials.

- C. The Contractor shall coordinate as necessary with the borrow pit surface and subsurface property owners, shall acquire all necessary permits and/or material sales agreements, and shall pay all required fees, royalties, and other costs associated with pit access and material extraction.
- D. The Contractor shall be responsible for all costs associated with locating, procuring, transporting, testing, storing, placing and compacting fill material for the work. The Owner is not responsible for fill lost during transportation.

## **PART 2 - PRODUCTS**

### **2.1 UNCLASSIFIED EXCAVATION**

- A. Excavation from the project area shall be considered unclassified. Complete all excavation regardless of the type, nature or condition of the materials encountered as shown on the drawings and/or at the Project Manager's direction.
- B. Excavation conforming to the specifications for Classified Fill Materials may be reused. Unclassified excavation intended for reuse shall be stockpiled and tested prior to placement in the work.
- C. Dispose of unusable excavation at a location provided by Contractor and approved by Owner.

### **2.2 CLASSIFIED FILL MATERIALS**

- A. Fill Material shall meet the requirements for Classified Fill material listed below.
- B. Classified Fill:
  - 1. Classified fill material shall consist of mineral soil, free from dirt, muck, frozen chunks, clay balls, roots, organic material, debris, or deleterious material. It shall have a liquid limit no greater than 25 and a plasticity index no greater than 6 as determined by AASHTO T-89 and T-90.
  - 2. Type I classified fill material:  
  
Type I classified fill material shall conform to the following gradation as determined by AASHTO T-27:

U.S. Standard Passing, <u>Sieve Size</u>	Percent <u>by Weight</u>
4 inch	100
2 inch	85-100
No. 4	20-60
No. 200	4-12

3. Type II classified fill material shall be crushed gravel consisting of sound, tough, durable rock fragments of uniform quality and shall meet the following requirements:

Degradation Value (ATM T-13): 45 Min  
Percent Fracture (ATM T-4): 50 Min (Single Face)

Type II classified fill material shall conform to the following gradation as determined by AASHTO T-27:

U.S. Standard Passing, <u>Sieve Size</u>	Percent <u>by Weight</u>
1 inch	100
No. 4	35-65
No. 10	25-45
No. 200	4-10

- C. Pipe Bedding Material: Use Type II classified material.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Safety – The Contractor shall be solely responsible for making all excavations in a safe manner. Provide appropriate measures to retain excavation sideslopes and prevent sloughing to ensure that persons working in or near the excavation are protected.
- B. Notify Project Manager of any discrepancies between Contractual requirements and site conditions prior to start of Work.
- C. Maintain subgrade, backfill and embankment areas or lifts open until testing is complete and testing requirements are met, or approval of testing is secured from the Project Manager.
- D. Any work covered up prior to test completion and achieving testing requirements or Project Manager's approval shall be excavated and reconstructed at Contractor's expense.

- E. Work in inclement weather is at Contractors risk. Any materials which become unstable as the result of improper moisture content, improper selection of techniques, equipment, or operations during inclement wet weather shall be replaced at Contractor's expense.
- F. Excavations and embankment shall be accomplished in such a manner that drainage is maintained at all times; any areas not so drained shall be kept free of standing water by pumping if necessary.
- G. The Contractor shall provide for the proper maintenance of traffic flow and accessibility as may be necessary, and shall also make adequate provisions for the safety of property and persons.
- H. No separate payment for any excavation shall be made. All excavation shall be incidental to the Bid Item being performed.

### **3.2 EXCAVATION**

- A. Excavate to lines and grades shown on the Contract Drawings. Remove and dispose of all topsoil, dirt, muck, frozen chunks, clay balls, roots, organic material, debris, or deleterious material.
- B. At Contractor's option, unclassified excavation may be stockpiled and tested for conformance with classified fill specifications. See Part 1 of this specification for testing requirements.
- C. Disposal of Excess Excavation:
  - 1. Dispose of all excess excavated materials offsite. Contractor shall make arrangements for the disposal of the excavated material and bare all costs incidental to such disposal.
  - 2. Sideslopes of excavation waste piles shall be sloped to match the materials natural angle of repose, or flatter.
  - 3. Excavation waste areas shall be completely within the limits of the disposal area property.
- D. Dewatering:
  - 1. Excavate all materials in a dewatered condition unless approved otherwise by the Project Manager.

2. Dewatering shall be performed in accordance with the requirements of Section 31 23 19, Dewatering and Control of Surface Water.
- E. Unauthorized Excavation:
1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or neat-line dimensions without written direction by the Project Manager.
  2. Unauthorized excavation, as well as remedial work as directed, shall be at Contractor's expense.
  3. Backfill and compact unauthorized excavations as specified for authorized excavations of same classification.

### **3.3 SITE PREPARATION**

- A. Clear and grub the construction area in accordance with Section 31 11 00 of the Specifications and the Contract Drawings. Remove all organic material, silt, and top soil and dispose at a location provided by the Contractor.
- B. Project area must be fully thawed (no seasonal frost) prior to placement of fill.
1. Prior to placement of fill Contractor may be directed to demonstrate that ground is frost free by excavating a minimum of three test pits evenly spaced over the project area. Excavation for this purpose will be at the Contractors sole expense.
  2. Minimum test pit depth shall be 4 feet.
  3. If frozen soils are encountered, the Project Manager shall be notified and the test pit shall be filled. At the discretion of the Project Manager additional time shall be allowed for the ground to thaw. Subsequent test pits shall be dug a minimum of 10 ft horizontal from previous pits.
- C. Fill all depressions or holes below the general area surface level, whether caused by test pits, removal of debris or unacceptable material, or otherwise. Fill with Classified material as shown on the drawings, and compact to specified density and to a level, uniform surface before the placement of subsequent layers.
- D. Sloped ground surfaces steeper than 1 vertical to 4 horizontal on which embankment is to be placed shall be plowed, benched, or broken up in such manner that the fill material will bond with the prepared surface.

### **3.4 EMBANKMENT CONSTRUCTION**

#### **A. Embankment Fill Placement:**

1. The specified material shall be placed at the locations and to the lines and grades indicated on the Contract Drawings. The material shall be placed and spread uniformly in successive layers not exceeding eight (8) inches in loose thickness. The Project Manager may approve lifts of greater thickness provided the equipment and method used will consistently achieve the specified density. The layers shall be carried up full width from the bottom of the fill to avoid the necessity of widening the edges after the center has been brought to grade. Each layer shall be compacted in accordance with Section 3.05 of this Specification.
2. Blading, rolling, and tamping shall continue until the surface is smooth, free from waves and irregularities, and conforms to elevations shown on the Contract Drawings. If at any time the material is excessively wet; it shall be aerated by means of blade graders, harrows, or other suitable equipment until the moisture content is satisfactory. The surface shall then be compacted and finished as specified above.
3. Oversized material shall be removed. Portions of any layer in which the embankment material becomes segregated shall be removed and replaced with satisfactory material or shall be added to and remixed to secure proper gradation as directed by the Project Manager. No separate payment will be made for any material removed or regraded in areas where material becomes segregated.

### **3.5 COMPACTION**

- A. Compact each embankment lift to 95% of maximum density at optimum moisture content as determined by ASTM D1557 or AASHTO T-180, Method D.
- B. Correct improperly compacted areas or lifts if soil density tests indicate inadequate compaction.
- C. Portions of any lift in which the materials become segregated to the extent that the required percent compaction cannot be attained, shall be removed by the Contractor and replaced with satisfactory materials, or blended with additional material until segregation is eliminated and specified percent compaction is attained.

- D. If, in the opinion of the Engineer, based on testing service reports and inspection, subgrade and layers of embankment that have been placed are below specified density, the Contractor shall perform additional compaction and testing at elevations directed by the Project Manager until specified density is obtained, at no additional cost to the Owner.
- E. The Contractor shall be responsible for providing the proper size and type of compaction equipment and for selecting the proper method of operating said equipment to attain the required compaction density.

### **3.6 GRADING**

- A. Existing ground contours shown on the Contract Drawings are based upon limited survey information and are approximate.
- B. Finished surfaces shall be not more than 0.10 foot above or below the finished grade elevations shown on the Contract Drawings; soft spots or settling areas shall be corrected at Contractor's expense. Feather finish grades to match adjacent existing roads and parking surfaces where required.

### **3.7 MAINTENANCE**

- A. As necessary, Contractor shall water the site while grading is in progress to control dust.
- B. Contractor shall protect newly graded areas from traffic and erosion and keep free of trash and debris.
- C. Contractor shall repair and re-establish grades in settled, eroded and rutted areas as directed by the Project Manager.
- D. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.
- E. All open excavations shall be adequately signed and barricaded to protect the public.

### **3.8 DENSITY TEST RECORD DOCUMENTATION**

- A. The results of each density test shall be recorded on a test sheet. The following information shall be recorded.
  - 1. Horizontal and vertical location.

2. Density and percent of referenced standard compaction.
3. Material description and appropriate compaction control standard.

**END OF SECTION**



**SECTION 31 23 19**  
**DEWATERING AND CONTROL OF SURFACE WATER**

**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. This Section describes the requirements for dewatering and the control of surface water during construction.

**1.2 SYSTEM DESCRIPTION**

- A. Dewatering and temporary diversion works shall be designed by and be the sole responsibility of the Contractor.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Selection of equipment and materials to perform the work is at the option of the Contractor.
- B. The Contractor shall be responsible for preparation of any required Storm Water Pollution Prevention Plan.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Contractor shall make his own provisions for diverting surface run off, alleviating ponding water, and dewatering excavation when ground water is encountered.
- B. Contractor shall be responsible for coordinating, acquiring, and paying for all permits required for dewatering operations.
- C. Remove ponded water and limit water flowing or infiltrating into the work area to the extent that the quality of work is not compromised.
- D. Surface water flows within the work area shall be diverted by constructing temporary ditches, berms, or other means to control and direct the water away from the work; use of pumping equipment may be required to

dewater some areas.

- E. Discharge from dewatering operations shall be returned to natural drainage routes. Settling pits, silt fences, straw dikes, or other appropriate measures shall be taken to prevent highly turbid waters from entering existing ponds, streams, or wetlands.

**END OF SECTION**

## **SECTION 31 23 33**

### **TRENCHING AND BACKFILL FOR UTILITIES**

#### **PART 1 – GENERAL**

##### **1.1 SCOPE OF WORK**

- A. The Work under this item includes furnishing all labor, materials and equipment to perform all operations pertaining to trenching and backfill for utilities. Trenching and Backfill for new electrical distribution systems is covered by section 33 71 00.20 Underground Electrical Utilities

##### **1.2 RELATED REQUIREMENTS**

- A. Section 31 23 00 - Excavation and Fill
- B. Section 26 00 00- Electrical Methods and Materials
- C. Section 33 71 00.20 Underground Electrical Utilities

##### **1.3 PROTECTION**

- A. Protect equipment and vehicular traffic from trenches and excavations by providing adequate barricades and signage.
- B. Protect excavation side-slopes or adjacent structures by providing adequate back-slopes, shoring, bracing or other methods required to prevent failure of the excavation or existing soils.
- C. Protect all above and belowground utilities.
- D. Notify the Project Manager of unexpected sub-surface conditions and discontinue work in affected areas until notification is given to resume work.
- E. Grade top perimeter of the excavation to prevent surface water runoff from entering the excavation.
- F. Provide for dewatering of the trench where ground water is encountered.

##### **1.4 QUALITY CONTROL ASSURANCE**

- A. Moisture-Density test standard: ASTM D1557 or AASHTO T-180, Method D.
- B. In-place Density Determination: Nuclear Method ASTM D2922 or AASHTO T-238.

- C. Quality control monitoring of trench backfill materials and construction by certified independent laboratory approved by Owner, secured and paid for by the Contractor.
- D. Minimum frequency for testing is indicated below. Additional testing may be necessary depending on field conditions
  - 1. Moisture Density and Gradation Analysis on Classified and Unclassified Materials: One (1) sample for approval, prior to use, plus one (1) additional sample when any change in material occurs which, in the opinion of the Project Manager, may significantly affect the optimum moisture content or maximum laboratory dry density.
  - 2. In-Place Density – Trench Backfill:
    - a. One (1) test per lift for every 200 lineal feet of trench.

## **1.5 SUBMITTALS**

- A. Moisture-Density test reports for backfill material from qualified testing laboratory.
- B. In-place density test results in approved format.
- C. If the Contractor changes the source and/or stockpile from which materials are obtained, Gradation Analysis and Moisture-Density test reports for these new sources shall be submitted to the Project Manager.
- D. The Contractor shall make allowances in his Bid for these items to cover expenses incurred for certified testing and no additional compensation will be allowed.

## **PART 2 – MATERIALS**

### **2.1 TRENCH BACKFILL**

- A. Material for trench backfill shall be obtained from the trench excavation.
- B. If the excavated material is unsuitable for trench backfill (contains organic matter, muck, peat, frozen materials, vegetation, debris or other unsuitable or deleterious matter), the Project Manager may direct the Contractor to furnish Classified Fill material.

### **2.2 LOCATOR/WARNING TAPE**

- C. Metallic Locator/Warning tape shall be capable of being inductively detected electronically. Tape shall be as manufactured by Lineguard, Inc., Wheaton,

Illinois, (708)-653-0271, Reef Industries, Inc., Houston, Texas, (713)-943-0070, or approved equal. Materials shall conform to the following:

1. Film: Inert plastic. Each film layer shall be not less than 0.0005-inch thick (0.5 mil).
2. Imprint: 3/4-inch or larger bold black letters.
3. Legend: The buried utility line tape shall be identified with imprint such as "Caution: Water Line Below" and the identification repeated on approximately 24-inch intervals.
4. Metallic foil laminated between two layers of impervious plastic film not less than 2 inches wide. The adhesive shall be compatible with the foil and film. Total thickness of tape shall not be less than 0.005 inch (5 mil).

### **PART 3 – EXECUTION**

#### **3.1 PREPARATION**

- A. Identify all existing underground utilities. Stake and flag their locations.
- B. Maintain and protect the existing utilities that may pass through the work area. The Contractor shall coordinate with ACS, the City, and all other local utility companies before beginning excavation activities.

#### **3.2 EXCAVATION**

- A. Excavate the subsoil required for installing piping and conduits.
- B. Cut trenches sufficiently wide to enable proper installation and inspection of utilities as specified and shown on the Contract Drawings.
- C. Remove and dispose of all organic material and debris from trench excavation.
- D. Correct unauthorized excavation or over-excavated areas at no cost to the Owner.

#### **3.3 DISPOSAL SITES**

- A. Except as otherwise stated, the Contractor shall make his/her own arrangements and assume all costs in connection with disposal sites. Disposal sites shall be located and maintained in such a manner as to prevent a public nuisance.
- B. If the disposal site is on private property, the Contractor shall obtain written permission from the property owner or owners for such disposal sites and shall furnish the Authority with a copy of this permission. The written permission shall specifically provide that the property owner will not hold the Owner, its employees,

agents, or engineers liable for use of or damage to this property. The Contractor shall be held liable for any trespass or property damage incurred outside of the disposal site.

### **3.4 TRENCH BACKFILL**

- A. The first lift is to provide at least a 6-inch bedding thickness under the pipeline and shall be placed before the pipe is laid in the trench. Subsequent lifts of not more than 8-inches shall be installed and individually compacted to 95% of maximum density as described in Section 31 23 00 Excavation and Fill, of these Specifications.
- B. No blocking of any type shall be used to adjust the pipe to grade.
- C. Where ground water is present, the Contractor shall provide drainage through pumping or ditching to ensure that the bedding does not become saturated before placement of the backfill material.
- D. The Contractor shall exercise caution when compacting above pipes to ensure that the pipes and coatings are not damaged by compaction and backfilling operations. All pipes or coatings damaged during backfill or compaction operations shall be repaired or replaced by the Contractor, at no expense to the Owner.

### **3.5 FIELD QUALITY CONTROL**

- A. Notify the Project Manager at least 24 hours in advance of trench backfilling operations to allow for inspection. Failure to obtain inspection prior to placement of backfill may be cause for rejection of pipe.
- B. The results of each density test shall be recorded on a test sheet. The following information shall be recorded.
  - 1. Horizontal and vertical location.
  - 2. Density and percent of referenced standard compaction.
  - 3. Material description and appropriate compaction control standard

**END OF SECTION**

**SECTION 32 05 09**  
**GEOTEXTILE FABRICS**

**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. The Work under this Section consists of furnishing all labor, equipment, supplies and materials necessary to perform all operations pertaining to the furnishing and placement of geotextile fabrics.

**1.2 RELATED REQUIREMENTS**

- A. Section 31 23 00 - Excavation and Fill.

**1.3 SUBMITTALS**

- A. General: Conform to Section 01 33 23, Shop Drawings, Product Data and Samples.
- B. Furnish Manufacturer's Information and design data, including complete product installation instruction.

**1.4 DELIVERY, STORAGE AND HANDLING**

- A. General Requirements: Conform to Section 01 60 13, Material and Equipment.
- B. Packaging and Identification Requirements:
  - 1. Geotextile rolls shall be furnished with suitable wrapping for protection against moisture, contamination and extended ultra-violet exposure prior to placement.
  - 2. Each roll or bundle shall be labeled or tagged to provide product identification sufficient for field identification.
  - 3. Products shall be stored in a manner that protects them from the elements. If stored outdoors, they shall be elevated and protected with a waterproof cover.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer: The manufacturer of the geotextile materials shall have a minimum of ten years' experience in their respective fields.
- B. Sampling and Compliance Requirements:
  - 1. A competent laboratory must be maintained by the producer of the fabric at the point of manufacture to insure quality control in accordance with ASTM testing procedures.
  - 2. That laboratory shall maintain records of its quality control results and provide, upon request of the specifying agent prior to shipment, a manufacturer's certificate.
  - 3. The certificate shall include:
    - a. Name of manufacturer.
    - b. Chemical composition.
    - c. Product description.
    - d. Statement of compliance to specification requirements.
    - e. Signature of legally authorized official attesting to the information required.
- C. Weather Limitations: All work shall be performed under weather conditions recommended by the manufacturer.

## **PART 2 - PRODUCTS**

### **2.1 GEOTEXTILE FABRIC**

- A. Woven Geotextile Fabric:
  - 1. Geotextile Fabric shall be GEOTEX 315ST or approved equal.
  - 2. The fabric shall be inert to naturally encountered chemicals, hydrocarbons, mildew and rot resistant, resistant to ultraviolet light exposure, insect and rodent resistant, and conform to the properties in the following table.
  - 3. The minimum average roll value (MARV) for strength properties of any individual roll tested from the manufacturing lot or lots of a particular shipment shall be in excess of the MARV stipulated herein.

SPECIFICATION PROPERTY	TEST LIMIT	METHOD
Grab Strength	300 lbs	ASTM D-4632



Trapezoid Tear Strength	100 lbs	ASTM D-4533
CBR Puncture Strength	900 lbs	ASTM D-4833
Survivability Class	2	AASHTO M288

B. Non-Woven Geotextile:

1. The fabric shall be inert to commonly encountered chemicals, hydrocarbons, mildew and rot resistant, resistant to ultraviolet light exposure, insect and rodent resistant, spun-bound, black, fuel resistant, and conform to the properties in the following table.
2. The average roll minimum value (weakest principle direction) for strength properties of any individual roll tested from the manufacturing lot or lots of a particular shipment shall be in excess of the average roll minimum value (weakest principle direction) stipulated herein.

SPECIFICATION PROPERTY	TEST LIMIT	METHOD
Grab Strength	150 lbs	ASTM D-4632
Grab Elongation	50% max	ASTM D-4632
Trapezoid Tear Strength	65 lbs	ASTM D-4533
Puncture Strength	90 lbs	ASTM D-4833
Mullen Burst Strength	315 psi	ASTM D-3786

3. Acceptable brands include:
  - a. Geotex 601, or approved equal.

**PART 3 - EXECUTION**

**3.1 INSTALLATION OF GEOTEXTILE FABRICS**

A. Preparation:

1. Prepare subgrade and embankment as specified.
2. Grade to a smooth surface, leaving no surface undulations or irregularities that the fabric can stretch and “bridge” over.
3. Remove any loose and angular materials, rocks and sticks that may damage the fabric.

**B. Installation:**

1. The geotextile fabric sheet shall be unrolled, positioned, and drawn tight without stretching, in accordance with manufacturer's recommendations.
2. Geomembrane liner shall be crated to prevent any damage during shipping. Provide an unfolding map which indicates where the liner bundle needs to be positioned to allow for ease in unfolding at the site. Install liner in accordance with the manufacturer's instruction by a certified installer. Install between layers of non-woven geotextile for protection.
3. No penetrations are allowed through the geomembrane liner except at the top of exterior dike wall.
4. Construction vehicles will not be allowed to travel directly on the fabric.
5. Take due care to ensure that fabric is not damaged during construction activities.
6. Fabric damaged to a degree that compromises its intended capabilities shall be replaced with same approved geotextile fabric at no additional cost to the Owner.

**3.2 FILL PLACEMENT**

- A. Fill or backfill placement shall be in accordance with Section 31 23 00 Excavation and Fill.
- B. A minimum of 6 inches of fill material shall be placed before any construction equipment is permitted to pass over the installed geotextile or geomembrane liner. At no time shall equipment be operated on the unprotected fabric.
- C. Care shall be taken to avoid tears or other damage to the fabric during placement. Tears or damage are cause for repair or replacement of the fabric at the Contractor's expense.

**3.3 GEOTEXTILE FABRIC REPAIR**

- A. If the geotextile becomes torn or damaged, it shall be repaired at the Contractor's expense prior to backfill operations.

- B. The fill material shall be cleaned from the surface of the geotextile and the torn area overlain with new fabric, providing a minimum of 3 feet of overlap around the edges of the torn area. Care shall be taken that the patch remains in place during subsequent fill placement.

**END OF SECTION**

**SECTION 32 31 13**  
**CHAINLINK FENCES AND GATES**

**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. The work covered by this specification section includes the furnishing of all labor, tools, equipment and materials necessary to design, fabricate, coat, package for shipment, deliver, and install fence materials as shown on the attached Contract Drawings and described in this Specification.
- B. Fencing is to be 8-feet in height measured from the ground surface to the top of the fence fabric.

**1.2 REFERENCES**

- A. The fence and materials shall be in accordance with this Specification, the Contract Drawings and with the following:
  - 1. 2004 Alaska Department of Transportation Standard Specifications for Highway Construction Section 607.

**1.3 DEFINITIONS**

- A. In this specification, the following words or expressions shall be understood to have the meaning given below:
  - 1. Fence – Chainlink fencing, fabric, pipes, posts, plates, gates, wire, truss rods, fasteners, latches and other materials shown in the Contract Drawings and necessary to install fence.
  - 2. Temporary Security Fence - Chainlink fencing with galvanized steel posts constructed of new materials or previously used chainlink fence in good condition.
  - 3. Safety Fence - Orange fabric fence with t-posts.

**1.4 SUBMITTALS**

- A. Submit under provisions of Section 01 30 00.
- B. The submittals include:
  - 1. Product Data: Submit manufacturer's standard printed information and literature for all materials to be incorporated in the work.

2. Shop Drawings: Submit dimensionally correct (scaled) shop drawings for all items to be fabricated (gates, etc.).
3. Assembly procedures and standard details for the installation of all fence materials.

## **1.5 QUALITY ASSURANCE**

- A. The manufacturer shall be experienced and regularly engaged in the supply and installation of fence materials. The manufacturer shall understand the system design and its intent and shall produce components suitable to accomplish that intent. Any deficiencies in the Contract Drawings or these Specifications which may jeopardize the performance of the system shall be brought to the immediate attention of the Engineer, prior to submittal of product description and information for acceptance, whenever possible.

## **1.6 IDENTIFICATION**

- A. All fence materials for each facility shall be marked with an identifying number that identifies which facility and component of the fence they pertain to.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- A. Packaging:
  1. Contractor shall verify shipping dimensions and weight limitations with shipper to ensure that the receipt and delivery of materials will not require the use of specialized equipment.
  2. Packing must meet the shipping requirements of all anticipated carrier(s) and be adequate to protect the materials from being damaged.
  3. Individual packages/crates must be limited to three thousand pounds (3,000) gross weight and be suitable for lifting by forklift and cable sling.
  4. Contractor shall provide packing lists with all bundles and packages which shall list all materials contained in the package or bundle. Packing list shall be securely attached to each bundle in a watertight carrier.

## **PART 2 - PRODUCTS**

### **2.1 NEW FENCING MATERIALS, POSTS AND ACCESSORIES**

- A. Zinc-Coated Steel Wire Fabric:
  - 1. Type 1-1.2 oz/sq ft , 2-inch mesh, 9 gauge
  - 2. Fabric selvage to be twist, twist.
  - 3. Provide three strands of 12.5 gauge, 4-point, class III barb wire.
- B. Tension Wire for top and bottom of Fabric: 7 gauge, coil spring steel, Class III
- C. All pipe should be SS40 Standard Fence Pipe. Posts and Braces (Class 1, zinc-coated steel pipe, Grade A or B):
  - 1. Line Posts: 2.375-inch O.D. and weight of 3.12 lb/ft.
  - 2. End, Corner, Man Gate and Pull Posts: 2.875-inch O.D. and weight of 4.64 lb/ft.
  - 3. Gate Posts: 4-inch O.D. and weight of 6.56 lb/ft.
  - 4. Brace Rail: 1.66-inch O.D. and weight of 1.84 lb/ft.
  - 5. Top Rail: Use top Tension wire unless otherwise noted.
- D. Gates:
  - 1. Size and type shown on Drawings.
  - 2. Class 1 steel pipe, Grade A or B, 1.90-inch O.D. and weight of 2.28 lb/ft.
  - 3. Gate leaves 6 feet wide and wider shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist.
  - 4. Gate leaves less than 6 feet wide shall have truss rods or intermediate braces.
  - 5. Gate fabric shall be attached to the gate frame by method standard with the manufacturer except that welding will not be permitted.
  - 6. All hardware shall be zinc-coated.
  - 7. Latches:
    - a. Frost free or strongarm latch for double gates, fork latch for single man gates.

- b. Latches shall be arranged for pad-locking so that the padlock will be accessible from both sides of gates.
- E. Accessories: Ferrous accessories shall be zinc-coated steel.
  - 1. Tension bars: 1/4 -inch x 3/4-inch flat bar.
  - 2. Standard tension bands: 1/8-inch x 1-inch with 5/16-inch carriage bolt.
  - 3. Wire Ties and Clips: 9 gauge.
  - 4. Steel Hog Rings: Aluminum or steel post ties
  - 5. Truss Rods: 3/8-inch diameter.
- F. Zinc Coating:
  - 1. All steel and iron parts will be zinc-coated after fabrication in accordance with FS RR-F-191.
  - 2. Weight of zinc coating per square foot of actual surface shall average not less than 1.2 ounces and no individual specimen show less than 1.0 ounce.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- A. Install posts, fabric, gates and accessories in accordance with ANSI/ASTM F567 and the manufacturer's instructions.
- B. Repair damaged galvanized surfaces with an approved cold galvanizing compound in accordance with manufacturer's instructions.

#### **3.2 POSTS**

- A. Spacing: Space posts equidistant measured on a horizontal line; on straight runs, space at 10 feet maximum.
- B. Location:
  - 1. Locate terminal posts (end, corner, and gate) at the beginning and end of each continuous length of fence and at abrupt changes in vertical and

horizontal alignments.

2. On straight runs, brace posts in two directions to act as pull posts.

C. Setting:

1. Set posts plumb and to the depth shown on the Drawings.
2. Posts to be placed to minimum 5-foot embedment or as indicated on the Drawings.
3. If corner, pull, or gate posts encounter bedrock prior to full embedment perform rock excavation / drilling to attain full depth and install concrete as shown on the drawings.
4. If line posts encounter bedrock prior to attaining full embedment perform rock excavation / drilling to attain full depth or anchor line posts using concrete filled sonotube as shown in the drawings.

### **3.3 INSTALLING FABRIC**

- A. Place fabric on the outside of posts around the area enclosed.
- B. Cut fabric by untwisting a picket, and attach each span independently at all terminal posts.
- C. Attach one end and then apply tension to remove all slack and attach other end, using stretcher bars with tension bands at maximum 15-inch intervals or any other approved method.
- D. The installed fabric shall have a smooth, uniform appearance, free from sag.
- E. Install fabric 2 inches above ground level with a tolerance of plus or minus 1-inch at each post.
- F. Fasten fabric to line posts at intervals not to exceed 15 inches and to the top and bottom tension wires at intervals not to exceed 24 inches.
- G. Join sections of fabric by weaving a single picket into the ends of the rolls to form a continuous mesh.

### **3.4 BRACES AND TRUSS RODS**

- A. Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished.



- B. Horizontal (compression) braces and diagonal truss (tension) rods shall be installed.
- C. Braces and truss rods shall extend from terminal posts to first line post.
- D. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal.

### **3.5 TENSION WIRES**

- A. Tension wires shall be installed along the top and bottom of the fence line and attached to the terminal posts of each stretch of the fence.
- B. Top tension wires shall be installed within the top 4 inches of the installed fabric.
- C. Bottom tension wire shall be installed within the bottom 6 inches of the installed fabric.
- D. Tension wire shall be pulled taut and shall be free of sag.

### **3.6 GATES**

- A. Install plumb with tops of posts level with each other.
- B. Gate fabric shall be the same design and height of line fence fabric, furnished with twisted selvage top and bottom.
- C. Install as detailed in the Contract Drawings: Intermediate clips shall be installed at the midspan of each bottom tension wire, between posts.

### **3.7 GROUNDING**

- A. Electrical grounds shall be installed along the fence between gate openings, at locations shown on the Plans. Electrical grounds shall also be installed where a power line passes over the fence.

### **3.8 TEMPORARY FENCE**

- A. The Contractor shall furnish, install, and maintain a 6-foot temporary fence to provide a continuously secure and enclosed area around the project site during construction activities. Temporary fencing shall be chainlink with galvanized steel posts constructed of new materials or previously used chainlink fence in good condition. Posts shall be galvanized steel pipe of adequate diameter to provide rigidity. Posts shall be mounted on concrete footings or driven into the

ground such that the fence cannot be knocked down by wind or pedestrians. Fabric shall be woven vinyl coated or galvanized steel mesh. Provide in continuous lengths to be wire tied to fence posts or prefabricated into modular pipe-framed fence panels.

Install temporary fence in locations as proposed by the Contractor and approved by the Engineer that maintains job site security and meets Owner's needs. Install posts at 10-foot maximum spacing and securely fasten fabric. There shall be less than 6 inches of clearance between fence fabric and grade. Posts and fabric shall be secured such that they cannot be easily moved or separated for pedestrian access. Install fence in straight lines with no gaps. Temporary security fencing shall be maintained during working and non-working hours. Maintain fence in good condition and immediately repair any damaged fence sections.

Temporary fence shall be replaced by permanent fence prior to project completion as detailed in the drawings.

**END OF SECTION**

**SECTION 33 05 00**  
**COMMON WORK RESULTS FOR UTILITIES**

**PART 1 – GENERAL**

**1.1 SCOPE OF WORK**

- A. Provide all labor, materials, equipment, and test equipment necessary to furnish, install, and place into operation the new underground electrical distribution system as indicated on the drawings, specifications, and staking sheets.
- B. Demolish the existing underground electrical distribution system as indicated on the drawings, specifications, and staking sheets.
- C. Cooperate with all others involved in the project, with due regard to their work, to promote rapid completion.
- D. Prior to commencing with the underground electrical distribution system upgrade, the Contractor shall prepare a schedule for the construction activities associated with the installation of the new underground electrical distribution system. The schedule shall identify the routing of the new system and the means to maintain electrical service to the existing electrical services.
- E. Local Conditions: The Contractor shall thoroughly familiarize himself with the work as well as the local conditions under which the work is to be performed. Schedule work with regard to seasons, weather, climate conditions, and all other local conditions which may affect the progress and quality of work.
- F. All construction activity shall be closely coordinated with the City of Akhiok. The existing underground electrical distribution system serves existing customers. At all times service shall be maintained to the customers except when outages are required for service conversion or other construction related activities. All outages shall be coordinated in advance with the City and shall be kept as short as possible.
- G. The City maintains an existing buried water distribution system. The system is constructed primarily of small diameter PVC lines. As built for the existing system are not available. The likelihood of exposing and/or damaging the existing water distribution system during installation of the new electrical system is high. The contractor shall coordinate with the city and keep necessary materials on hand to perform repairs to the existing water distribution system on an as-needed basis. The contractor shall be fully responsible for the cost of all labor and materials necessary for repair of existing utilities damaged as a result of contractor activities. No additional payment will be made to the contractor for repairs to existing utilities damaged as a result of contractor activities.

- H. At certain times, roads will be required to be closed or construction activities will interfere with pedestrian or property owner access. All City requirements for road closing or limited access shall be followed at all times. Obtain a copy of the City requirements prior to beginning construction. Any required signs, barricades, or other equipment required for traffic control shall be provided by the Contractor. All activities that limit access to public or private property or right of ways shall be coordinated with the City of Akhiok.
- I. See Division 1 of which contain information and requirements that apply to work specified herein.
- J. As part of the upgrade of the underground distribution system at the airport, existing Federal Aviation Administration (FAA) navigational aids will have the electrical service converted from the existing electrical distribution system to the new electrical distribution system. All preliminary work that can be accomplished prior to converting the electrical services shall be accomplished in order to keep the electrical outage to the equipment to a minimum. The contractor shall coordinate with the FAA and the Alaska Department of Transportation (DOT) for all work on or around the airport. The Contractor shall prepare, complete, and provide all notices for air traffic, in the form of NOTAMs or other notifications that the FAA may require, to the FAA and DOT when the existing navigational aids are affected.

## **1.2 RELATED REQUIREMENTS**

- A. This section applies to all Division 33 work.
- B. See Division 1 which contains information and requirements that apply to work specified herein.

## **1.3 TELEPHONE SERVICE**

- A. The contractor shall be responsible for the cost of repairing any damage to the telephone system resulting from contractor activities.

## **1.4 CODES AND STANDARDS**

- A. Codes: Perform all work in strict accordance with all applicable national, state, and local codes; including, but not limited to the latest legally enacted editions of the following specifically noted requirements:
  - 1. NFPA 70, National Electric Code – NEC.
  - 2. ANSI-C2, National Electrical Safety Code – NESC.
  - 3. RUS Bulletin 1728F-806.

- B. Standards: Reference to the following standards infers that installation, equipment, and materials shall be within the limits for which it was designed, tested, and approved, in conformance with the current publications and standards of the following organizations:
1. American National Standards Institute – ANSI.
  2. American Society for Testing and Materials – ASTM.
  3. Factory Mutual – FM.
  4. Institute of Electrical and Electronics Consultants – IEEE.
  5. National Electrical Contractors Association – NECA.
  6. National Electrical Manufacturers' Association – NEMA.
  7. National Fire Protection Association – NFPA.
  8. Underwriters Laboratory – UL
- C. If the Contractor observes that the Drawings and/or Specifications are at variance with such codes and regulations, he shall promptly notify the Authority in writing.
- D. Should the Contractor perform any work in non-compliance with the above-mentioned codes and regulations without such notice to the Authority, the Contractor shall bear all costs arising therefrom.
- E. The above codes are referenced to establish minimum requirements and wherever this specification requires higher grades of material or workmanship than required by the codes, this specification shall prevail.

## **1.5 SPECIFIC TERMINOLOGY**

- A. Streamlining: In many instances, the products, reference standards, and other itemized specifications have been listed without verbiage. In these cases, it is implied that the Contractor shall provide the products and perform in accordance with the references listed.
- B. The word "Contractor" as used in Division 33 specifications shall mean "Electrical Contractor."
- C. The word "General Contractor" as used in Division 33 specifications shall mean the Contractor responsible for the project. The General Contractor may or may not be the same entity as the Contractor.
- D. "Furnish" means to purchase material as shown and specified, and cart the material to an approved location at the site or elsewhere as noted or agreed to be installed by supporting crafts.

- E. "Install" means to set in place and connect, ready for use and in complete and properly operating finished condition, material that has been furnished.
- F. "Provide" means furnish all products, labor, sub-contracts, and appurtenances required and install to a complete and properly operating, finished condition.
- G. "Accessible" means arranged so that an appropriately dressed man 6-foot 2 inches tall, weighing 250 pounds, may approach the area in question with the tools and products necessary for the work intended, and may then position himself to properly perform the task to be accomplished, without disassembly or damage to the surrounding installation.
- H. "Serviceable" means arranged so that the component or product in question may be properly removed and replaced without disassembly, destruction, or damage to the surrounding installation.
- I. "Product" is a generic term which includes materials, equipment, fixtures, and any physical item used on the project.

#### **1.6 SPECIAL CONDITIONS**

- A. Contactor shall ensure that appropriate safety measures are implemented and that all workers are aware of the potential hazards from electrical shock associated with working on or near energized medium voltage distribution equipment.
- B. All electrical work shall be performed by Alaska licensed Journeyman Electricians or licensed Apprentice Electricians under the direct supervision of a licensed Electrical Administrator, unlimited line work outside.
- C. Submit written proof of all Journeyman and Apprentice Electricians' current licenses.
- D. Perform work with skilled craftsmen specializing in said work. Install all materials in a neat, orderly, and secure fashion, as required by these specifications and commonly recognized standards of good workmanship.

#### **1.7 DRAWINGS, SPECIFICATIONS, STAKING SHEETS, & SYMBOLS**

- A. The Drawings, Specifications, and Staking Sheets are complementary; what is shown on one is as binding as if called for in both. Do not scale the Drawings. Locations of devices, fixtures, and equipment are approximate unless dimensioned.
- B. The Drawings are partly diagrammatic and do not show precise routing of circuits or exact location of all products, and may not show in minute detail all features of the installation; however, provide all systems complete and in proper operating order.

- C. Drawing symbols used for basic materials, equipment and methods are commonly used by the industry and should be universally understood. Special items are identified by a supplementary list of graphical illustrations, or called for on the Drawings or in the specifications.

## **1.8 SUBMITTALS**

- A. Provide submittals within 30 days of Notice to Proceed (NTP) for all products and systems described in Division 33 specifications and/or shown on the Drawings and Staking Sheets to demonstrate compliance with the requirements of the project. Furnish submittals in the manner described herein, and in Division 1. In addition, include data for review, and organize data, as noted below:
  - 1. Specific reference and/or drawings reference for which literature is submitted for review with an index, following specification format, and item by item identification.
  - 2. Manufacturer's name and address, and supplier's name, address, and phone number.
  - 3. Catalog designation or model number with rough-in data and dimensions.
  - 4. Operation characteristics.
  - 5. Complete customized listing of characteristics required. Indicate whether item is "As Specified" or "Proposed Substitution." Indicate any deviations on submittal. Mark out all non-applicable items. The terminology "As Specified" used without this customized listing is not acceptable.
  - 6. Wiring diagrams for the specific system.
  - 7. Coordination data to check protective devices.
  - 8. Working construction Drawings (Shop Drawings).
- B. Submittal Data:
  - 1. Transformers.
  - 2. Electrical Utilities Material and Equipment.
  - 3. Lighting Fixtures, Lamps and Accessories
  - 4. Service Disconnects.
  - 5. Raceways, Fittings, and Supports.
  - 6. Conductors.
  - 7. Wire and Cable.
  - 8. Additional items that may be listed on the Schedules, Bill of Materials, specified, or on the drawings.

- C. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents. Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provision of a complete and satisfactory working installation of equal quality to system specified is the sole responsibility of the Contractor.

## **1.9 COORDINATION**

- A. Electrical Drawings are partly diagrammatic and it is not the intent to show in detail all features of work or exact physical arrangement of equipment. Equipment shall be located and installed so that it will be readily accessible for operation and maintenance.
- B. If equipment is placed incorrectly with respect to accessibility and required operating clearances, the work affected shall be removed and re-installed at the Contractor's expense.
- C. The Contractor shall schedule his work to coordinate through the General Contractor and with all other subcontractors, power and telephone utilities in order to maintain job progress and to avoid conflicts with equipment installation or work done by the various trades.
- D. The Contractor is responsible for maintaining required operating clearances. Should the Contractor become aware of operating clearances violation or if the installation of electrical equipment as shown produces an operating clearances violation, notify the Authority in writing before proceeding with the installation.

## **1.10 DEVICES AND EQUIPMENT**

- A. Devices and equipment shall be listed for the intended service. Manufacturers or model numbers shown on the drawings or in the specifications is provided to indicate the required features. Substitutions of equivalent items will be accepted unless items specifically indicate no substitutes.
- B. Install all equipment such that the minimum required operating clearances are maintained.
- C. Protect all materials and equipment during the entire duration of construction work against contamination or damage. Replace or repair to original manufactured condition any items damaged during construction. Immediately report to the Authority any items found damaged prior to commencing construction.



### **1.11 INSPECTIONS**

- A. Contact the Authority a minimum of two weeks prior to completion of work to schedule a substantial completion inspection. The Authority will generate a punch list of corrective action items during the inspection. Work will not be considered complete until all corrective action items in the Authority's punch list have been satisfactorily completed and photographic or other positive documentation has been provided to the Authority.
- B. Submit certification for tests and inspections required by the electrical inspector having jurisdiction. Certificates of approval that are issued shall be transmitted to the Authority.
- C. The Contractor shall pay all costs and fees required by governing / reviewing agencies.
- D. Cooperate with the Authority and provide assistance at all times for the inspection of the electrical work performed under this Contract. Remove covers, operate machinery, or perform any reasonable work which, in the opinion of the Authority, will be necessary to determine the completeness, quality, or adequacy of the work.

### **1.12 STAKING SHEETS**

Staking sheets are included as part of the Contract Documents. RUS Units referenced have not been included unless the Unit has been modified by this project. Contractor shall obtain copies of the RUS Units and keep them on the jobsite at all times for reference.

### **1.13 RECORD DRAWINGS & STAKING SHEETS**

- A. Reference requirements stated elsewhere in these specifications.
- B. In addition to other requirements, mark up a clean set of Drawings and Staking Sheets as the work progresses, to show the dimensioned location and routing of all electrical work which will become permanently concealed. Show complete routing and sizing of any significant revisions to the systems shown.
- C. Maintain Record drawings and Staking Sheets in an up-to-date fashion in conjunction with the actual progress of installation. "Record" progress mark-ups shall be available on-site for examination by the Authority at all times.
- D. Prepare wiring diagrams on reproducible media using AutoCAD V.2012 or later for all individual special systems as installed. Identify all components and show all wire and terminal numbers and connections.

- E. Prior to substantial completion, deliver these drawings and staking sheets and their electronic files in both .dwg and full size .pdf format to the Authority and obtain a written receipt.

#### **1.14 PROJECT COMPLETION AND DEMONSTRATION**

- A. Division 1 - Closeout Requirements.
- B. Tests: During final inspection, conduct operating tests for approval.
- C. Demonstrate installation to operate satisfactorily in accordance with requirements of Contract Documents. Should a portion of installation fail to meet requirements of Contract Documents, repair or replace items until compliance is attained.
- D. Have instruments available for measuring voltage and current values and for demonstration of continuity, ground, or open circuit conditions. Furnish personnel to assist in taking measurements and making tests.
- E. In the event that systems are not complete and fully operational at the time of Final Inspection, all costs of any subsequent inspections shall be borne by the Contractor at no additional cost to the Authority.

#### **1.15 TESTS**

- A. Division 1 - Closeout Requirements.
- B. The Contractor shall be responsible for field testing all electrical systems and equipment shown on the drawings.
- C. The Contractor shall prepare and submit a test plan for review and approval by the Authority.
  - 1. Field testing cannot take place without an approved test plan.
    - a. The Test Plan shall outline the tests planned for each item of equipment.
    - b. The Test Procedures shall identify the test equipment to be utilized, the action of each test step and the expected result so that a test technician who has no knowledge of the details of the equipment design shall be able to successfully conduct the test.
  - 2. In the presence of the Authority,
    - a. Test the equipment and electrical circuits for proper connection, continuity, and absence of undesirable shorts and grounds.
    - b. Test wire and cable installation, when complete.

- c. Check for continuity, visual damage, marking, and proper phase sequence before performing insulation testing.
- D. Report all test results in writing. Where tests disclose problem areas, retest after the defect has been corrected.
- E. Any rework or repair of equipment required during or as a result of the testing shall be done by the Contractor at no additional expense to the Authority.
- F. The Contractor shall furnish to the Authority at the time the project is accepted, any special tools, calibration equipment, and testing apparatus specified or furnished by the equipment manufacturer for the proper adjustment and maintenance of the electrical equipment provided.

### 1.16 CERTIFICATE OF COMPLETION

- A. Submit, at time of request for Final Inspection, a completed letter in the following format:

I, \_\_\_\_\_(Name), of \_\_\_\_\_(Firm), certify that the Electrical Work is complete in accordance with Contract Drawings and Specifications, and authorized change orders (copies of which are attached hereto), and will be ready for Final Inspection as of \_\_\_\_\_(Date). I further certify that the following Specification requirements have been fulfilled:

1. Megger readings performed, \_\_\_\_ copies of log attached.
2. Operating manuals completed and instructions of operating personnel performed \_\_\_\_\_(Date).
3. Record drawings up-to-date and ready to deliver to the Authority.
4. Emergency systems tested and fully operational.
5. All other tests required by Specifications have been performed.
6. All systems are fully operational. Project is ready for Final Inspection.

SIGNED: \_\_\_\_\_ DATE: \_\_\_\_\_

TITLE: \_\_\_\_\_

### PART 2 – MATERIALS

Not used.

### PART 3 – EXECUTION

Not used.

**END OF SECTION**

**SECTION 33 56 13**  
**ABOVE GROUND FUEL STORAGE TANKS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and the Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Follow all provisions of Section 33 05 00, "Common Work Results for Utilities".
- C. See project drawings and Section 01 64 00, "Receipt of Owner Furnished Materials" for tank quantities and locations.
- D. OWNER provided tank shop drawings will be provided upon request once they are available from the Tank Manufacturer.

**1.2 WORK INCLUDED**

- A. This section includes the furnishing of all labor, tools, equipment, and materials necessary to fabricate, coat, package for shipment, deliver, and install the appropriate number of the following tanks in accordance with the awarded Contract schedule(s):
  - 1. CONTRACTOR PROVIDED six thousand (6,000) nominal gallon, double-wall, horizontal, steel, skid mounted, above ground bulk storage tank for diesel service. Outer tank dimensions shall be in accordance with the Contract Drawings (UL142).
  - 2. ALL TANK APPURTANCES for Contractor provided tanks.

**1.3 SUBMITTALS**

- A. Submit each item specified in this Section according to the Conditions of the Contract and Division 01 Specification Sections and Section 33 05 00, "Common Work Results for Utilities".
- B. Submit shop drawings for the following components:
  - 1. Submittals shall include all tank appurtenances including but not limited to tank liquid level indicators, normal/emergency vents, isolation valves, sample hatches, overfill prevention valves, high/low level alarms, etc. as listed in these specifications and shown on the drawings.

2. Submit tank shop drawings, prior to fabrication, showing all principal dimensions of the tanks, details and locations of all accessories, penetrations and appurtenances, thickness of sheets and plates, details of joints and welds and description of coating system. All deviations from these Specifications and the Contract Drawings shall be clearly shown and identified on the shop drawings.
3. Submit material lists with catalog cuts for any proposed substitutions.
4. Quality Control Plan.
5. Tank Coating Schedule.

#### **1.4 REFERENCED STANDARDS**

- A. American National Standards Institute (ANSI):
  1. B1.20.1, Pipe Threads, General Purpose (Inch).
- B. American Society for Testing Materials (ASTM):
  1. A53, Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  2. A105, Specification for Forgings, Carbon Steel, for Piping Components.
  3. A106, Standard for Seamless Carbon Steel Pipe.
  4. A181, Forgings, Carbon Steel, for General Purpose Piping.
  5. A183, Carbon Steel Track Bolts and Nuts.
  6. A234, Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- C. American Society of Mechanical Engineers (ASME):
  1. ASME B31.4, Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids.
  2. ASME B31.9, Building Services Piping.
  3. B16.3, Malleable-Iron Threaded Fittings.
  4. B16.5, Pipe Flanges and Flanged Fittings.
  5. B16.34, Valves—Flanges, Threaded, and Welding End.

6. B16.39, Pipe Unions, Malleable Iron Threaded.
- D. Underwriters Laboratories (UL):
  1. UL 142, Steel Aboveground Storage Tank Installation & Testing.
- E. National Fire Protection Association (NFPA):
  1. NFPA 30/30A Flammable and Combustible Liquids Code.

## 1.5 QUALITY ASSURANCE

- A. Piping, fittings, and valves manufactured or procured from sources beyond territorial boundaries of the United States will not be acceptable.
- B. The installing contractors shall have the necessary knowledge, skills and equipment to enable proper and safe above ground storage tank installation.
- C. Tank Handling: To prevent damage to the tank, equipment to handle the vessel shall be of adequate size to lift and lower the tank without dropping or dragging.
- D. Tank Storage: If the tank must be temporarily stored prior to installation, it shall be placed in an area away from activity where tank damage could occur. Factory-installed protective padding material should remain in place until the tank is ready to be lowered in the excavation.
- E. Comply with all applicable city and state codes and ordinances. In case of conflict with drawings or specifications, the codes and ordinances shall govern.
- F. Tank manufacturers shall have a minimum 10 years of experience including the manufacture of at least five similar tanks in the previous three years.
- G. Tank Leak Test: Provide tank integrity testing in the form of a hydrostatic / air test or other approved method in accordance with UL 142. **Provide additional air test after tank is installed on site in accordance with the IFC.**

## 1.6 DRAWINGS

- A. Contract Drawings are diagrammatic and show the general design, arrangement, and extent of the facility. Due to the small scale of the drawings it is not possible to show all offsets, fittings, and accessories which may be required. Contractor shall carefully investigate the field conditions and work requirements for all trades and arrange accordingly.
- B. Contractor is responsible for verifying drawing dimensions by making field measurements and preparing separate shop drawings.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Materials and apparatus shall be new unless otherwise specified, and each shall have all necessary accessories to make it functionally complete. All items of the same type shall be of the same manufacturer.
- B. Tank manufacturer to provide shop-welded standoffs as required for bolting on appurtenances in the field.
- C. FIELD WELDING TO TANKS IS PROHIBITED.**

### **2.2 6,000 GALLON DOUBLE WALL AST**

- A. 6,000 gallon tanks shall be CONTRACTOR furnished and Contractor installed. All tank appurtenances shall be provided by the Contractor and installed in the field.
- B. Tank Appurtenances for 6,000 Gallon Tank:
  - 1. Provide all tank appurtenances as required by applicable codes. Appurtenances shall include fill tubes & internal piping.
  - 2. Labeling: Provide labeling on tank in accordance with the International Fire Code and NFPA 704, including but not limited to product identification, hazard identification, tank numbering, compartment storage capacity, etc.
  - 3. Provide atmospheric and emergency venting for the storage tank in accordance with UL 142.
    - a. Primary Tank Combination Atmospheric Vent/Alarm: Threaded 3" pressure/vacuum vent with integral whistle overfill alarm set to activate at 6 oz/sq. inch pressure. Provide Morrison Bros., Co Fig 922, or approved equal. Set whistle to start at 90% of tank capacity.
    - b. Emergency Vents: Aluminum body, flanged connection emergency vent set to open at 16 oz/sq. inch pressure. Emergency vent shall be sized in accordance with UL142. Morrison Bros, Co. Model 244F, with flanged adapter, or approved equal. Loose manholes not permitted.
  - 4. Liquid Level Clock Gauge: Stainless Steel float operated clock gauge with readout in feet and inches, up to 12 feet in 1/4" increments installed in stilling well. Morrison Bros, Co. Model No. 818, or approved equal.
  - 5. Gauge Hatch: Brass cap, brass adapter, and brass chain, Buna-N gasket, 2-inch FPT connection. Morrison Figure 307, or approved equal.



6. Fill drop tube, 3-inch shop fabricated.
7. See project drawings for further specifications and requirements.

### **2.3 COATINGS FOR EXTERNAL TANK SURFACES**

A. The tank exterior, saddles, and skids shall be shop coated in accordance with the following specification and in accordance with the coating manufacturer's recommendations.

1. Surfaces to be coated: All exterior surfaces of tanks, including bottom of vertical tanks, nozzles, skids, pipe supports, fittings and pipe.
2. Surfaces not coated: Flange and nozzle faces, penetration threads, flange and manhole bolts.
3. Surface Preparation: All surfaces to be coated shall be sand blasted in accordance with the Structural Steel Painting Council SSPC-SP10, near white blast criteria. Alternate methods of surface preparation which provide equal, or better, surface preparation will be considered. Identify proposed alternate surface preparation methods, if any, on bid.
4. Coatings:
  - a. Prime Coat- Devoe Catha-Coat 302H (3 mils minimum dry finish thickness (DFT))
  - b. Intermediate Coat – Devoe Bar-Rust 236 (5-6 mils minimum DFT)
  - c. Top Coat- Devoe Devthane 389 (2-3 mils DFT)
5. Coat Colors: All coats shall be contrasting colors. Top coat color shall be white.
6. Where field touch up of paint is required, wire brush area to bare metal and paint with prime, intermediate and top coats as indicated above.
7. Touch-up Paint: Provide 10 gallons each (30 gallons total) of prime, intermediate, and top coat coatings. The touch-up coating shall be color matched to coatings applied to the tanks.

B. Coating Application

1. The Contractor shall submit to the Project Manager, for his/her approval, the tank manufacturer's proposed painting schedule. At minimum, this shall include the spreading rate in square feet per gallon for each coat, minimum dry film thickness for each coat, application temperature, curing time and temperature, humidity limits, and paint and paint thinner to be used for the final coat. The painting schedule shall be in accordance with the paint manufacturer's recommendation and this specification, and shall be approved, in writing, by the Project

Manager prior to application.

2. If paint is diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. Deficiencies in film thickness shall be corrected by the application of an additional coat(s) of paint.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION OF ABOVEGROUND TANK**

- A. General: Comply with current edition of Steel Tank Institute Standard No. R912 and R931, Contract Drawings and manufacturers written instructions.
- B. Site Preparation: Site shall be properly graded to provide drainage of surface water and prevent stagnant water under or around the tank.
- C. The tank shell shall be maximum 12-inches above finished grade. Infill between tank foundation elements with classified fill as required.
- D. Testing: Before placing tank in service, conduct on-site air pressure tests on both the inner tank and the secondary containment in accordance with UL 142 and other applicable codes.
- E. Touch up painting: After final placement and setting of tank, and after all connections to/from the tank and all appurtenances have been installed, tank paint is to be touched up using the touch up paint provided by the manufacturer or as indicated under tank coatings requirements in this section.
- F. Tank shall be electrically grounded.

**END OF SECTION**

## **SECTION 33 61 14**

### **PEX HYDRONIC ENERGY DISTRIBUTION**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Pre-insulated arctic pipe system for not to exceed 200F glycol/water service at 90 psi in direct burial installation. Provide press-fit couplings, adapters, sleeves, shells/couplings, end caps, insulation, shrink sleeves, and all other components required for a complete installation. Heat trace and alarm wires are not required. Install all piping in accordance with manufacturer's instructions.

##### **1.2 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Requirements for Mechanical.
- B. Section 23 21 13 - Hydronic Piping.
- C. Section 33 61 24 – Steel Hydronic Energy Distribution.

##### **1.3 REFERENCES**

- A. ASTM – American Society for Testing and Materials:
  - 1. ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
  - 2. ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems.
  - 3. ASTM F2080 – Standard Specification for Cold-Expansion Fittings with Metal Compression-Sleeves for Cross-Linked Polyethylene (PEX) Pipe.
- B. CSA – Canadian Standards Association:
  - 1. CSA B137.5 – Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.
- C. DIN – German Institute for Standardization (Deutsches Institut für Normung):
  - 1. DIN 4726 – Plastic Piping Used in Warm Water Floor Heating (Warmwasser-Fußbodenheizungen und Heizkörperanbindungen - Rohrleitungen aus Kunststoffen).
- D. ISO – International Organization for Standardization:
  - 1. ISO 9001 – Quality Management Systems – Requirements.
- E. ISO – International Organization for Standardization:
  - 1. ISO 9001 – Quality Management Systems – Requirements.
- F. PPI – Plastic Pipe Institute
  - 1. PPI TR-3 – Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe

#### **1.4 SYSTEM DESCRIPTION**

- A. PEX to be designated as PEXa and be manufactured by the high-pressure peroxide (Engel) method.
- B. Provide fittings where required and as indicated on the drawings.

#### **1.5 SUBMITTALS**

- A. Provide submittals for all products and systems described herein. Provide in accordance with the requirements of Section 23 05 00 - Common Work Results for Mechanical and Division 1.
- B. Product Data:
  - 1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information, specifications, and installation instructions.
  - 2. Joint Kits: Submit manufacturers catalog information, specifications, and installation instructions.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### **1.6 CLOSEOUT SUBMITTALS**

- A. Division 1 - Closeout Requirements.
- B. Project Record Documents: Record actual locations of piping

#### **1.7 QUALITY ASSURANCE**

- A. Division 1 – Quality Control
- B. Install and test products in accordance with manufacturer's installation instructions, including storage and handling, installing pipe, fittings, and accessories, building entries, field insulation kits, and testing.

#### **1.8 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing products specified in this section.
- B. Fabricator or Installer: Company specializing in performing Work of this section.

#### **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Division 1 - Material and Equipment: Transportation and Handling.
- B. Deliver pipe in banded coils cut to the length required. The coils shall remain strapped or banded while in storage and should not be uncoiled until time of installation.
- C. Accept materials on site with labeling in place. Inspect for damage.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation. Maximum accumulated UV exposure to not exceed one year for outer jacket.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

### **1.10 FIELD MEASUREMENTS**

- A. Verify field measurements prior to installation.

### **1.11 WARRANTY**

- A. Division 1 - Closeout Requirements: Warranties.
- B. The pipe manufacturer shall warrant the crosslinked polyethylene carrier pipe to be free from defects in material and workmanship for a period of twenty-five (25) years.

## **PART 2 - PRODUCTS**

### **2.1 CARRIER PIPE**

- A. Crosslinked polyethylene (PEX) carrier pipe shall conform to the requirements of one or more of the following: ASTM F876, ISO 15875 or DIN 16892 and/or DIN 16893. PEX carrier pipe shall have a minimum degree of crosslinking of 70% when tested in accordance with ASTM D2765, Method B
- B. Oxygen Diffusion Barrier: Coextruded barrier layer that limits oxygen diffusion through the PEX carrier pipe to less than 0.32 mg/(m<sup>2</sup>\*day) at 40°C temperature, as defined by DIN 4726, shall be applied to the PEX carrier pipe.

### **2.2 INSULATED PIPE SYSTEM**

- A. Provide single carrier pipe, diameter as indicated. Continuous corrugated seamless polyethylene outer jacket. Foamed in place polyurethane insulation (0.015 btu/hr-ft-f). Insulation to completely fill the annular space between the carrier pipe and jacket to create a fully bonded system that will expand and contract as a unit. Tees, elbows, couplings and sleeves to be hot forged brass or cast bronze. Weld end adapters to be carbon steel. All connections to be with press-fit compression fittings except where indicated as welded. Threaded or bolted compression fittings will not be accepted. Rehau Insulpex, Perma-Pipe PEX-Gard, Rovanco Rhinoflex or approved equal

### **2.3 JOINT KITS**

- A. Straight and tee joint kits to include polyethylene shells and Canusa HDPE (or equal) shrink casings to form a continuous watertight jacket. Insulation to be flexible closed cell foam sheets or rigid urethane foam half shells. Note that two-part pour-in-place urethane foam will not be accepted.
- B. Provide complete joint insulation kits including all required attachments, sealing rings, heat shrink tape, etc. required for installation.
- C. Kits at reducing tees and at PEX to steel connections to allow for outside diameter (O.D.) variations. Any difference in O.D. between pipe, fittings and joint kits must not exceed the allowable shrink tolerance of the supplied heat shrink casing.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Division 1 – Work Covered by Contract Documents: Coordination.

### **3.2 PREPARATION**

- A. Remove debris and dirt on inside and outside before assembly.
- B. Keep open ends of pipe free from debris and dirt. Protect open ends with temporary plugs or caps.

### **3.3 INSTALLATION - PIPING SYSTEMS**

- A. Install in accordance with manufacturer's instructions.
- B. Install piping to allow for expansion and contraction and for differential ground movement without stressing pipe, joints, or connected equipment.
- C. Install insulation joint kits in accordance with manufacturer's instructions.

### **3.4 TESTING**

- A. See Section 23 21 13 - Hydronic Piping.

### **3.5 SYSTEM START-UP**

- A. See Section 23 21 13 - Hydronic Piping.

**END OF SECTION**

**SECTION 33 61 24**  
**STEEL HYDRONIC ENERGY DISTRIBUTION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Pre-insulated piping, elbows, and insulation joint kits for exterior above and below grade hydronic piping.

**1.2 RELATED SECTIONS**

- A. Section 23 05 00 – Common Work Requirements for Mechanical.
- B. Section 23 05 29 - Hangers and Supports for Piping and Equipment.
- C. Section 23 21 13 - Hydronic Piping.
- D. Section 33 61 14 – PEX Hydronic Energy Distribution.

**1.3 REFERENCES**

- A. American Society of Mechanical Engineers:
  - 1. ASME B31.1 - Power Piping.
  - 2. ASME B31.9 - Building Services Piping.
  - 3. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.
- B. ASTM International:
  - 1. ASTM A53B - Standard Specification for Pipe, Steel, Black and Hot-Dipped.
- C. American Welding Society:
  - 1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
  - 2. AWS D1.1 - Structural Welding Code - Steel.
- D. Manufacturers Standardization Society of the Valve and Fittings Industry:
  - 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
  - 2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

**1.4 SYSTEM DESCRIPTION**

- A. Provide flanges and couplings at locations requiring servicing, and as indicated on the drawings.
- B. Provide pipe hangers and supports in accordance with Drawings and specifications.

**1.5 SUBMITTALS**

- A. Provide submittals for all products and systems described herein. Provide in accordance with the requirements of Section 23 05 00 - Common Work Results for Mechanical and Division 1.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Joint Kits: Submit manufacturers catalog information.

C. Welders' Certificate: Include welders' certification of compliance in accordance with Quality Assurance below.

**1.6 CLOSEOUT SUBMITTALS**

A. Division 1 - Closeout Requirements.

**1.7 QUALITY ASSURANCE**

A. Division 1 – Quality Control

B. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

C. Perform pipe welding with experienced welder with current API or equivalent certification for pipe welding in all positions.

**1.8 QUALIFICATIONS**

A. Manufacturer: Company specializing in manufacturing products specified in this section.

B. Fabricator or Installer: Company specializing in performing Work of this section.

**1.9 DELIVERY, STORAGE, AND HANDLING**

A. Division 1 - Material and Equipment: Transportation and Handling.

B. Accept materials on site with labeling in place. Inspect for damage.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

**1.10 FIELD MEASUREMENTS**

A. Verify field measurements prior to fabrication.

**1.11 WARRANTY**

A. Division 1 - Closeout Requirements: Warranties.

**PART 2 - PRODUCTS**

**2.1 CARRIER PIPE**

A. ASTM A53B, ERW black steel, Schedule 40, with nominal 1.5" polyurethane insulation and HDPE jacket, Perma-Pipe Xtru-Therm, Rovanco, or approved equal.



- B. Pre-fabricated elbows, tees, and Z-bends to be equivalent construction to straight pipe using ASTM A234 seamless carbon steel butt weld fittings. Standard elbows and tees to have nominal 3' long tangents or as indicated on Drawings.
- C. Make custom fabrications in accordance with details on the Drawings. All field joints to be configured for straight butt welds unless specifically indicated otherwise.

## **2.2 JOINT KITS**

- A. Straight and tee joint kits to include polyethylene shells and Canusa HDPE (or equal) shrink casings to form a continuous watertight jacket. Insulation to be flexible closed cell foam sheets or rigid urethane foam half shells. Note that two-part pour-in-place urethane foam will not be accepted.
- B. Provide complete joint insulation kits including all required attachments, sealing rings, heat shrink tape, etc. required for installation.
- C. Kits at reducing tees and at PEX to steel connections to allow for outside diameter (O.D.) variations. Any difference in O.D. between pipe, fittings and joint kits must not exceed the allowable shrink tolerance of the supplied heat shrink casing.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Division 1 – Work Covered by Contract Documents: Coordination.

### **3.2 PREPARATION**

- A. Remove scale and dirt on inside and outside before assembly and welding.
- B. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

### **3.3 INSTALLATION - PIPING SYSTEMS**

- A. Install in accordance with manufacturer's instructions.
- B. Install piping to allow for expansion and contraction and for differential ground movement without stressing pipe, joints, or connected equipment.
- C. Install insulation joint kits in accordance with manufacturer's instructions.

### **3.4 TESTING**

- A. See Section 23 21 13 - Hydronic Piping.

### **3.5 SYSTEM START-UP**

- A. See Section 23 21 13 - Hydronic Piping.

**END OF SECTION**

## **SECTION 33 71 20**

### **UNDERGROUND ELECTRICAL DISTRIBUTION**

#### **PART 1 - GENERAL**

##### **1.1 SCOPE**

- A. This Specification provides for the construction of underground power distribution facilities using cable-in-conduit for primary and secondary conductors. All construction work shall be done in a thorough and workmanlike manner in accordance with the Drawings, Staking Sheets, and specifications, and the standards specified herein.
- B. Any modified RUS Construction Units or any new construction units are included on the Drawings. Any standard RUS Construction Units referenced on the Drawings or Staking Sheets shall be obtained by the Contractor. The lack of having the correct RUS construction unit drawing will not be acceptable as an excuse for an incorrect installation.
- C. The electric utility is the City of Akhiok, herein after referred to as the electric utility or utility.

##### **1.2 RELATED REQUIREMENTS**

- A. Division 1 Specifications.
- B. Division 33 Specifications.

##### **1.3 CODES AND STANDARDS**

- A. Codes: Perform all work in strict accordance with all applicable national, state, and local codes; including, but not limited to the latest legally enacted editions of the following specifically noted requirements:
  - 1. ANSI-C2, National Electrical Safety Code – NESC.
  - 2. RUS Bulletin 1728F-806, Specifications and Drawings for Underground Electric Distribution, the Staking Sheets, Drawings and Specification, and Construction Drawings.

##### **1.4 QUALITY CONTROL**

- A. All material shall be Rural Utility Service (RUS) approved and accepted.
- B. All construction work shall be done in a thorough and workman-like manner in accordance with the latest adopted edition of ANSI C2, National Electric Safety Code (NESC), RUS Bulletin 1728F-806, Specifications and Drawings for Underground Electric Distribution, the

Staking Sheets, Specifications, and Construction Drawings, and local regulations. The Contractor shall obtain a copy of these specifications and shall keep them on the jobsite at all times.

- C. This specification supplements the references identified above. Where there is a conflict, the more stringent condition shall apply. In general, standard RUS construction unit drawings shall be used. Modified construction units may be included on the Drawings or Staking Sheets and be identified with a modifier.

## **1.5 SUBMITTALS**

Shop Drawings and Product Data: Submit shop drawings and product data in accordance with contract requirements. At a minimum, submit the following:

- A. Primary cable.
- B. Primary load break terminations.
- C. Primary load break surge arrestors.
- D. Cold shrink for sealing HDPE duct.
- E. Schedule 80 PVC conduit, fittings, and elbows.
- F. Schedule 40 HDPE conduit, fittings, and elbows.
- G. Liquid tight flexible non-metallic conduit and fittings.
- H. Conduit supports.
- I. Hardware.
- J. Primary sectionalizing cabinet and extensions.
- K. Primary sectionalizing cabinet marker.
- L. Transformer ground sleeves.
- M. Secondary URD cable.
- N. Secondary pedestals.
- O. Secondary cable terminations.
- P. Grounding material.
- Q. Meter bases.
- R. Cable route marking tape.

- S. Cable route markers.
- T. Equipment identification labels.
- U. Cable marking labels.
- V. Warning signs.
- W. Padlocks.
- X. Cable pulling lubricant.

## **1.6 INSPECTION AND INVENTORY OF BURIED UNITS**

Before any backfilling operations are begun, the Contractor and electric utility, or the Authority, shall jointly inspect all trenches, cable placement, risers, pedestals, and other construction not accessible after backfill and an inventory of units shall be taken. If corrections are required, a second inspection shall be made after completion of the changes.

## **1.7 STORAGE OF MATERIAL AND EQUIPMENT**

All material and equipment to be used in construction shall be stored so as to be protected from deteriorating effects of the elements. If outdoor storage cannot be avoided, the material and equipment shall be stacked on supports well above the ground line and protected from the elements as appropriate, and with due regard to public safety.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Products shall conform to the following requirements. Items of the same classification shall be identical including equipment, assemblies, parts, and components.
- B. Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacturer of the product.
- C. All hardware and fasteners shall be stainless steel.

### **2.2 PRIMARY LOAD BREAK TERMINATIONS**

Primary cable terminations in sectionalizing cabinets, transformers, and other pad mounted equipment shall be made using 200 amp load break separable connectors meeting the following requirements. The primary separable connectors shall be an assembly of load break elbows, load break feed through inserts, load break junctions, insulated standoff bushings, load break protective caps, and surge arresters.

- A. Meets the latest editions of the following standards:
  - 1. IEEE Std 386 standard for Separable Connectors.
  - 2. IEEE Std 404 standard for Cable Joints and Splices
  - 3. ANSI C119.4 Standard for Copper and Aluminum Conductor Connectors.
  - 4. AEIC CS5, CS6 and CS8 Standards for EPR Insulated Cables.
  - 5. ICEA S-94-649 Standard for EPR Insulated Cables
  
- B. Has the following voltage ratings and characteristics:
  - 1. Standard Voltage Class: 15 kV.
  - 2. Maximum Phase to Ground: 8.7 kV.
  - 3. AC 60 Hz 1 Minute Withstand: 35 kV.
  - 4. BIL and Full Wave Crest: 110 kV.
  - 5. Continuous current rating of 200 amps.
  
- C. Load break elbows shall be provided with a sheath seal to seal the junction between the cable and the load break elbow. Provide either a 3M Sheath Seal Kit 5831 or an integral jacket seal.
  
- D. Load break junctions shall be provided with U-straps.
  
- E. Load break elbows and surge arresters shall be provided with a test point and hold down bail.
  
- F. Insulated standoff bushings shall be provided with a stainless steel bracket.

### **2.3 PRIMARY LOAD BREAK SURGE ARRESTERS**

- A. Load break surge arrestors shall meet the following requirements.
  - 1. Metal oxide varistor elbow.
  - 2. IEEE Std. C62.11, Standard, Metal Oxide Surge Arrestors for AC Power Circuits.
  - 3. Shielded dead-front.
  - 4. Suitable for use on 200 amp load break interfaces.
  - 5. 9 kV MCOV, 7.65 kV.

## 2.4 PRIMARY SECTIONALIZING CABINETS

Sectionalizing cabinets shall be of fiberglass construction and shall meet the following requirements.

- A. Single or three-phase as required for the installation or indicated on the Drawings or Staking Sheets.
- B. Dimensions as follows:
  - 1. Three-phase cabinet shall be Nordic Fiberglass ND-552454, with 18" Extension, or approved equal.
  - 2. Single-phase cabinet shall be Nordic Fiberglass ND-362436, with 18" Extension, or approved equal.
- C. Lid shall open wide to allow easy access to junctions from the top and sides.
- D. Direct burial type incorporating a wide base flange.
- E. Produced from fire-retardant resin and a combination of chopped glass spray-up and hand lay-up using woven roving glass reinforcement.
- F. All hardware shall be stainless steel. Provide stainless steel or silicon bronze penta-head bolt. Provide provisions for pad locking.
- G. Extra heavy duty fiberglass construction. Provide a combination of chopped glass spray-up and hand lay-up woven roving glass reinforcement. Provide a smooth exterior finish with marine grade gel coat. Provide external ribs molded into the front, back and sides to provide side-wall strength.
- H. Mounting plates shall be stainless steel. Three-phase cabinets shall be provided with mounting plates to accommodate up to three 4-point 15 kV load break junctions with U-straps. Single-phase cabinets shall be provided with a mounting plate to accommodate one 4-point 15 kV load break junctions with U-straps. Three-phase cabinets shall be provided with six stainless steel parking stands above the mounting plates. Single-phase cabinets shall be provided with two stainless steel parking stands above the mounting plate.
- I. Provide 3/8" solid copper grounding system.
- J. The exterior shall be covered with Munsell green gel-coat, containing UV stabilizer, and providing superior weather-ability and resistance to ultraviolet attack.
- K. Meet ANSI C57.12.28 Pad-Mounted Enclosure Integrity Standard.

## 2.5 PRIMARY CABLE IN CONDUIT

All medium voltage conductors shall meet the following requirements:

- A. Voltage Rating: 15 kV.
- B. Acceptable manufacturers:
  - 1. Okonite.
  - 2. Cablec Corporation.
  - 3. Southwire.
  - 4. Approved equal.
- B. Medium voltage cable shall be suitable for primary underground distribution systems installed in underground ducts or conduits.
- C. Medium voltage cable shall meet the following standards.
  - 1. AEIC CS6.
  - 2. ASTM B-3, "Standard Specification for Soft or Annealed Copper Wires".
  - 3. ASTM B-496, "Standard Specification for Compact Round Concentric Lay-Stranded Copper Conductors".
  - 4. IEEE 48 Test procedures and requirements for high voltage alternating current cable terminations.
  - 5. IEEE 386 Separable insulated connector systems for power distribution systems above 600 volts.
  - 6. IEEE 404 Cable joints for use with extruded dielectric cable rated 5000 volts through 46,000 volts and cable joints for use with laminated dielectric cable rated 2,500 volt through 500,000 volt
  - 7. IEEE 592 Exposed semi-conducting shields on pre-molded high voltage cable joints and separable insulated connectors.
  - 8. ICEA S-68-516.
  - 9. UL 1072 Medium-Voltage Power Cables.
  - 10. NFPA 70 National Electric Code (NEC).

11. NEMA WC 8 Ethylene-propylene-rubber insulated wire and cable for the transmission and distribution of electric energy.
  12. RUS U-1
- D. Conductor temperature Ratings:
1. Continuous Operation: 105°C.
  2. Emergency Operation: 140°C.
  3. Short Circuit Rating: 250°C.
- E. Cable shall have both conductor and insulation shielding and shall have a polyethylene jacket. Cable shall conform to NEMA WC8 for ethylene-propylene-rubber insulation. The year of manufacture shall be durably marked on the outer surface of each cable at regular intervals throughout the cable length.
- F. Conductor: Concentric-lay, strand filled, compressed bare aluminum, Class B stranded.
- G. Strand Fill: Provide water swellable powder that meets or exceeds ICEA T-31-610 water penetration resistance and ANSI/NEMA Class A connectorability requirements.
- H. Strand Screen: Extruded semi-conducting ethylene-propylene rubber.
- I. Insulation: Ethylene-propylene rubber, 133 percent, not less than 220 mils average thickness.
- J. Insulation Screen: Extruded semi-conducting ethylene-propylene rubber.
- K. Concentric bare copper strands to form a fully rated concentric neutral installed over the insulation screen.
- L. Encapsulating Jacket: Non-conducting linear polyethylene, with extruded red stripes, that meets the requirement of ICEA. Red stripes shall be spaced 120° apart. Provide NESC required lightning bolt.
- M. The jacket of each cable shall be provided with markings as required by NEC Article 310.120.
- N. Cable in Conduit: Install single conductor in 2 inch diameter Schedule 40 HDPE conduit meeting the following requirements:
1. Red extruded stripes and NESC lightning bolt.
  2. Wall thickness in accordance with NEMA TC7.
  3. Material in accordance with ASTM D 3350.



4. Dimensions in accordance with ASTM D 3485.
5. Manufactured in accordance with ASTM F 2160.

## 2.6 SECONDARY UD CABLE

- A. All secondary underground distribution conductors shall be a cable assembly for underground service, aluminum, 600 volt, cross-linked polyethylene insulated conductors meeting the requirements of ANSI/ICEA S-81-570. Conductors shall be rated 90°C continuous operation, 130°C emergency overload, and 250°C short circuit rated. UD cable shall be installed in duct.
- B. Conductors shall conform to the following standards.
  1. B-231 Aluminum 1350 Conductors, Concentric-Lay-Stranded.
  2. B-609 Aluminum 1350 Round Wire, Annealed and Intermediate Tempers, for Electrical Purposes.
  3. B-786 19 Wire Combination Unilay-Stranded Aluminum Conductors for Subsequent Insulation.
  4. B-901 Compressed Round Stranded Aluminum Conductors Using Single Input Wire.
  5. ICEA S-81-570
  6. UL Standard 854 for USE-2.
- C. Conductors shall be stranded, compressed 1350-H16/H26 aluminum. Neutrals shall triple yellow extruded stripe.
- D. Cables shall be provided with "YES" neutrals and shall have sequential footage markers. Conductors shall be durably surface printed for identification.
- E. Each multiplex cable shall be provided in the sizes indicated in the Drawings or Staking Sheets. Cables shall be provided based on the standard Code Word for the specific cable. Cables shall be provided as follows:
  1. Duplex Conductors:

Cables utilized for lighting or other 120 volt service. Cable shall consist of two insulated conductors, one of which shall be the neutral. Conductors shall be marked for easy line identification.
  2. Triplex Conductors:

Cables utilized for single phase service or other uses as indicated on the Drawings or Staking Sheets. Cable shall consist of three

insulated conductors, one of which shall be the neutral. Conductors shall be marked for easy phase identification.

3. Quadruplex Conductors:

Primarily used for three-phase service. Cable shall consist of four insulated conductors, one of which shall be the neutral. Conductors shall be marked for easy phase identification.

F. Cable in Conduit: Install duplex, triplex and quadruplex cables in 2 inch diameter Schedule 40 HDPE conduit meeting the following requirements:

1. Wall thickness in accordance with NEMA TC7.
2. Material in accordance with ASTM D 3350.
3. Dimensions in accordance with ASTM D 3485.
4. Manufactured in accordance with ASTM F 2160.

## **2.7 SECONDARY CABLE TERMINATIONS**

- A. Secondary cable terminations at transformers shall be Thomas & Betts Homac insulated in-line connector, 5/8" threaded stud, Type EZC, or approved equal. Provide 4, 6, or 8 outlets as required for the services on the transformer. Rated for copper or aluminum conductors.
- B. Secondary cable terminations at secondary pedestals shall be Thomas & Betts Homac insulated multi-port connectors, RAB 350 series dual rated connector, or approved equal. Provide outlets as required for the services on the pedestal, minimum 4. Rated for copper or aluminum conductors.

## **2.8 BURIED CABLE MARKING TAPE**

- A. Buried cable marking tape shall meet the following requirements:
  1. 5 mil thick.
  2. Six inches wide.
  3. Detectable Aluminum core.
  4. Permanently printed A.P.W.A uniform color coded.
  5. Red – "CAUTION BURIED ELECTRIC LINE BELOW."

## **2.9 TRANSFORMER GROUND SLEEVE**

- A. Transformer ground sleeves shall be provided for each transformer and shall be selected specifically for the transformer installed and to properly support the transformer. Transformer bases shall not extend past the outside of the ground sleeves. Provide molded supports on the top and on

the sides to support transformers the weight of the transformers. Provide a window beneath the high and low voltage compartments for cable entry.

- B. Single phase transformer ground sleeves shall be nominal 32 inches high. Three phase transformer ground sleeves shall be nominal 36 inches high. Extend the top of the ground sleeve a minimum of 12 inches above grade.
- C. The ground sleeve shall be manufactured of SMC (Sheet Molding Compound), a thermosetting compound which is pre-mixed with pigments that are molded into the fiberglass and cannot peel. Ground sleeves shall be produced using fire-retardant resin and a combination of chopped glass spray-up and hand lay-up using 18 oz. woven roving glass reinforcement for great strength.
- D. Provide tie-down bracket to hold the transformer in place. All hardware shall be stainless steel.
- E. Nordic Fiberglass, Inc., or approved equal.
- F. Munsell green gel-coat, 7GY3.29/1.5.

## **2.10 SECONDARY PEDESTALS**

- A. All hardware shall be stainless steel. Provide stainless steel or silicon bronze penta-head bolt. Provide provisions for pad locking.
- B. Provide "Electric" molded into the pedestal top.
- C. Copolymer polypropylene pedestals manufactured by an injection molding process.
- D. Pedestal shall accommodate a minimum of three six port 350 MCM connectors.
- E. Pedestals shall be minimum 38 inches high, with a burial depth of 16 inches. Provide a top lid for access to the connectors.
- F. Nordic Fiberglass or approved equal.
- G. Munsell green gel-coat.

## **2.11 CABLE ROUTE MARKER**

- A. Provide buried cable route markers as indicated in Section 3.19.
- B. Cable route markers shall be minimum 66 inches high and shall be three-rail hybrid constructed of fiberglass and UV stable plastic.
- C. Cable route markers shall meet the requirements of RUS Construction Unit UM12.

- D. Provide telephone number and utility name on each marker.
- E. Provide ten spare cable route markers to the electric utility at the end of the project.

## **2.12 EQUIPMENT IDENTIFICATION LABELS**

- A. At each new sectionalizing cabinet and transformer, an identification tag shall be installed on the outside of the cabinet or transformer.
- B. The identification tag shall be minimum 2 inches high and shall be UV stabilized. The tag shall be self-adhesive.
- C. Identification tags shall match the location number identified on the Staking Sheets.

## **2.13 PADLOCKS**

- A. Provide Sterling Junior brass padlocks, with keys, from Engineering Unlimited, dba Sterling Security Systems, for each sectionalizing cabinet, transformer, and secondary pedestal, whether existing or new, on the project.
- B. Contractor may use temporary locks on the cabinets during construction but shall remove all temporary locks and install the Sterling Junior padlocks on the equipment prior to substantial completion.
- C. Assign the padlocks and keys to the electric utility.
- D. Provide five spare padlocks with keys above the quantity required for all new and existing equipment.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

Materials to be used for construction will be designated by one or two lower-case alphabetic characters shown on the Drawings and in the "ITEM" column in the drawing material blocks. For example, "Uhp" designates an elbow termination.

### **3.2 TRANSFORMER INSTALLATION**

- A. Transformers shall be handled carefully to avoid damage to the finish and shall be positioned in accordance with the Drawings or Staking Sheets, and specifications. Only qualified and experienced personnel shall be allowed to make connections and cable terminations.
- B. At the entrance of the 15 kV CIC into the ground sleeve, cut the HDPE conduit off above the bottom of the ground sleeve and install a cold shrink

tubing over the HDPE and the 15 kV primary cable to seal off the HDPE conduit. See detail on Drawings for additional requirements. Cold shrink tubing shall be Scotch 3M series 8429 or approved equal specifically selected to shrink over the HDPE and the outside of the 15 kV primary cable to seal the conduit water tight.

### **3.3 HANDLING OF CABLE**

Cable shall be handled carefully at all times to avoid damage, and shall not be dragged across the ground, fences or sharp projections. Care shall be exercised to avoid excessive bending of the cable. The ends of the cable shall be sealed at all times against moisture with suitable end caps. Where it is necessary to cut the cable, the ends shall be terminated and or sealed immediately after the cutting operation.

### **3.4 EQUIPMENT PADS**

The site for equipment pads shall be on undisturbed earth adjacent to but not over the trench. The site shall be cleared of all debris and excavated to the specified depth. Gravel, sand or other acceptable self-draining material shall be added to the site and thoroughly compacted.

### **3.5 EQUIPMENT ENCLOSURES**

Excavations for sectionalizing cabinets and transformer ground sleeves shall be made so as to disturb the surrounding earth as little as practical. Enclosures shall be installed with side walls plumb. When ground sleeves are of fiber, plastic, or other semi flexible material, backfilling shall be done with covers in place and with careful tamping so as to avoid distortion of the enclosure. When installation is complete, the cover of the enclosure shall not be lower than and not more than two inches higher than the grade specified by the Owner. Soil in the immediate vicinity shall be tamped and sloped away from the enclosure. The excess soil shall be removed from the site or spread evenly over the surface of the ground to the satisfaction of the Owner.

### **3.6 INSTALLATION OF SECTIONALIZING CABINETS**

- A. Install cabinets in accordance with the manufacturer's instructions and the requirements of RUS specifications.
- B. Provide a cabinet extension as required for areas where there will be higher than normal snow buildup.
- C. Ground cabinets in accordance with RUS specifications.
- D. Install a 72" spring loaded cabinet marker to identify the cabinet location.
- E. Install four point load break junctions on each mounting plate.

- F. All unused junction bushings and standoff bushings shall be provided with a load break protection cap.
- G. Primary cables in three-phase sectionalizing cabinets shall be installed with A-phase on the left, B-phase center, and C-phase on the right, facing the sectionalizing cabinet.
- H. At each three-phase sectionalizing cabinet, each 4-point junction shall be identified with the associated phase using 2" high, self-adhesive letters attached to the enclosure above the junction point. Letters shall be white with an orange background.
- I. Provide surge arresters as required.
- J. At the entrance of the 15 kV CIC into the ground sleeve, cut the HDPE conduit off above the bottom of the ground sleeve and install a cold shrink tubing over the HDPE and the 15 kV primary cable to seal off the HDPE conduit. See detail on Drawings for additional requirements. Cold shrink tubing shall be Scotch 3M series 8429 or approved equal specifically selected to shrink over the HDPE and the outside of the 15 kV primary cable to seal the conduit water tight.

### **3.7 IDENTIFICATION OF EQUIPMENT**

- A. Each sectionalizing cabinet, transformer, and secondary pedestal shall be provided with an identification number. The number shall match the number or location shown on the drawings and in the staking sheets.
- B. Where existing equipment is already provided with identification, remove the existing identification in its entirety and install the new identification as shown on the drawings and in the staking sheets.
- C. The identification number shall be located on the front of the equipment and shall be 2" high black, vinyl self-adhesive letters.

### **3.8 TRENCHING FOR ELECTRICAL DISTRIBUTION**

- A. All trenching depths specified are minimum as measured from the final grade to the top surface of the cable. The routing shall be as shown on the plans and specifications unless conditions encountered are such that changes are necessary to accomplish the work. In such event, the Owner shall be notified promptly. Bedrock is present throughout the community and it is anticipated that the contractor will encounter bedrock shallower than 48" below grade during construction. For the purposes of this contract bedrock is defined as material that cannot be loosened and removed at a minimum rate of 10 bank cubic yards per hour by a hydraulic excavator capable of developing 40,000 lbs of curl force using a 36" wide, 5-tooth digging bucket at the upper limit of the manufacturers recommended power envelope (roughly equivalent to a CAT 330

hydraulic excavator with 36” wide digging bucket operated at full power by a competent operator). A weathered rock layer should be anticipated throughout the project area. Refer to the project geotechnical report and ground penetrating radar assessment for additional background information on expected depth to bedrock along the proposed conduit routing. If bedrock is encountered, the Contractor shall determine the nature and extent of the difficulty and choose the best method of achieving minimum embedment depths in accordance with the drawings and specifications. Bedrock encountered during construction at depths within 12” of the geophysics-based assessment shall be considered incidental to the contract and no additional payment will be made to achieve the required minimum burial depth.

- B. If explosives or use of blasting agents are being considered by the Contractor to achieve the required embedment depths, a project-specific blasting plan developed by a licensed explosives/blasting consultant with a minimum 5 years of experience and safety record for similar sized projects is required. Review and approval of the blasting plan by the Owner and Engineer is required prior to use of any explosives or blasting agents.
- C. Where trenches are intended for more than one cable, particular care must be taken to provide for extra depth and width to allow for soil falling into the trench during the laying of the first cables.
- D. The contractor shall not allow water to accumulate in the trenches. Divert surface water away from trenches and implement dewatering pumps as necessary to keep trenches free of water. If water flow causes trench damage and reduction in trench depth, the trench must be cleared to the specified depth before installing the cable.
- E. The contractor will be provided approximate coordinates for each proposed above grade structure (transformer, sectionalizing cabinet, etc). All trenches shall follow straight lines between staked points whenever possible while also staying fully within established Rights of Way and / or utility easements. Secondary and service trenches shall extend in a straight line from takeoff points wherever possible. The trenches shall be dug so that the bottom has a smooth grade. Rocks in excess of one inch shall be removed from the bottom of the trench. Conductors shall be bedded in sand as shown on the drawings.
- F. All trenches shall follow straight lines between staked points as far as possible. Secondary and service trenches shall extend in a straight line from takeoff points wherever possible. The trenches shall be dug so that the bottom has a smooth grade. Rocks, stones and gravel in excess of one inch shall be removed from the bottom of the trench. Where this cannot be done, a two-inch bed of engineer approved bedding material shall be placed in the bottom of the trench.

- G. Construction shall be arranged so that trenches will be left open for the shortest practical time to avoid creating a hazard to the public and to minimize the likelihood of trench collapse due to other construction activity, rain, accumulation of water in the trench, etc.
- H. Install buried cable marking tape as required by the RUS construction units and as shown on the drawings.
- I. Existing utilities shown on the Plans are based on incomplete records. Contractor shall coordinate with Local Utilities and have appropriate materials on hand to repair water, sewer, communication, and electrical utility damage that may occur as a result of construction activities. Contractor shall repair damaged utilities at no additional cost to the project.

### **3.9 INSTALLING CABLE**

- A. The cable shall be placed in the trench as soon after the trenching operation as feasible. Wherever possible, cable shall be played out from the reel mounted on a moving vehicle or trailer. The reel shall be supported so that it can turn easily without undue strain on the cable. The cable shall be carefully placed in the trench by hand. All cable placement shall be done under constant supervision to be certain that no damage to the cable occurs.
- B. The cable shall be inspected carefully by the Contractor as it is removed from the reel in laying operations to be certain that it is free from visible defects. The Authority shall decide upon corrective action when defects are discovered.
- C. Cable shall be handled carefully at all times to avoid damage, and shall not be dragged across the ground, fences or sharp projections. Care shall be exercised to avoid excessive bending of the cable.
- D. Primary cable installed but which will not be terminated within the same working day shall be sealed using heat shrink or cold shrink end caps. All sealed ends shall be impervious to water penetration.
- E. The minimum bending radius of primary cable is 12 times the overall diameter of the cable. The minimum bending radius of secondary and service cable is six times the overall diameter of the cable. In all cases the minimum radius specified is measured to the surface of the cable on the inside of the bend. No cable bends shall be made within 6.0 inches, of a cable terminal base.
- F. Where more than one cable is to be placed in a trench, the spacing required by the specifications shall be observed. Care shall be taken that any soil falling into the trench during the laying of the first cables does not reduce the clearances of the last, cable below that specified. Should this



occur the excess soil must be removed carefully by hand or with equipment that will not damage the installed cables.

- G. Sufficient slack and in no case less than 24 inches shall be left at all transformer pads and terminal points so that movements of cable after backfilling will not cause damaging strain on the cable or terminals. Provide cable loops as indicated at sectionalizing pedestals.
- H. The cable trench shall be compacted 3'0" minimum from all pads, pedestals and terminal points.

### **3.10 BACKFILLING**

- A. The first eight inches of trench backfill shall be sand bedding (Unified Soil Classification System (USCS) "SW" or "SP"). This soil layer shall be carefully compacted so that the cable will not be damaged.
- B. Soil backfill above the pipe zone shall free of organic matter and contain no solid material larger than two inches in any dimension. Place backfill in lifts not exceeding 8 inches and compact to 95% of the material's maximum dry density as determined by ASTM D1557. All rock, debris, soil, and deleterious materials generated during the course of the project shall be removed from the site to a properly designed facility, and any damage to the premises repaired immediately to the pre-construction status. Hazardous or regulated materials generated during the course of the work shall be handled, transported and disposed by the Contractor in full conformance with all local, state and federal regulations and guidelines.
- C. Pieces of scrap cable shall not be buried in the trench as a means of disposal.

### **3.11 CABLE FIELD INSTALLED IN HDPE CONDUIT**

Primary and secondary cable may be field installed in 2" HDPE conduit at Contractor's option. All field installation shall meet the following requirements:

- A. All cables installed in conduits shall be lubricated prior to pulling with an approved pulling lubricant which is compatible with cable materials. Lubricant shall be slow drying and its dried residue shall be nonconductive and noncombustible. Polywater Type J, or approved equal.
- B. Lubricants with a wax-based formula, such as "Yellow 77" or similar product, are not an acceptable lubricant and shall not be used.
- C. Cables shall be pulled through conduits using a rotational eye swivel, which shall be separate from the means of cable attachment.

### **3.12 PRIMARY CABLE TERMINATION**

- A. All primary cable terminations at sectionalizing cabinets and transformers shall be made using prefabricated load break elbows installed in accordance with the manufacturer's instructions.
- B. Terminations shall be suitable for the size and type of cable that they are used with and for the environment in which they will operate. Any indication of misfit, such as a loose or exceptionally tight fit, shall be called to the Owner's attention. The outer conductive surface of the termination shall be bonded to the system neutral.
- C. Load break elbows shall be installed in accordance with the manufacturer's instructions.
- D. The cable shield shall be grounded in accordance with the manufacturer's instructions. Provide jacket seal around the ground braid or shield.
- E. A portable covering or shelter shall be available for use when terminations are being prepared and when prefabricated terminations are being switched. The shelter shall be used as necessary to keep rain, snow and windblown dust off the insulating surfaces of these devices. Since cleanliness is essential in the preparation and installation of primary cable fittings, care shall be exercised to prevent the transfer of conducting particles from the hands to insulating surfaces. Mating surfaces shall be wiped with a solvent such as denatured alcohol to remove any possible accumulation of dirt, moisture or other conducting materials. A silicone grease should be applied afterwards in accordance with the manufacturer's recommendations. Whenever prefabricated cable devices are opened, the unenergized mating surfaces shall be lubricated with silicone grease before the fittings are reconnected.

### **3.13 CABLE SPLICING**

New cables shall not be spliced.

### **3.14 SECONDARY CABLE TERMINATION**

- A. A suitable inhibiting compound shall be used with all secondary and service connections.
- B. All secondary cable connections installed in secondary pedestals shall be made with preinsulated secondary connector blocks. Diving bells with open terminals, insulating boots or moisture barriers that depend solely on tape are not acceptable.
- C. All transformer secondary phase terminal connections shall be completely insulated. The secondary phase terminals, threaded studs, shall be made with a preinsulated secondary transformer connection block.

- D. The secondary connections and insulation shall have accommodations for all future and existing services as shown on the plans and specifications.

### **3.15 IDENTIFYING CABLES AT TERMINATION POINT**

- A. All cables shall be provided with permanent cable identification tags as indicated on the Drawings, Staking Sheets, or specifications, or identified by the Authority. Temporary markers may be used during construction but shall be removed prior to substantial completion.
- B. As the cables are laid they shall be identified and tagged. The identification shall be of a permanent type, such as that done with an embossing type tape writer on plastic or corrosion resistant metal tags. The tag shall be securely attached to the cable with stainless steel strap. Paper or cloth tags are not acceptable. Hand marking or lettering is not acceptable.
- C. Cable identification shall be installed on each primary conductor, and each duplex, triplex, or quadruplex secondary conductor. Secondary cables shall be identified at transformers and pedestals. Cable tags shall be white, polyolefin, approximately 2”X1”. Circuit number shall be typed or machine printed in black. Hand marking or lettering is not acceptable. Identification shall consist of the name of the service, or other method that clearly identifies each service, as directed by the electric utility.
- D. All tags shall be easily visible without moving the cable or any other piece of equipment or item. Secure around the cable with black “Ty-wraps.”
- E. Primary cables, both new and existing, shall be identified at every accessible location. Each cable shall be identified with the phase of the conductor.
- F. Primary cables shall be identified with the origination of the circuit using minimum 1” high letters.
- G. Any temporary tag used during construction shall be removed and a permanent tag shall be installed prior to substantial completion.
- H. In addition to other identification, each primary conductor, both new and existing, shall be identified by phase using Scotch 35 marking tape. Provide a minimum of 3-inches of tape at each accessible location. Color identification shall be as follows:
  - 1. Phase A: Red.
  - 2. Phase B: White.
  - 3. Phase C: Blue.

### **3.16 SECONDARY PEDESTALS**

- A. All secondary pedestals shall be approximately at the same height above finished grade.

### **3.17 GROUNDING**

- A. All neutral conductors, ground electrodes, and groundable parts of equipment shall be interconnected. All interconnections shall be made as shown or noted on the Drawings or Staking Sheets or required for a complete and safe system. A copperclad ground rod shall be installed at all equipment locations as shown in the Drawings or Staking Sheets. At a minimum, ground rods shall be installed at each sectionalizing cabinet, electrical service and other equipment as required by RUS specifications and drawings.
- B. The equipment ground, neutral wires, and lightning-protective equipment shall be interconnected and attached to a common ground wire.
- C. All ground conductors and connectors shall be copper. Aluminum material is not acceptable.
- D. Ground wire sizes, not otherwise indicated, shall be not smaller than No. 4 AWG.
- E. Unless otherwise indicated, the concentric shield shall be grounded at each sectionalizing cabinet and transformer.
- F. Surge Arrester Grounding: Surge arresters shall be grounded. Ground resistance for distribution-class arresters shall be not more than 5 ohms. Ground wire connections shall be not less than #4 AWG for distribution arresters.
- G. At each existing or new electrical service, install a ground rod as indicated or required on the Drawings or Staking Sheets. Install new ground rod whether there is an existing ground rod or not. If there is an existing ground rod, connect the existing ground rod to the new ground rod.
- H. All buried grounding conductor connections shall be made with exothermic welds.

### **3.18 WARNING SIGNS**

- A. Each transformer, sectionalizing enclosure, and secondary pedestal shall display a warning sign placed so that it is visible to anyone attempting entry into the enclosure.
- B. Provide signs as required by RUS Unit UM33

### **3.19 CABLE ROUTE MARKERS**

- A. Permanent cable route markers shall be installed at all corners and direction changes in the primary cable.
- B. On straight runs, install cable route markers every 200 feet between equipment.

### **3.20 PADLOCKS**

- A. Prior to substantial completion, the Contractor shall cut and remove all temporary locks or other security devices that may be installed on the electrical equipment and install the new padlocks on the electrical equipment.
- B. Contractor shall turn spare padlocks and keys over to the electric utility prior to substantial completion.

### **3.21 TESTS**

- A. Operating Test: After the installation is completed, the Contractor shall conduct an operating test for approval. Equipment shall be demonstrated to operate in accordance with the requirements herein. Tests shall be performed in the presence of the Owner or the Owner Representative. The Owner shall be notified no less than 7-days prior to test date. The Contractor shall furnish field transportation, instruments, power, tools and personnel required for the test.
- B. Ground-Resistance Measurements: Ground-resistance measurements shall be taken and certified by the Contractor. Certified test results shall be submitted to the Owner no less than 5-days prior to energization of the distribution system. No part of the electrical distribution system shall be energized prior to the receipt of written approval from the Owner of the resistance testing of that system's ground rods and grounding systems. Test reports shall indicate the location of the ground point and grounding system and the resistance and the soil conditions at the time the test was performed. Ground-resistance measurements shall be made in normally dry weather, not less than 48 hours after rainfall, and with the ground under test isolated from other grounds. The resistance to ground shall be measured using the fall-of-potential method described in IEEE No. 142.

**END OF SECTION**

## SECTION 33 73 13

### PADMOUNT LIQUID-FILLED UTILITY TRANSFORMERS

#### PART 1 - GENERAL

##### 1.1 SCOPE

- A. This specification covers electrical characteristics and mechanical safety features of mineral-oil immersed, self-cooled, padmounted transformers with separable insulated high voltage bushings. All characteristics, voltage designations and tests shall be in accordance with the latest editions of ANSI Standards C57.12.26 and C57.12.00, except as modified herein.
- B. Transformers shall be designed in accordance with RUS requirements and shall be of new construction.
- C. The transformers will be non-evaluated units but shall be provided with minimum efficiencies as specified herein.
- D. Transformers shall be suitable for step-up or step-down service as indicated on the Drawings and Staking Sheets.

##### 1.2 RELATED REQUIREMENTS

- A. Division 1 Specifications.
- B. Division 33 Specifications.

##### 1.3 STANDARDS

All characteristics, definitions, and terminology, except as specifically covered in this specification, shall be in accordance with the latest revision of the following ANSI and NEMA standards.

- |           |  |
|-----------|--|
| C57.12.00 | IEEE Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.   |
| C57.12.26 | IEEE Standard for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers for Use with Separable Insulated High-Voltage Connectors (34500GrdY/19920 Volts and Below; 2500 kVA and Smaller).                |
| C57.12.28 | Pad-Mounted Equipment - Enclosure Integrity.   |
| C57.12.34 | IEEE Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers (2500 kVA and Smaller) - High Voltage: 34500GrdY/19920 Volts and Below; Low-Voltage: 480 Volt 2500 kVA and Smaller. |

C57.12.35	Bar Coding for Distribution Transformers.
C57.12.90	IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers.
C57.12.91	Guide for Loading Mineral-Oil-Immersed Overhead and Pad-Mounted Transformers rated 500 kVA and less with 55°C or 65°C average winding rise.
NEMA TR-1	Transformers, Regulators, and Reactors.
NEMA TP-1	Guide for Determining Energy Efficiency for Distribution Transformers
NEMA TP-3	Standard for Labeling of Distribution Transformer Efficiency.
NEMA 260	Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas.
DOE	10 CFR Part 431 – Department of Energy – Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule

#### **1.4 SUBMITTALS**

- A. Submit complete electrical data, mechanical and layout drawings, and wiring and connection diagrams for each type of transformer provided.
- B. Drawings shall indicate the kVA rating, transformer impedance, voltage (both primary and secondary), phase of the transformer, winding connection, and tap changers.
- C. Provide certified test reports prior to shipment of the transformers. Test reports shall indicate the impedance, no load, and full load loss of each transformer, by serial number, and shall include the transformer efficiency, expressed in percent, of the transformer based on the test procedures required by DOE 10 CFR Part 431.
- D. Certified test reports shall contain a statement identifying the amount of PCB in the insulating oil.

#### **1.5 WARRANTY**

The failure of any transformer due to defective design, material and/or workmanship within 12 months after being energized or eighteen months after being delivered, whichever comes first, shall be repaired or replaced without cost. Any defect in design, material and/or construction discovered within this period shall be corrected at the manufacturer's expense, either by repair or replacement.

## **PART 2 – PRODUCTS**

### **2.1 RATINGS**

A. General:

- |                              |   |
|------------------------------|---|
| 1. Primary Voltage Rating:   | As indicated on the Drawings and Staking Sheets.                        |
| 2. Secondary Voltage Rating: | As indicated on the Drawings and Staking Sheets.                        |
| 3. Frequency:                | 60 Hz.  |
| 4. Phase:                    | Single or three-phase, as indicated on the Drawings and Staking Sheets. |
| 5. Impedance:                | NEMA Standard.  |
| 6. kVA Rating:               | As indicated on the Drawings and Staking Sheets.                        |
| 7. BIL Rating:               | 7.2/12.47 kV: 95 kV.<br>600 Volt and lower: 30 kV.                      |
| 8. Temperature Rating:       | Self-cooled, 65° C above a 30° C ambient.                               |

### **2.2 ACCEPTABLE MANUFACTURERS**

Acceptable manufactures shall be as follows.

- A. ABB.
- B. Cooper Power.
- C. Ermco.
- D. General Electric.
- E. Howard Transformers.
- F. Approved equal.



**2.3 EFFICIENCY**

The efficiency requirement of DOE 10 CFR part 431.196, for liquid filled transformers, is provided below. Transformers shall meet or exceed the efficiency requirements listed.

Single-phase		Three-phase	
kVA	Efficiency (%)	kVA	Efficiency (%)
10	98.70	15	98.65
15	98.82	30	98.83
25	98.95	45	98.92
37.5	99.05	75	99.03
50	99.11	112.5	99.11
75	99.19	150	99.16
100	99.25	225	99.23
167	99.33	300	99.27
250	99.39	500	99.35
333	99.43	750	99.40
500	99.49	1000	99.43
667	99.52	1500	99.48
833	99.55	2000	99.51
		2500	99.53

**Note:** All efficiency values are at 50 percent of nameplate-rated load, determined according to the DOE Test-Procedure. 10 CFR Part 431, Subpart K, Appendix A.

**2.4 TRANSFORMER LOSSES**

Transformer no load and load losses shall be quoted with the transformer bid and shall be guaranteed by the manufacturer. Transformer losses determined by the factory tests on the individual transformers shall not exceed the guaranteed bid losses by more than 10%. No individual unit shall be shipped that exceeds guaranteed no load losses by more than 10%.

**2.5 TRANSFORMER TAPS**

Transformers shall be furnished with four each 2-1/2% full capacity high-voltage taps, 2 above and 2 below rated nominal voltage. The tap changer shall be clearly labeled to reflect that the transformer must be de-energized before operating the tap changer as required in Section 4.3 of IEEE Std C57.12.34.

## 2.6 THREE-PHASE TERMINAL ARRANGEMENTS

- A. Primary bushings shall consist of 200-amp loadbreak inserts in accordance with the following.
1. High voltage bushings shall be installed in the high voltage termination compartment located on the front left of the transformer and requiring access via the low voltage termination compartment on the front right.
  2. The high voltage bushings shall be 15 kV 200A bushing wells with bushing well inserts installed. The bushings shall be externally removable and be supplied with a removable stud.
  3. The transformer shall be provided with six (6) high voltage bushings in accordance with Figure 2 dimensions of IEEE Std C57.12.34 standard for loop feed configurations. The bushing heights shall be in accordance with Figure 3 minimum dimensions of IEEE Std C57.12.34 standard.
  4. A cable accessory parking stand shall be provided and shall be located such that the separable insulated connectors that are designed for operation after the transformer is in place can be operated with hot-line tools.
- B. Secondary terminals:
1. On three-phase transformers with 600 volt, or less, rated secondary windings the secondary terminals shall be provided with tin-plated spade-type bushings for vertical takeoff. The spacing of the connection holes shall be 1.75" on center, per ANSI C57.12.34 Figure 13a. Provide six connection holes.
- C. On transformers provided with a wye-wye connection, the primary neutral connection shall be brought out as a fully insulated H0 bushing in the primary compartment and the low voltage neutral connection shall be brought out as a fully insulated X0 bushing in the secondary compartment. A single H0/X0 bushing will not be acceptable. Provide each bushing with a removable external ground strap connected to a ground pad.

## 2.7 SINGLE-PHASE TERMINAL ARRANGEMENTS

- A. Primary bushings shall consist of 200-amp loadbreak inserts in accordance with the following.
1. The high voltage bushings provided shall be externally clamped bushing wells suitable for loop feed. These wells shall be removable to allow for field replacement of the bushings without opening the tank.
  2. The bushing configuration shall be per IEEE C57.12.38 Figure 3 for ANSI Type II units.

- B. Secondary terminals:
  - 1. On single-phase transformers, provide threaded stud-type line and neutral terminals per the table below:

<b>kVA Rating</b>	<b>Thread Size</b>	<b>Minimum Length (Inches)</b>
10-75	0.625-11 UNC-2A	1.25

**2.8 PROTECTION**

- A. Bayonet with current limiting fuses. The high-voltage overcurrent protection scheme provided with the transformer shall be an externally removable loadbreak expulsion Bay-O-Net fuse assembly with a flapper valve to minimize oil spillage. The bayonet fuses shall be in series with ELSP under-oil partial-range current-limiting back-up fuses with an interrupting rating of 50,000 RMS symmetrical amperes interrupting with minimum melting current approximately 200% of transformer nameplate rating.

**2.9 CORE AND COIL**

- A. Windings shall be copper or aluminum. All windings shall meet with the guaranteed temperature rise requirements.
- B. The core and coil shall be vacuum processed to ensure maximum penetration of insulating fluid into the coil insulation system. The windings will be energized to heat the coils and drive out moisture, and the transformer will be filled with preheated filtered degassed insulating fluid.
- C. The core shall be manufactured from amorphous metal or grain-oriented silicon steel and shall be precisely stacked to eliminate gaps in the corner joints. The coil shall be insulated with B-stage, epoxy coated, diamond pattern, insulating paper, which shall be thermally cured under pressure to ensure proper bonding of conductor and paper.

**2.10 TANK AND CABINET**

- A. The enclosure integrity of the tank and cabinet shall meet the requirements for tamper resistance set forth in ANSI C57.12.28 including but not limited to the pry test, pull test, and wire probe test.
- B. Enclosures:
  - 1. Three-phase transformers shall be compartmental type with dual compartment and barrier between high and low voltage compartments. The high-voltage and low-voltage compartments, separated by a metal barrier, shall be located side-by-side on one side of the transformer tank.

When viewed from the front, the low-voltage compartment shall be on the right. Each compartment shall have a door that is constructed so as to provide access to the high-voltage compartment only after the door to the low-voltage compartment has been opened. There shall be one or more additional fastening devices that must be removed before the high-voltage door can be opened. Where the low-voltage compartment door is of a flat panel design, the compartment door shall have three-point latching with a handle provided for a locking device. Hinge pins and associated barrels shall be constructed of corrosion-resistant material, passivated AISI Type 304L.

2. Single-phase transformers shall be ANSI Type 2 provided with a single lift up door. Door shall be provided with tamper resistant strips.
3. A recessed, captive, silicone bronze penta-head bolt that meets the dimensions per IEEE Std C57.12.28 standard shall secure all access doors. Handles and doors shall be provided with provisions for padlocking.
4. The compartment depth shall be in accordance with IEEE Std C57.12.34 standard, unless additional depth is specified.
5. Transformer enclosures shall be provided with a 304L stainless steel cabinet, door, & sill.
6. All hardware, handles, and hinges shall be 304L stainless steel.
7. Enclosures shall meet ANSI C57.12.28 for enclosure integrity.

**C. TANK**

1. The transformer tank shall be stainless steel.
2. Bolted main tank cover, where applicable.
3. The tank base shall be designed to allow skidding or rolling in any direction. Lifting provisions shall consist of four lifting lugs welded to the tank.
4. The tank shall be constructed to withstand 7 psi without permanent deformation, and 15 psi without rupture. The tank shall include a 15-psig pressure relief valve with a minimum flow rate of 35 SCFM.

**2.11 PAINTING**

- A. The transformer unit shall be painted Munsell 7GY3.29/1.5 green. All parts of the transformer that can accept paint shall be painted.
- B. The tank and cabinet coating shall meet all the requirements of ANSI C56.12.28 including:

1. Salt Spray Test.
2. Crosshatch Adhesion Test.
3. Humidity Test.
4. Impact Test.
5. Oil Resistance Test
6. Ultraviolet Accelerated Weathering Test.
7. Abrasion Resistance - Taber Abraser.

## **2.12 INSULATING OIL**

The dielectric coolant in the transformer shall be highly refined Type II inhibited new mineral oil and meet the minimum requirements as specified in Table 1, "Functional Property Requirements," of ASTM D3487 and ANSI C57.106.

## **2.13 NOISE**

- A. The padmounted transformer shall be designed and constructed to minimize the audible noise generated with the transformer energized at rated voltage.
- B. Standard transformer sound level shall not exceed the values given in Table 0-3 of the latest edition of NEMA Publication TR1.

## **2.14 NAMEPLATES & LABELS**

- A. Diagrammatic nameplate that conforms to the latest edition of ANSI C57.12.00. Impedance of the transformer shall be included on the nameplate. The nameplate shall be etched and black-filled aluminum or stainless steel. Affix to the enclosure with rivets.
- B. Safety labels shall be provided with each transformer. Safety labels shall meet the latest edition of NEMA Standard No. 260. Labels shall be made of weather resistant material per the latest edition of NEMA Standard 9.15 and UL969.
- C. In addition to warning labels, provide a label indicating the transformer kVA rating on the front of the transformer, in minimum 2-1/2" black letters.

## **2.15 ACCESSORIES**

Provide the following accessories:

- A. Three-Phase Transformers:
  1. Bolted main tank cover.

2. 1.0" upper fill plug.
  3. 1.0" drain valve with sampling device in LV compartment.
  4. Tank anchoring.
  5. Automatic pressure relief valve.
  6. Metal drip shield.
  7. Ground provisions per C57.12.34 section 9.11.
  8. Meet NEMA TR-1 sound levels.
  9. Liquid level gauge.
  10. Dial-type thermometer gauge.
  11. Pressure vacuum gauge.
  12. 24" deep cabinet.
- B. Single-Phase Transformers:
1. Oil site gauge (glass window with ball float).
  2. 0.5" drain plug in LV compartment.
  3. Upper oil fill plug.
  4. Tank anchoring
  5. Lifting bolts.
  6. Ground pads.

### **PART 3 – EXECUTION**

#### **3.1 TESTING AND LOSSES**

- A. All units shall be tested for the following:
1. No Load (Core) Losses.
  2. Load Losses at 85°C and rated current.
  3. Percent Impedance at 85°C and rated current.
  4. Excitation current (100% voltage) test.
  5. Winding resistance measurement tests.

6. Ratio tests using all tap settings.
  7. Polarity and phase relation tests.
  8. Induced potential tests.
- B. The manufacturer shall provide certification for all design and other tests listed in Table 17 of ANSI C57.12.00 including verification that the design has passed Short Circuit Criteria per ANSI C57.12.00 and C57.12.90.
- C. One PDF copy of the factory certified test report of each test, in IEEE 1388 format, shall be delivered to the Engineer prior to shipment of the transformers.

### **3.2 SHIPPING**

- A. The transformers shall be packaged to protect from damage during shipment, handling, and storage.
- B. The transformers shall be shipped complete and fully assembled. Each transformer shall be fastened to a pallet to allow loading and unloading with a forklift.
- C. Exterior of shipping unit shall carry identification of contents.

END OF SPECIFICATION