SPECIAL PROVISIONS

FOR

SIX MILE EAST CABLE TERMINAL REACTOR REPLACEMENT

W.O. E2120054

JUNE 8, 2023

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SPECIAL PROVISIONS

These Special Provisions supplement the provisions of the Chugach Electric Association, Inc.'s (Chugach's) 2022-2023 Outside Electrical Line Construction Contract (OELCC) and the Technical Specifications.

SECTION 1

SUMMARY OF WORK

1.1 SECTION INCLUDES

- Description of project
- Contractor use of premises
- Permits and Licenses
- Supplementary Instructions to Bidders

1.2 DESCRIPTION OF THE PROJECT

This project includes the replacement of the reactor for Six-Mile East Cable Terminal (SMET) located at 40451 47th Street, JBER, Alaska.

Six Mile East Cable Terminal Reactor Replacement

The project consists of replacing an existing 230kV reactor with a new HICO 230kV, 30 MVAR reactor.

The retirement scope of work includes the removal and disposal of the existing 230kV reactor. The project also consists of removal and disposal of all overhead connections from the existing reactor to the existing Breaker 174 including, but not limited to, the jumper wire, all bushings, insulators, connectors, and bus steel supports. The project also consists of the removal and disposal of the foundations for the reactor, steel supports, and existing conduits from the reactor to the pulling box inside the control building and installing a plate and weatherproof seals over the conduit openings of the pulling box. The project will also remove and dispose of a portion of existing ground grid which conflicts with the new reactor foundation and containment.

The construction scope of work includes installing a new oil containment foundation with jumpers, to receive the new reactor and a fire resistance wall to comply with code requirements. Also included is rerouting of the existing 4" ADS pipe with clearing and grubbing, matching the existing substation grade and adding crushed rock surface course in the project area. Mounting a NEMA 4 enclosure on the outside wall of the control building and installing a conduit sleeve between the new enclosure and existing cable pull-box inside the control building. Installation

of new rigid conduit runs will be required between the new reactor and the control building along with terminations of the AC power wires for the reactor. The new ground grid will be installed around the reactor and connect to the existing ground grid.

Construction at SMET will be performed at the existing energized substation. Portions of the existing station will be de-energized during construction of the new facilities. Contractor is responsible for coordinating clearances with Chugach. The substation is located on JBER property, and will also require coordination for permitting, transportation of material, and construction. This project will install all jumpers that will energize the substation with the new reactor and includes final phasing of all circuits.

Note: JBER requires a BCE Work Clearance Permit be obtained prior to any commencing of work that disturbs the ground surface by any means. If work is not started within 15 days of the approval date or it is suspected that job site conditions have changed, this request must be reprocessed.

The Work includes a final, as-built planimetric and topographic survey of the substation area, completed by a Land Surveyor registered in the State of Alaska.

Construction at the substation includes testing and commissioning for the Contractor installed cables, and sensing and control circuits.

1.3 WORK

The Work consists of all obligations, duties, and responsibilities necessary to the successful completion of the Contract assigned to or undertaken by the Contractor under the Contract Documents, including all labor, materials, equipment, and other incidental operations to provide a complete facility and the furnishing thereof.

1.4 CONTRACTOR USE OF PREMISES

A. Limit the use of the premises to Work, storage of project materials, equipment, and access.

B. Coordinate use of premises under direction of Chugach.

C. Assume full responsibility for protection and safekeeping of products under this Contract.

D. Obtain and pay for use of additional storage and Work areas needed for operations under this Contract.

E. No sanitary facilities or utilities are available at the site. Contractor shall furnish all temporary utilities and sanitary facilities at the site for construction purposes and comply with all local, state, and federal codes, regulations, and laws, including JBER requirements. No additional compensation will be made for costs associated with the forgoing.

F. Install and maintain all temporary erosion and pollution control measures as shown in the attached Erosion & Sediment Control Plan (ESCP) including silt fence, vehicle tracking controls, fiber roll, and other best management practices (BMPs) for the project site.

G. Install and maintain best management practices (BMPs) required in all areas affected by any construction activity. Cost of providing all measures required for temporary erosion and pollution control measures other than those specifically identified as paid for in a specific Bid Unit are considered incidental to the cost of the affected unit. No additional compensation will be paid for temporary erosion and pollution control measures.

1.5 PERMITS AND LICENSES

A. Except as otherwise provided in the Contract Documents, the Contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the Work.

1.6 CONTAMINATED SOILS AND CONTRACTORS DISCHARGE RESPONSE PLAN

A. There are no known areas of contaminated soil located within the project area. If contaminated soils are encountered, Contractor shall contact Chugach for further direction.

1.7 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

A. Substitutions and Product Options:

1. At time of bidding, unless otherwise specified in the Specifications, Bidder may, on an "approved equal" or substitution-basis, propose other equipment which the Bidder considers comparable with or superior to the specified items. In the absence of a listing of such equipment, it will be assumed that the Bidder intends to furnish the items as specified.

2. Bidder shall provide sufficient information and data necessary for a full evaluation of any equipment proposed on an "approved equal" or substitution-basis. At a minimum, information shall include complete description, physical dimensions, manufacturer's name and model number, price, time for delivery, and a specific listing of any characteristics which differ from those specified and could require engineering changes to equipment, buildings, structures, and services. Failure to supply adequate or accurate information may result in rejection of Bidder's proposal.

3. The determination of the suitability of "approved equals" or substitutions for the service intended, and final acceptance thereof, shall be by Chugach. The successful Bidder shall be liable for the cost of any subsequent engineering changes which are clearly attributable to negligence on the part of the Bidder to furnish proper information with his proposal.

4. If any revisions to Drawings or Specifications are required to conform equipment, materials, or work to national, state, and local laws, codes, ordinances, and regulations, Bidder shall give notice when submitting its bid and include a statement listing the additions to or deductions from the bid price required by the revisions.

5. If Bidder fails to give notice, Bidder shall provide the equipment, materials, and Work as intended by the above without extra cost to Chugach.

B. Surveys: All surveys shall be performed as specified in Section 3 of these Special Provisions.

END OF SECTION

SECTION 2

MEASUREMENT AND PAYMENT

2.1 SECTION INCLUDES

- Measurement Methods
- Measurement by Weight
- Lump-Sum Measurement

2.2 MEASUREMENT METHODS

A. Measurement methods specified in the Bid Schedule of the Contract shall govern if they differ from methods specified in this Section.

B. The Contractor shall compute all quantities and submit calculations for approval by Chugach. Where necessary, such computations shall be based upon surveys performed by the Contractor as specified by the Special Provisions in Section 3.3 Field Engineering.

C. Payment will be full compensation for furnishing all labor, materials, tools, equipment, transportation, services, and incidentals, as specified and for performing all work necessary for completing the erection or installation of the item or work classification.

D. Full compensation for all expense involved in conforming to the requirements for measuring materials shall be considered as included in the prices paid for the materials being measured, and no additional compensation will be made therefore.

E. All costs in connection with the Work specified herein will be included with the related item of Work in the Bid Schedule, or incidental to the Project.

F. Measurement Standards: All Work to be paid for at a Contract price per unit of measurement shall be measured by Chugach in accordance with United States Standard Measures.

2.3 MEASUREMENT BY WEIGHT

A. Material to be measured and paid for by weight and not measured by handbook weights, shall be weighed on accurate, State of Alaska approved scales, furnished by and at the expense of the Contractor. A ton is defined as 2,000 pounds avoirdupois.

2.4 LUMP-SUM MEASUREMENT

A. Lump-sum measurement shall be for the entire item, unit of Work, structure, or combination thereof, as listed in the Bid Schedule.

B. If the Contractor requests progress payments for lump-sum items or amounts in the Bid Schedule, such progress payments shall only be allowed if approved by Chugach in writing. Progress payments will be made in accordance with a well-balanced, detailed program of payment-apportioning, prepared by the Contractor and submitted to Chugach for approval.

C. Such program for each applicable lump-sum item shall show estimated quantities and unit prices therefore as allocated by the Contractor to the different features of the Work and major subdivisions thereof. The summation of extensions of quantities and unit prices and related costs shall total, in each case, the exact amount to be paid under the lump-sum Contract Price for the item.

D. Such programs will be used for computing progress payments as provided herein, but will not be used to determine the amount of the final payment for the Work of this Contract. Final Payment will be based on actual percentage of Work completed by the Contractor.

END OF SECTION

SECTION 3

COORDINATION AND FIELD ENGINEERING

3.1 SECTION INCLUDES

- Coordination
- Field Engineering
- Project Documents

3.2 COORDINATION

A. Contractor shall coordinate scheduling, submittals, and Work of the various activities with Chugach to assure efficient and orderly sequence of installation of interdependent construction elements.

B. All work around and near energized facilities shall be coordinated with Chugach's Power Control Center. The project area inside the substation will be de-energized but the rest of the 230kV yard will remain energized for the project, and proper clearances and safety procedures will need to be maintained throughout the entirety of the project.

C. All outage requests must be submitted to Chugach's Power Control Center seven calendar days prior to outage. Outages will be granted based on system constraints.

D. All work within SMET shall be coordinated with Chugach's Power Control Center and Chugach's Project Engineer.

E. Chugach's system operation may require other crafts to perform work at or near this project in the station. Contractor shall coordinate activities with Chugach's site representative to avoid delays and interference.

F. After Chugach occupancy of premises, coordinate access to site with Chugach for remaining Work and Work not in accordance with Contract documents.

G. SMET is located inside Joint Base Elmendorf-Richardson (JBER) and the Contractor is responsible for obtaining the base access permits (DBIDS) for its employees and all subcontractors.

3.3 FIELD ENGINEERING

A. The Contractor shall use a Land Survey registered in the State of Alaska to do survey work which includes establishing elevations, lines, and levels, utilizing recognized engineering survey practices.

B. The Contractor shall locate and protect survey control and reference points.

C. All survey work shall be performed under the supervision of a Land Surveyor registered in the State of Alaska and acceptable to Chugach.

D. Activities of the Surveyor are to be restricted to within the Chugach property boundary or public right-of-way. Obtain written permission from JBER for ingress or egress to Chugach property. Obtain written permission for use of JBER's property by the Surveyor for parking or other work performed by the Surveyor that is not completely within the Chugach property or public right-of-way. Permission must be granted in a written agreement between the property owner and the Surveyor. Chugach Electric Association, Inc. shall be held harmless from any act of the Surveyor.

E. Copies of all field notes produced by the Surveyor shall be provided to Chugach.

F. An as-built survey of the substation area shall be completed. The survey shall include the location and elevation of each concrete pad and routing of each underground conduit. Horizontal and vertical control tables shall be included in the as-built survey include northing, easting, and elevation tables. The survey shall be completed and certified by the Land Surveyor. The Land Surveyor shall verify that the elevations and locations of the Work are in conformance with the Contract Documents. Survey should comply with the CAD/GIS Spatial Data Standards in Appendix E. Vertical Control shall use (NAD83) State of Alaska Zone 4.

G. In addition to a signed, stamped paper copy of the as-built drawing, an updated folder via Sharefile or email containing the drawing information in AutoCAD Release 2019 shall be submitted to Chugach. The Sharefile folder shall be accompanied by the layer naming convention and other information as necessary to allow Chugach to utilize the Sharefile folder. The Sharefile folder shall also contain a listing of all surveyed points with coordinate positions listed by point number and again by like items.

H. Geotechnical and subsurface site conditions of the SMET site can be found in Appendix C.

3.4 PROJECT RECORD DOCUMENTS

A. As-Built Drawings, Field Notes and Surveyor's Certificate

1. Maintain on the Site two separate sets of marked-up full-scale Contract Drawings indicating as-built conditions. These drawings shall be always maintained in a current condition until completion of the Work and shall be available for review by Chugach at all times. All variations from the Contract Drawings, for whatever reason, including those occasioned by modifications, optional materials, and the required coordination between trades shall be indicated. These variations shall be shown in the same general detail utilized in the Contract Drawings. Upon completion of the Work, the marked-up drawings shall be furnished to Chugach.

2. Store Record Documents separate from documents used for construction.

3. Record information concurrent with construction progress.

4. Record Documents and Shop Drawings shall be legibly marked to record actual construction including:

    a. Measured depths of foundations in relation to finish floor datum.

    b. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

    c. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

    d. Field changes of dimension and detail.

    e. Details not on original Contract Drawings.

5. Submit as-built drawings, field notes and Surveyor's certified as built not later than twenty (20) days after completion of construction.

B. Test and Inspection Reports

1. Submit test and inspection reports per the following schedule and as specified elsewhere in the Technical Specifications
    a. Compaction test reports – Submit the day after test is completed.
    b. Concrete test reports – Submit the day after test period is completed.

c. Equipment test reports and as-builts – Submit per Technical Specification.
d. Backfill and other imported material to site – material ticket shall be provided day that material is delivered to site.
e. Pile driving record for H-piles – Submit the day after Piles are driven.

END OF SECTION

SECTION 4

SUBMITTALS

4.1 SECTION INCLUDES

- Submittal Procedures
- Construction Progress Schedules
- Shop Drawings
- Product Data
- Samples
- Manufacturers' Instructions
- Manufacturers' Certificates

4.2 SUBMITTAL PROCEDURES

The Contractor shall submit pertinent data as required in other parts of these Contract Documents for Chugach's approval:

A. Transmit each submittal with Chugach accepted form.

B. Sequentially number the transmittal forms. Resubmittals are to have the original submittal number with an alphabetic suffix.

C. Identify Project, Contractor, Subcontractor or Supplier; pertinent drawing sheet and detail number(s), and Specification section number, as appropriate.

D. Apply Contractor's stamp, signed or initialed, certifying that review, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents. Submittals will not be reviewed by Chugach until they have been reviewed by the Contractor.

H. Schedule submittals to expedite the Project and deliver to Chugach. Coordinate submission of related items. Allow 14 calendar days for Chugach’s review.

F. If substitutions become necessary after Contract award and initial approval of Contractor furnished materials, the Contractor shall submit all

information as required in the bid and include a detailed explanation as to causes for the substitution.

G. Provide space on submittals for Contractor's and Chugach's review stamps.

H. Revise and resubmit submittals as required; identify all changes made since previous submittal.

I. Distribute copies of approved submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

J. No material and/or procedure requiring Chugach's approval shall be used or implemented until such approval has been given.

4.3 CONSTRUCTION PROGRESS SCHEDULES

A. A schedule shall be submitted with the bid and include the planned duration of the following major construction groups:

1. BMPS & Security Fence
2. Outages
3. Demolition
4. Site Work
5. Conduits
6. Ground Grid
7. Foundations
8. Reactor
9. Cable
10. Testing/Commissioning
11. Chugach Commissioning
12. Energization

The schedule shall include milestone dates, time allowances for Chugach commissioning/testing, manpower loading, and cash flow.

B. The Contractor shall incorporate the following milestones dates into its schedule. Liquidated damages in the amounts noted in the Invitation to Bid will be assessed for failure to meet specific milestone dates due to circumstances under the control of the Contractor. Liquidated damages will be assessed for each day beyond the milestone date the Work specified in the milestone is incomplete.

August 28th, 2023	All work needed to receive the Reactor shall be complete.
September 29th, 2023	All work complete.

C. The Contractor shall take into consideration that Chugach has scheduled to begin testing/commissioning of all equipment inside SMET in October of 2023. If the Contractor has completed all work prior to the above date, Chugach may begin commissioning earlier. All Chugach commissioning must be completed prior to energizing any substation component from the Chugach system.

The Contractor shall make allowances for testing and commissioning by Chugach personnel prior to substantial completion. Chugach will require the following time for commissioning/testing:

1.	Reactor, 230kV, 30MVAR:	10 working days
2.	Control Cable Termination:	15 working days

A working day is defined as Monday through Friday 7AM to 3:30PM.

D. Within five (5) working days of award, the Contractor shall submit one (1) hard copy and one (1) electronic copy of an updated construction schedule for approval by Chugach. The construction schedule shall be updated to include cashflow on a weekly basis for each individual bid unit and planned percent complete by task and overall project. The construction schedule shall be submitted in MS Project.

E. The construction schedule shall be updated with actual percent complete by task and manpower and one electronic copy submitted with all invoices.

F. The basic construction schedule (data on planned performance) shall not be changed without Chugach's concurrence.

4.4 SHOP DRAWINGS

The Contractor shall:

A. Submit electronic copies of shop drawings, if applicable.

B. After review by Contractor, distribute in accordance with Submittal Procedures above and upon completion of Project, provide copies for Record Documents described in Special Provisions, Section 8 - Contractor Closeout.

4.5 PRODUCT DATA

The Contractor shall:

A. Submit the number of product data copies which the Contractor requires, plus an electronic copy which will be retained by Chugach.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to the Project.

C. After review, distribute in accordance with Submittal Procedures above and provide copies for Record Documents described in Special Provisions, Section 8 - Contractor Closeout.

4.6 SAMPLES

The Contractor shall:

A. Submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing Work.

B. Include identification on each sample with full product information.

C. Submit the number or samples specified in individual Specification sections; one of which will be retained by Chugach. Reviewed samples which may be used in the Work are indicated in individual Specification sections.

4.7 MANUFACTURERS INSTRUCTIONS

The Contractor shall:

A. When specified in individual Specification sections, submit manufacturers printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for product data.

B. Identify conflicts between manufacturers' instructions and Contract Documents. Notify Chugach in a timely manner to allow resolution of the conflicts without impact on the project completion.

4.8 MANUFACTURERS CERTIFICATES

The Contractor shall:

A. When noted in individual Specification Sections, submit manufacturers certificate in quantities specified for product data.

B. Indicate material or product as it conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product but must be acceptable to Chugach.

END OF SECTION

SECTION 5

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

5.1 SECTION INCLUDES

- Temporary Utilities
- Temporary Controls
- Construction Facilities
- Staging Area

5.2 TEMPORARY UTILITIES

A. The Contractor is responsible for providing construction power for this project through a Contractor owned generator outside the substation fence. Installation of temporary construction power equipment shall be closely coordinated with Chugach to mitigate any impact on construction of the new facilities and existing facilities. No additional compensation shall be paid for temporary power.

B. Temporary Lighting

The Contractor shall provide and maintain adequate lighting for construction operations at all times.

C. Temporary Electrical Service for Heaters

The Contractor shall provide temporary electrical service for all equipment containing heaters.

D. Site Office and Telephone Service

Contractor may provide, maintain and heat an office for its use at the jobsite. Chugach or its representative shall have access to this office and the office shall have a workspace set aside for Chugach or Chugach's representative. Cell phone communication will be acceptable.

E. Water Service

The Contractor shall obtain potable water as needed for the Work.

F. Temporary Sanitary Facilities

The Contractor shall provide sanitary facilities at the site as required by law or regulation.

G. Barriers

The Contractor shall:

1. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

2. Protect stored materials, site, and structures from damage.

5.3 TEMPORARY CONTROLS

A. Water Control

1. Temporary erosion and pollution control measures have been prepared for this project and are included in project drawings. The Contractor shall comply with all municipal, state, and federal laws governing storm water pollution control. The Contractor shall provide all temporary erosion and sedimentation control measures in accordance with the drawings to prevent soil erosion and discharge of soil bearing water runoff to adjacent properties.

2. The Contractor shall maintain excavations free of water. Provide, operate, and maintain pumping equipment as required. Costs for dewatering and disposal of water removed from all excavations are incidental to the cost of the affected unit. No additional compensation will be paid for dewatering any excavation.

3. The Contractor shall protect site from puddling or running water.

B. Traffic Control

1. It is not anticipated that traffic control is required for this project.

2. Work shall be conducted so as to cause minimum inconvenience to JBER. Contractor shall provide written notice no later than 48 hours prior to any restriction in access. Access shall not be blocked for more than three (3) hours.

C. Dust and Mud Control

1. If required provide temporary tracking mats to control dust and tracking of dirt and mud onto paved areas entering and exiting the site during construction operations. Costs for dust and mud control

are incidental to the cost of the affected unit. No additional compensation will be paid for dust and mud control.

5.4 CONSTRUCTION FACILITIES

A. Protection of Installed Work

The Contractor shall:

1. Protect installed Work and provide special protection where specified in individual specification sections.

2. Provide temporary and removable protection for installed products. Control activity in immediate work area to minimize damage.

B. Security

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

C. Parking

All parking shall be in designated areas and not on road right-of-ways.

D. Cleaning

1. Maintain areas free of waste materials, debris, and rubbish. Maintain Site in a clean and orderly condition.

2. Remove waste materials, debris, and rubbish from site weekly and dispose of off-site in compliance with all local, State and Federal regulations.

E. Removal of Utilities, Facilities and Controls

1. Remove temporary above grade or buried utilities, equipment, facilities, materials prior to final inspection.

2. Clean and repair damage caused by installation or use of temporary Work.

END OF SECTION

SECTION 6

MATERIAL AND EQUIPMENT

6.1 SECTION INCLUDES

- Material and equipment quantities.
- Products.
- Transportation and Handling.
- Storage and Protection.
- Owner Furnished Material

6.2 MATERIAL AND EQUIPMENT QUANTITIES

Material and equipment quantities shown on drawings are the Engineer's best estimate and shall be verified by the Contractor. Discrepancies shall be brought to Chugach's attention and conflicts resolved in a timely manner so as not to interfere with scheduled completion of the work.

6.3 PRODUCTS

Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Product does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components authorized for reuse.

The Contractor shall not reuse materials except as specifically permitted by the Contract Documents.

6.4 TRANSPORTATION AND HANDLING

The Contractor shall:

A. Furnish the necessary labor and equipment to load, haul to the jobsite, and offload all materials for the project.

B. Exercise due care in the handling of all materials. Transport and handle products in accordance with manufacturer's instructions.

C. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

6.5 STORAGE AND PROTECTION

The Contractor shall:

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate-controlled enclosures.

B. For exterior storage of products, place on sloped supports, above ground.

C. Provide off-site storage and protection when Site does not permit on-site storage or protection.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to ensure products are undamaged and are maintained under specified conditions.

6.6 OWNER FURNISHED MATERIALS

A. Material on the owner furnished material (OFM) list will be the ONLY material furnished by Chugach.

END OF SECTION

SECTION 7

CHUGACH-FURNISHED MATERIAL

7.1 SECTION INCLUDES

- Chugach-Furnished Material
- Transfer of Material
- Damage to Chugach-Furnished Material
- Installation of Chugach-Furnished Material
- Manufacturer's Representative

7.2 CHUGACH-FURNISHED MATERIAL

A. All Chugach furnished material is listed in the "List of Owner-Furnished Materials." If material does not appear on this list, the Contractor shall provide it.

B. The costs associated with the Chugach-furnished material listed represent original costs to Chugach and may or may not be replacement costs.

C. The Contractor shall include the Chugach-furnished materials for this project in his insurance posted for the work.

7.3 TRANSFER OF MATERIAL

A. Coordinate with Chugach for transfer and transportation of Chugach-furnished materials and equipment. Chugach furnished materials and equipment shall be located at Chugach's Operations Warehouse at 5601 Electron Drive, Anchorage, Alaska, 99518.

B. Chugach-furnished materials and equipment may have been previously unpackaged for inspection. The Contractor shall repackage the material and equipment as necessary for transport and storage subject to the approval of Chugach.

C. After the acceptance of Chugach-furnished items, the Contractor shall place them at the point of installation or in areas as approved by Chugach. Chugach may direct that certain items be stored in heated storage buildings. The Contractor is responsible for transporting Chugach-furnished material from the specified storage location to the jobsite. The Contractor is

responsible for loading all Chugach furnished materials at their storage location and off-loading Chugach-furnished material at the jobsite.

The new 230kV reactor will be delivered and off-loaded to the reactor foundation by the reactor manufacturer and assisted by the Contractor.

D. After acceptance, Chugach-furnished items are the Contractor's responsibility. The Contractor shall appropriately store and protect all Chugach-furnished items upon acceptance.

E. Heating: Store materials and equipment which are equipped with electric heaters with heaters energized. Provide electrical energy for all heaters.

Maintain temperature within enclosures above the dew point of the surrounding air; regularly check temperatures within the enclosures and heaters to ensure proper operation.

F. Spare Parts and Special Tools: Place spare parts and special tools together with any unused materials and equipment in storage at the Jobsite upon completion of the Work as directed by Chugach.

7.4 DAMAGE TO CHUGACH-FURNISHED MATERIAL

The Contractor shall repair or replace any Chugach-furnished items damaged by the Contractor's handling and storage.

7.5 INSTALLATION OF CHUGACH-FURNISHED MATERIAL

A. Except as otherwise specified, installation Work shall be the responsibility of the Contractor and all mistakes in installation and damage shall be corrected by the Contractor at no cost to Chugach.

B. The Contractor will not be held liable for faulty manufacture of Chugach-furnished items or for mistakes in the manufacturer's drawings.

C. Supply and fix all ancillary conduit, bolts, anchors, cabling, supports, and line required to place all Chugach-furnished items in operation.

7.6 MANUFACTURER’S DRAWINGS

A. Drawings approved by Chugach will be given to the Contractor for all equipment furnished by other contracts that is to be installed and connected by this contract. These drawings shall be used for construction and are provided as reference drawings for the project.

B. Drawings and specifications for equipment furnished by Chugach under other contracts for installation under this contract will be available in the office of Chugach for inspection before bidding.

7.7 MANUFACTURER'S REPRESENTATIVE

Chugach is providing manufacturer’s representatives to oversee the installation of the reactor.

END OF SECTION

SECTION 8

CONTRACT CLOSEOUT

8.1 SECTION INCLUDES

- Closeout Procedures
- Closeout Documents
- Final Cleanup

8.2 CLOSEOUT PROCEDURES

A. Provide notice and accompany Chugach and its representative(s) for final completion inspection per the OELCC.

8.3 DOCUMENTS

A. Provide and sign all documents and as-built drawings per the OELCC.

8.4 FINAL CLEANUP

A. The Contractor shall maintain the site in a clean and orderly condition. All equipment, packaging materials, temporary facilities, etc., shall be removed within ten (10) working days of construction completion.

END OF SECTION

TECHNICAL SPECIFICATIONS

FOR

SIX MILE EAST CABLE TERMINAL REACTOR REPLACEMENT

W.O. E2120054

JUNE 8, 2023

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SECTION 024155

MISCELLANEOUS DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Special Provisions apply to this Section.

1.2 SUMMARY

A. The Contractor shall supply all labor, materials, equipment, tools and supervision necessary to complete miscellaneous demolition at existing substation site including removing and disposing of structures and debris and site restoration.

B. Items of demolition work associated with this section include the following:

1. Remove designated and disposed of items as shown on drawings.

1.3 CERTIFICATION REQUIREMENTS

A. Conform to applicable local, State, and Federal requirements.

B. Conform to applicable requirements for hauling and disposal of debris to Contractor-furnished disposal site.

1.4 COORDINATION REQUIREMENTS

A. Traffic: Conduct demolition operations to ensure minimum interference with roads, streets, bike paths, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, bike paths, or other occupied or used facilities without prior written permission from authorities having jurisdiction.

B. The Contractor and its subcontractors shall minimize tracking soil onto adjacent sidewalks, trails, and streets. All tracked soil material shall be cleaned up at the end of each workday.

C. Locate and protect all utilities.

D. Coordinate all work with utility.

PART 2 -PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove improvements, or obstructions, as required, to the extent necessary for the execution of the work.

3.2 PROTECTION

A. Protect existing shrubs and vegetation adjacent to and outside of construction limits of work.

B. Locate, identify, and protect all existing facilities from damage.

C. Protect survey benchmarks, property corners, existing structures, and improvements to remain from damage or displacement.

D. Provide continuous vehicle access and egress.

3.3 DEMOLITION

A. Verify all existing utilities, site conditions, information, and dimensions.

B. Provide, erect, and maintain temporary barriers, security devices, and temporary support structures as necessary to protect and support existing items which are not indicated to be removed.

C. Notify Chugach's Representative immediately in the event that hazardous or contaminated materials are encountered or suspected. Conform to procedures applicable to local, State, and Federal regulations when handling, transporting, and disposing of hazardous or contaminated materials.

D. Identify and indicate all utility locations on Project Record Documents.

E. Remove materials to be re-installed or returned to Chugach in a manner to prevent damage.

F. Remove demolished materials, rubbish, and debris from site as work progresses. Upon completion of work, leave areas of work in clean condition. Local, State, and Federal regulations regarding hauling and disposal shall apply.

G. Do not burn or bury materials on site.

3.4 DISPOSAL OF WASTE MATERIAL

A. Remove waste materials and excess excavated material to a contractor-furnished disposal site in compliance with all applicable local, State, and Federal requirements.

3.5 SALVAGED MATERIAL

A. All material and equipment designated for removal, not designated to be reused or relocated in other Sections or on the Drawings, will become the property of the Contractor on the date that it is removed.

3.6 USE OF EXPLOSIVES

A. Use of explosives will not be permitted.

END OF SECTION 024155

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Special Provisions, apply to this Section.

1.2 SECTION INCLUDES

A. Cast-in-place (CIP) concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

1.3 REFERENCES

A. American Concrete Institute (ACI)

1. ACI 301 - Standard Specification for Structural Concrete
2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete
3. ACI 306 - Cold Weather Concreting
4. ACI 309 - Guide for Consolidation of Concrete
5. ACI 318 - Building Code Requirements for Structural Concrete
6. ACI 347 - Guide to Formwork for Concrete

B. American Society for Testing and Materials (ASTM)

1. ASTM A 36 – Carbon Structural Steel
2. ASTM A 123 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
3. ASTM A 615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
4. ASTM A 706 - Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
5. ASTM C 31 - Making and Curing Concrete Test Specimens in the Field
6. ASTM C 33 - Concrete Aggregates
7. ASTM C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens
8. ASTM C 42 - Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
9. ASTM C 94 - Ready-Mixed Concrete

10. ASTM C 143 - Test Method for Slump of Hydraulic-Cement Concrete
11. ASTM C 150 - Portland Cement
12. ASTM C 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
13. ASTM C 171 - Sheet Materials for Curing Concrete
14. ASTM C 172 - Sampling Freshly Mixed Concrete
15. ASTM C 173 - Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
16. ASTM C 231 - Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
17. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete
18. ASTM C 309 - Liquid Membrane-Forming Compounds for Curing Concrete
19. ASTM C 494 - Chemical Admixtures for Concrete
20. ASTM C 618 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
21. ASTM C 881 - Epoxy-Resin-Base Bonding Systems for Concrete
22. ASTM F 1554 - Anchor Bolts, Steel, 36, 55, and 105-Yield Strength

1.4 SUBMITTALS

A. Submit the following in accordance with the Special Provisions Submittals and Schedules:

1. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds, and other products incorporated into the work.
2. Shop drawings for reinforcement shall be prepared for fabrication, bending, and placement of concrete reinforcement. Comply with ACI SP-66, "ACI Detailing Manual," showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
3. Samples of materials listed below including names, sources, and descriptions:
   a. Normal weight aggregates.
4. Laboratory and field test reports for concrete material, mix design tests, and quality control tests.
5. Concrete ready-mix plant, proposed mix for each class, source of mix materials, and mix curing times shall be submitted and accepted by Chugach at least two weeks prior to placement of concrete.

6. Concrete ready-mix plant batch tickets.

1.5 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified:

1. ACI 318, "Building Code Requirements for Reinforced Concrete."
2. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."

B. Concrete Testing Service: Engage an independent testing laboratory acceptable to Chugach to perform material evaluation tests and to design concrete mixes.

C. Field Testing of Materials and Installed Work: Engage an independent testing laboratory acceptable to Chugach to perform field testing of materials and installed work during progress of work.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form-coating compounds with a maximum VOC of 350 mg/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory-fabricated, fixed length, cone type, removable or snap-off galvanized metal form ties, with waterproofing washer designed to prevent form deflection and to prevent spilling concrete upon removal. Provide units that will leave no metal closer than 1-1/2 in. to exposed surface.

1. Provide ties that, when removed, will leave holes not larger than 1-in. diameter in concrete surface.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615 or A 706, Grade 60, deformed, unless noted otherwise.

B. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class2).

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I.
   1. Use one brand of cement throughout project unless otherwise acceptable to Chugach.

B. Fly Ash: ASTM C 618, Type F.

C. Normal Weight Aggregates: ASTM C 33. Provide aggregates from a single source for exposed concrete.

D. Water: Drinkable and free from any deleterious material.

E. Admixtures, General: Calcium chloride or any admixtures containing chloride ions shall not be used.

F. Water-Reducing Admixture: ASTM C 494, Type A.

G. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G.

H. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

I. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

J. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

2.4 RELATED MATERIALS

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
   1. Waterproof paper.
   2. Polyethylene film.
   3. Polyethylene-coated burlap.

C. Liquid Membrane-Forming Curing Compound: Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.

D. Water-Based Acrylic Membrane Curing Compound: ASTM C 309, Type I, Class B.

E. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

F. Bonding Compound: Polyvinyl acetate (interior surfaces only) acrylic or styrene Butadiene.

G. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.

H. Chemical Hardener/Sealer: One part penetrating liquid magnesium flourosilicate hardener, waterproofing and preservative treatment.

I. Chemical Waterproofing: Xypex Concentrate or approved equal.

J. Isolation joint Filler Material: Premolded asphalt-impregnated fiber sheeting.

K. Anchor Bolts and Studs to be Embedded in Concrete: ASTM F1554, Grade 36 hot dip galvanized in accordance with ASTM A153.

L. Plates, Structural Shapes, Studs and other Miscellaneous Metals to be Embedded in Concrete: ASTM A36 hot dip galvanized in accordance with ASTM A123.

2.5 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Chugach for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

B. Submit written reports to Chugach of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until proposed mix designs and test results have been reviewed by Chugach.

C. Design mixes to provide normal weight concrete with the following properties.

1. Class 4500: Minimum compressive strength at 28 days: 4,500 psi. Maximum water/cement ration: 0.40. Minimum pounds cementitious material/cubic yard: 660. Maximum fly ash content as a percentage of cementitious material: 25%. Maximum coarse aggregate size: 3/4 in. Maximum water-soluble chloride ion content, percent by weigh of cement 0.15, Air content: 4.5% minimum, 7.5% maximum, by volume.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances

warrant, as accepted by Chugach. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Chugach before using in work.

2.6 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing, HRWR, admixture (superplasticizer) in concrete as required for placement and workability. Provide test verification that use of HRWR in floor mix designs has a positive effect on controlling shrinkage.

B. Use non-chloride accelerating admixture or Type III Portland cement in concrete slabs placed at ambient temperatures below 50°F (10°C).

C. All concrete shall contain an air entraining admixture conforming to ASTM C 260.

D. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.

E. Slump Limits: In addition to observing the specified maximum water/cement ratios, proportion and design mixes to result in concrete slump at point of placement as follows:

1. Floor Slabs: Not more than 3 in.
2. Concrete containing HRWR admixture (Superplasticizer): Not more than 8 in. after addition of HRWR to site-verified 3-in. slump concrete.
3. Other concrete: Not more than 4 in.

2.7 CONCRETE MIXING

A. Use ready-mix concrete.

B. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity of coarse and fine aggregates, cementitious materials, admixtures, and amount of water introduced.

C. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as specified.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate the installation of joint materials, vapor retarders, and insulation board with placement of forms and reinforcing steel.

B. Dispose of rejected or excess concrete off-site, at no additional expense to Chugach.

3.2 FOUNDATION AND ANCHOR BOLT TOLERANCES

A. Location of foundation: one inch in any direction.

B. Top of concrete elevation: plus or minus ½-inch.

C. Foundation vertical surfaces: one percent from vertical.

D. Exposed horizontal surfaces: one quarter of one percent from horizontal and ¼-inch between any two points.

E. Centerline of anchor bolt cluster: plus or minus ¼-inch in any direction.

F. Anchor bolt cluster orientation: plus or minus 2 degrees.

G. Anchor bolt axis: one percent from vertical.

H. Anchor bolt projection: plus or minus ¼-inch.

I. Distance between anchor bolts in cluster: plus or minus 1/8-inch (non-accumulative).

3.3 FORMS

A. General: Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.

B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste. Align tie holes on a vertical and horizontal grid.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

D. Chamfer all exposed corners and edges, unless otherwise directed, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints. Use 3/4-in. chamfer where not otherwise indicated.

E. Provide a 1/8-in. tooled edge radius on the exposed edge of slabs.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Re-tighten forms and bracing before concrete placement as required to prevent mortar leaks and maintain proper alignment.

3.4 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.

1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Chugach.

D. Place reinforcement to obtain coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

3.5 JOINTS

A. Construction Joints: Concrete surfaces upon or against which concrete is to be placed and to which new concrete is to adhere, that have become so rigid that the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Chugach.

B. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as otherwise indicated.

C. The surfaces of construction joints shall be clean, and surface dry when covered with fresh concrete. Cleaning shall consist of the removal of laitance, loose or defective concrete, coatings, sand, curing compound, and other foreign material. The cleaning shall be accomplished by wet sandblasting or water blasting utilizing pressures not less than 6,000 psi, washing thoroughly with air-water jets, and surface drying the joints prior to placing of adjoining concrete. The sandblasting or high-pressure water blasting and washing shall leave the concrete roughened to an amplitude of 1/4-in. In the process of wet sandblasting or high-

pressure water blasting, care shall be taken to prevent undercutting of an aggregate in the concrete.

3.6 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces. Provide adequate anchorage and lateral stability to screed strips which will support strike-off templates or compaction type screeds.

3.7 PREPARATION OF FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before reinforcement is placed.

B. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

C. Coat steel forms with a nonstaining, rust-preventive material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work.

B. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.

C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes or weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 in. and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6 in. into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

3. Maintain reinforcing in proper position during concrete placement.

F. Concrete Temperature: The temperature of the concrete at the time it is placed shall not be more than 70°F (21° C) nor less than 40°F (4°C) regardless of the ambient air temperature for all classes of concrete.

G. Cold-Weather Placing: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40°F (4°C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C) and not more than 70°F (21°C) at point of placement.

a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

b. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

3.9 FINISH OF FORMED SURFACES

A. Rough Form Finish: For formed concrete surfaces not exposed to view in the finish work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4-in. in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is an as-cast concrete surface obtained with selected form-facing material,

arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment, not later than one day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

3.10 MONOLITHIC SLAB FINISHES

A. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared and concrete has stiffened sufficiently to permit operation of floats.

B. Non-slip Broom Finish: Apply nonslip broom finish to exterior slabs.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Chugach before application.

3.11 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than seven days.

C. Concrete shall be maintained at a minimum of 40°F (4°C) for a minimum of 3 days.

D. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

1. Provide moisture curing by the following methods:

a. Keep concrete surface continuously wet by covering with water.

b. Use continuous water-fog spray.

c. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-in. lap over adjacent absorptive covers.

2. Provide moisture-cover curing as follows:

a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 in. and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Provide curing and sealing compound to exposed interior and exterior slabs as follows:

a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within two hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Recoat roof surfaces within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

E. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

F. Final cure concrete surfaces to receive chemical hardener/sealer or finish flooring by moist curing or by use of moisture-retaining cover.

G. Contractor shall inform Chugach, in writing, of the minimum curing time before concrete can be loaded.

3.12 REMOVAL OF FORMS

A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50°F (10°C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

3.13 REUSE OF FORMS

A. Clean and repair surfaces of forms to be reused in work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces except as acceptable to Chugach.

3.14 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Dry Packing under Base Plates: where shown on the Drawings, place dry pack under equipment and structure base plates. Dry pack shall consist of two parts sand, one part cement and just enough water to allow molding a shape by hand. The packing shall be done by hand, ramming with bars.

E. Waterproofing Oil Containment Concrete: Waterproof all concrete surfaces on the interior of the oil containment facilities. Apply waterproofing in accordance with the manufacturer's written procedures. Xypex Chemical Corp. products are recommended for fulfilling this requirement.

3.15 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Chugach.

1. Cut out honeycomb, rock pockets, voids over 1/4-in. in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 in. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.
2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with

patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Chugach. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. For non-exposed surfaces, flush out form tie holes, fill with dry-pack mortar, or precast cement cone plugs secured in place with bonding agent. For exposed surfaces, specified to receive a Smooth Form Finish, a Smooth Rubbed Finish or a Brush Abrasive Blast Finish, plug and neatly grout form tie holes to within 3/8-in. of the finished surface.

1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

C. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verity surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having required slope.

1. Repair finished unformed surfaces that contain defects that affect durability of concrete. Surface defects, as such, include crazing and cracks in excess of 0.01-in. wide or that penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.

2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.

3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Chugach.

4. Repair defective areas, except random cracks and single holes not exceeding 1 in. in diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4-in. clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

D. Perform structural repairs with prior approval of Chugach for method and procedure, using specified epoxy adhesive and mortar.

E. Repair methods not specified above may be used, subject to acceptance of Chugach.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: The Contractor shall employ the services of a professional testing laboratory or ACI certified technician approved by Chugach to perform field tests and to submit test reports.

B. Sampling and testing for quality control during placement of concrete shall include the following:

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

2. Slump: ASTM C 143; one test point of final discharge for each day's pour or four for every 200 cy, whichever is more frequent, of each type of concrete; additional tests when concrete consistency seems to have changed.

3. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour or four for every 200 cy, whichever is more frequent, of each type of air-entrained concrete.

4. Concrete Temperature: Test each time a set of compression test specimens is made.

5. Compression Test Specimen: ASTM C 31, one set of four standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.

6. Compressive Strength Tests: ASTM C 39, one set for each day's pour exceeding 5 cu. yds. plus additional sets for each 50 cu. yds. more than the first 25 cu. yds. of each concrete class placed in any one day; one specimen tested at seven days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

a. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batched or from each batch if fewer than five are used.

b. When total quantity of a given class of concrete is less than 50 cu. yds. Chugach may waive strength test if adequate evidence of satisfactory strength is provided.

c. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

d. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

C. Test results will be reported in writing to Chugach, Ready-Mix Producer (if applicable), and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing

service, concrete type and class, location of concrete batch in structure, design compressive strength, concrete mix proportions and materials, compressive breaking strength, and type of break for both seven-day tests and 28-day tests.

D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

E. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Chugach. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

3.17 CONCRETE FINISH SCHEDULE

A. Formed Finish:

1. Rough Form Finish; All formed concrete surfaces not exposed to view in the finished work.
2. Smooth Form Finish; All formed concrete surfaces not specifically covered by one of the other listed finishes.
3. Smooth Rubbed Finish; All interior formed concrete surfaces exposed to view or to be covered with a coating material.

B. Slab Finish:

1. Trowel Finish; All building floor slab surfaces exposed to view in finished construction.
2. Nonslip Broom Finish; All exterior slabs.

C. Hardener/Sealer: All floor slab surfaces.

D. Waterproofing: All oil containment surfaces

END OF SECTION 033000

SECTION 067233

COMPOSITE STRUCTURAL FIREWALL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Chugach-furnished composite structural firewall.

B. Receiving, assembling, and erecting composite structural structures and associated anchorage.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Special Provisions, apply to this Section.

1.3 DESCRIPTION OF THE WORK

A. This section covers receiving and installing composite structural firewall and all connections, clips, fasteners, appurtenances, accessories, and incidentals necessary to provide a complete, operable, and serviceable installation as shown on the Drawings and as specified herein.

1.4 SUBMITTALS

A. None.

1.5 QUALITY ASSURANCE

A. Follow manufacturer's instructions in transporting, handling, and installing the materials.

B. Employ only qualified crafts.

C. Provide adequate means of handling of the installation of the materials.

D. Verify that field conditions are acceptable and are ready to receive materials.

E. Begin installation only after examination is complete and site is in all respects, ready for material installation to proceed. If an unanticipated condition is encountered that could affect the installation of the composite structural firewall, do not proceed with Work until resolution is provided in writing. This is not intended to direct the means or methods of installation, but to notify Chugach of conditions that may require a change in design.

1.6 COORDINATION

A. Transport, store, and handle materials as specified by the manufacturer. Coordinate all material transfer and installation activities with Chugach.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

A. Visually inspect material for physical damage.

B. Verify dimensions as shown on the Drawings.

C. Assure work of other trades is complete and site is ready to receive the materials.

D. Any parts which do not fit or are misaligned will be rejected.

3.2 ERECTION

A. Erect items plumb and level, accurately fitted, free from distortion or defects in accordance with Drawings.

B. Torque bolts in accordance with manufacturer's instructions.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Field cutting, drilling, punching, or burning is not permitted. Any parts which do not fit or are misaligned will be rejected.

E. Carefully attach and remove temporary supports or guides required to hold or assemble members so as not to damage finish.

F. Field touch-up damaged galvanized coatings with manufacturer's recommended zinc-rich paint. Apply 2 coats at a dry film thickness of 2.0 mils each coat.

G. Assemble columns, spacers, brackets, and install composite panels in the proper order in accordance with manufacturer's instructions.

H. Assemble bottom, column, top, and end covers in the proper order and location in accordance with manufacturer's instructions.

I. Pack gaps underneath the first panel in accordance with manufacturer's instructions.

3.3 ERECTION TOLERANCES

A. Maximum Variation From Level: 1/16 inch per ten feet.

B. Maximum Offset From True Alignment: 1/8 inch.

3.4 TESTS

A. None.

3.5 PROTECTION

A. Assure adequate protection from the environment prior to installation.

END OF SECTION 067233

SECTION 067413

FIBERGLASS REINFORCED GRATING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Chugach-furnished Fiberglass Reinforced Plastic (FRP) Molded Grating

B. Chugach-furnished FRP Molded Grating Support Legs

C. Chugach-furnished FRP Structural Shapes

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Special Provisions, apply to this Section.

1.3 DESCRIPTION OF THE WORK

A. This section covers receiving and installing FRP Molded Grating, FRP Molded Grating Support Legs, FRP Structural Shapes, and all connections, clips, fasteners, appurtenances, accessories, and incidentals necessary to provide a complete, operable, and serviceable installation as shown on the Drawings and as specified herein.

1.4 SUBMITTALS

A. None.

1.5 PROJECT RECORD DOCUMENTS

A. As-built Drawings as specified in Special Provisions.

B. Test reports.

C. Operating and installation manuals.

1.6 QUALITY ASSURANCE

A. Follow manufacturer’s instructions in transporting, handling, and installing the materials.

B. Employ only qualified crafts.

C. Provide adequate means of handling of the installation of the materials.

D. Verify that field conditions are acceptable and are ready to receive materials.

E. Begin installation only after examination is complete and site is in all respects, ready for material installation to proceed.

F. If an unanticipated condition is encountered that could affect the installation of the FRP materials, do not proceed with Work until resolution is provided in writing. This is not intended to direct the means or methods of installation, but to notify Chugach of conditions that may require a change in design.

1.7 COORDINATION

A. FRP materials shall be installed by the Contractor. Coordinate all material transfer and installation activities with Chugach.

B. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins, and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.

C. Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, and other types of damage. Store adhesives, resins, and their catalysts and hardeners in dry indoor storage facilities between 70º*F* and 85º*F* until they are required.

PART 2 - PRODUCTS

A. FRP Molded Grating, FRP Molded Grating Support Legs, and FRP Structural Shapes listed under description of work are Chugach-furnished. Product information is included on the project Drawings.

B. Contractor shall supply and install all additional materials for complete and functional installation as shown on the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Visually inspect material for physical damage.

B. Verify dimensions as shown on the Drawings.

C. Assure work of other trades is complete and site is ready to receive the materials.

D. Any parts which do not fit or are misaligned will be rejected.

3.2 PREPARATION

A. Clean placement surfaces of debris.

B. Remove protective coverings.

3.3 INSTALLATION

A. Contractor shall load, transport, and offload all material.

B. Contractor shall install gratings, grating pedestals, and embedment/ledge angles in accordance with manufacturer's assembly drawings. Fasten materials securely in place with fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products.

3.4 TOLERANCES

A. Alignment 1/4 inches horizontal, 1/4 inches vertical.

3.5 TESTS

A. None.

3.6 PROTECTION

A. Assure adequate protection from the environment prior to installation.

END OF SECTION 067413

SECTION 260500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Special Provisions, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Electrical equipment coordination and installation.
2. Sleeves for cables.
3. Sleeve seals.
4. Common electrical installation requirements.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

1.4 REFERENCES

A. The latest and applicable sections of the following standards shall be used in the performance of the work:

1. NESC – National Electric Safety Code
2. NEC – National Electric Code
3. IEEE – Institute of Electrical and Electronics Engineers
4. RUS Bul. 1724E-300 (Design Guide for Rural Substations)
5. RUS Pub. 202-1 (List of Materials)
6. AEIC – Association of Edison Illuminating Companies

7. NEMA- National Electrical Manufacturer's Association

8. NECA- National Electrical Contractor's Association

9. NETA – InterNational Electrical Testing Association

1.5 SUBMITTALS

A. As required by Special Provisions and as outlined here.

B. Shop drawings and product data for all Contractor furnished equipment and materials.

C. Manufacturers' test reports.

D. Equipment manuals and installation manuals.

E. Approval of submittals required when materials substitutions are made.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain accurate information of all installations on drawings, product information, test reports and instruction manuals and as required by Special Provisions.

1.7 QUALITY ASSURANCE

A. Use qualified crafts, trained in the specific task(s) to be performed. Certify special qualifications where required.

B. Follow recommendations and instructions of equipment manufacturer in addition to requirements of drawings and specifications in handling and erection of equipment.

1.8 FIELD MEASUREMENTS

A. Verify that all field measurements are as indicated on the drawings.

B. Determine required location, arrangement and quantities of equipment and materials from drawings.

1.9 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow for piping and conduit installed at required slope.

4. So connecting cables will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and install sleeves in the wall and other structural components as they are constructed.

C. Coordinate timing of installations with other trades and Chugach's personnel working on other projects in the station.

D. Coordinate installations of Owner-Furnished materials with Chugach personnel.

PART 2 - PRODUCTS

2.1 CONTRACTOR-FURNISHED EQUIPMENT AND MATERIALS

A. Unless otherwise specified, the Contractor shall furnish all fittings, hangers, conduits, anchors, junction boxes, mounting brackets, cable supports, terminal board jumper wires, wire terminals, solderless lugs, connectors, identification tags, identification signs, insulating tape, insulating compounds, grounding system hardware, and all other electrical accessories, hardware, or materials required to satisfactorily install and place into service all equipment and material specified or shown on the drawings, or supplied by Chugach.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive the work.

B. Beginning of the installation means acceptance of existing conditions.

3.2 PREPARATION

A. Before assembly and erection thoroughly clean equipment of all protective coatings and foreign materials.

B. Verify all equipment elevations prior to placement.

C. Schedule testing services and other inspections in a timely manner.

3.3 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. All electrical installations shall be in accordance with the applicable standards, manufacturer's instructions specified herein and any requirements of the local regulatory or code enforcing agencies, unless otherwise specified herein. The Contractor shall place the equipment accurately in position, level the equipment, assemble all equipment which requires such, including wire connections where required. Also, the Contractor shall remove, modify and reinstall equipment where required and adjust and make ready for service the electrical equipment and material required by these Specifications or as shown on the drawings. After the installation is complete, the Contractor shall clean each piece of equipment. All work shall be done in an orderly and skillful manner and shall present a neat appearance when completed.

B. Construction installation quality and workmanship shall comply with NECA 1.

C. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

D. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

E. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete walls, engineered wall panels or fire-rated floor and wall assemblies.

B. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

C. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

D. Cut sleeves to length for mounting flush with both surfaces of walls.

E. Seal space outside of sleeves with weather sealant for the penetration of the exterior wall and the enclosure.

F. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.

G. Interior Penetrations of Non Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.

3.5 SLEEVE-SEAL INSTALLATION

A. Install and seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for sleeve. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 TESTS

A. All materials and equipment installed and/or connected by the Contractor shall be thoroughly checked, tested and made completely ready for in-service commercial operation. Refer to specifications Section 260550, Field Testing, for test requirements.

3.7 PROTECTION

A. Maintain safe clearances from all existing installations not part of this project.

B. Safeguard all existing facilities.

END OF SECTION 260500

SECTION 260513

CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers the furnishing and installation of all wire and cable, required to complete the installation of equipment as shown on the Drawings, and as specified herein with terminations and connections required to provide functioning power and control systems as required.

B. This Section includes installation of wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

C. This section covers the termination and installation requirements for the AC power connection to the reactor.

1.2 REFERENCES

References listed in Section 260500 shall apply in conjunction with the following:

A. NEMA WC7 – Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and distribution of Electrical Energy.

1.3 SUBMITTALS

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

B. Approval of submittals required when materials substitutions are made.

1.4 QUALIFICATIONS

A. Manufacturer: As approved by Chugach.

B. Construction Personnel: Foreman responsible for termination and installation of all cables in the station equipment and control building shall have completed such work in the past for an electric utility, inspected and reviewed with Chugach personnel similar Chugach installations for workmanship requirements, and be acceptable to Chugach.

1.5 PROJECT RECORD DOCUMENTS

A. Submit As-built Drawings as specified in Special Provisions Sections 3.4.

B. Accurately record actual sizes and locations of direct buried cables on the drawings.

C. Accurately record any deviation from project drawings.

1.6 QUALITY ASSURANCE

A. Handle wire and cable in accordance with the manufacturer's instructions.

B. Do not exceed minimum bending radii for cables and wires or exceed pulling tensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

1.7 FIELD MEASUREMENTS

A. Cable lengths shown on the cable schedule are estimates only. Contractor is responsible for verification of the exact lengths necessary.

B. Determine required separation between cables and other work.

C. Determine cable routing to avoid interference with other work.

1.8 COORDINATION

A. Schedule cable and wire installation in conjunction with equipment placement.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements and approved by Chugach.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for type XHHW-2.

D. Overhead and Underground conductors: See Owner furnished material list for Chugach supplied conductors. Contractor to supply all other Conductors and Cables.

E. General Purpose Wiring
   1. General purpose wiring circuits shall be 600V UL type XHHW-LS 90°C, with low-smoke zero halogen (LS-ZH) insulation, flexible strand, with copper conductor. An example of acceptable wire would be Houston Wire and Cable type HW010. The Contractor shall submit wire types to be used for Chugach approval.

F. Control Cable
   1. Control cable/wiring installed in trays or raceways shall be indoor/outdoor low-smoke zero halogen (LS-ZH) jacketed non-PVC flame retardant 600V UL type TC (tray cable) color coded by ICEA method 1 Table E-2 or Chugach approved equivalent. An example of an acceptable control cable would be Houston Wire and Cable type HW170. The Contractor shall submit cable types to be used for Chugach approval.

G. Instrumentation Cable
   1. Instrumentation cable/wiring installed in trays or raceways shall be indoor/outdoor low-smoke zero halogen (LS-ZH) jacketed non-PVC flame retardant 600V UL type TC (tray cable) color coded by ICEA method 1 Table E-2 or Chugach approved equivalent. An example of an acceptable control cable would be Houston Wire and Cable type HW170. The Contractor shall submit cable types to be used for Chugach approval.

H. Power Cable
   1. Power cable/wiring installed in trays or raceways shall be indoor/outdoor low-smoke zero halogen (LS-ZH) jacketed non-PVC flame retardant 600V UL type TC (tray cable) color coded by ICEA method E-1 or Chugach approved equivalent. An example of an acceptable power cable would be Houston Wire and Cable type HW170 or HW172. The Contractor shall submit cable types to be used for Chugach approval.

2.2 CONNECTORS

A. Solderless pressure connectors

B. Compression connectors: Ring-type lugs

C. Description: Factory-fabricated connectors of size, ampacity rating, material, type, and class for application and service indicated.

D. All terminals for #8 wire and smaller shall be made with the terminals shown in

E.

F. Table I. All terminals for wire larger than #8 shall be made with terminals shown on Drawings. Burndy terminations shall be double crimped with a Burndy MR8-9Q tool. No substitutions will be permitted.

Table I: Wire Terminals

Wire Range (AWG)	Stud Range	Terminal Mfg./Type
8	8-10	Burndy#YAV8CL
10-12	8-10	Burndy #YAV10-H
14-20	8-10	Burndy #YAV14-H
18-22	8-10	Burndy #YAV18-H

1. Contractor shall provide the correct Burndy YAV type terminals with the proper hole size for the specified screw size. Drilled out terminals are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. Completely and thoroughly swab conduits before installing wire.

3.3 CONDUCTOR AND INSULATION APPLICATIONS

A. As indicated on the drawings.

3.4 INSTALLATION

A. Install cable and accessories in accordance with manufacturer's instructions.

B. Avoid abrasion and other damage to cables during installation.

C. Do not exceed cable pulling tensions, sidewall pressures or bending radius limitations. For Chugach supplied conductor information on these limitations will be furnished by Chugach at the time of construction.

D. Neatly train and lace wiring inside boxes, equipment, panelboards, and cable trays.

E. Clean conductor surfaces before installing lugs and connectors.

F. Make terminations which are rated to carry the full ampacity of conductors with negligible temperature rise.

G. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

1. Use pulling lubricants where necessary.

    a. Use only lubricants approved for use with cable types specified that do not leave flammable residue or support flame propagation.
    b. Pulling lubricants shall not deteriorate conductor or insulation.
    c. Soap/wax based lubricants shall not be used.
    d. Use Polywater J or equivalent where compatible with cable types installed as specified by the lubricant manufacturer.

2. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

H. Support cables according to Section 260500 "Common Work Results for Electrical."

I. For multi-conductor cable, after the cable jacket has been stripped back to the appropriate length, each cable shall have a minimum 2-inch piece of heat shrink tubing with internal hot melt sealing compound installed. The heat shrink tubing shall be long enough and positioned so that approximately 1-inch of heat shrink tubing is positioned over the cable jacket and 1-inch of heat shrink tubing is positioned over the conductors. Heat shrink tubing shall be Thomas & Betts HS-series, heavy-wall heat-shrinkable tubing, black in color.

J. Identify and color-code conductors and cables according to Section 260553 "Electrical Identification."

K. Ensure that all control, communication, status or relaying cables and conductors have sufficient length to be re-terminated at any location within the cabinet or rack. Jacket shall be stripped and the uncovered conductors secured at no more then 6” intervals.

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Splicing

1. No splicing allowed.

3.6 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test conductors as specified in Section 260550, Field Testing and as specified in this section.
2. Measure tightness of bolted connections and compare torque measurements with manufacturer’s recommended values.
3. Inspect wire and cable for physical damage and proper connection.
4. Inspect shield grounding, cable supports, and terminations for proper installation.

3.7 PROTECTION

A. Protect cable ends cables that have not been terminated with a suitable cap designed specifically for the purpose (heat shrink, etc.), taping of cable ends is not acceptable.

END OF SECTION 260513

SECTION 260526

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrodes

B. Connectors

C. Conductors

1.2 REFERENCES

A. ANSI/IEEE C2 – National Electric Safety Code

B. ANSI/NFPA 70 National Electric Code

C. IEEE 80 – Guide for Safety in AC Substation Grounding

D. IEEE 142 – Grounding of Industrial and Commercial Power Systems

1.3 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.4 PROJECT RECORD DOCUMENTS

A. Submit As-built Drawings as specified in Special Provisions.

B. Accurately record actual locations of electrodes and connections.

1.5 COORDINATION

A. Coordinate work with site excavating, foundation installation, backfilling and final grading.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Materials as shown on the drawings or as approved by Chugach.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section 250513 "Conductors and Cables."

B. Material: Tinned coated Copper.

C. Equipment Grounding Conductors (low-voltage): Insulated with green-colored insulation.

D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

E. Grounding Electrode Conductors: Stranded soft-drawn tinned copper cable.

F. Underground Conductors: Bare, stranded, soft-drawn tinned coated copper unless otherwise indicated.

G. Copper Bonding Conductor: As follows:

1. Bonding Conductor: No. 2, stranded tinned coated copper conductor.

H. Grounding Bus: Bare, annealed copper bars of rectangular cross section (with insulators at required locations).

2.3 CONNECTOR PRODUCTS

A. Provide swaged connections as shown on the drawings.

B. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

C. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

D. Welded Connectors: Not used, unless specifically approved by Chugach. Contractor shall submit written request for use.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Sectional type; solid copper or copper-bonded.

1. Solid Copper Size: 3/4 inch diameter by 10-foot rods coupled with fittings authorized by the rod manufacturer.

2. Copper-Bonded Size: 1-inch diameter by 2x10-ft rods coupled with fittings authorized by the rod manufacturer.

2.5 CONNECTORS

A. Material: Bronze or copper or tinned coated copper.

B. Below Grade: Swaged.

C. Above Grade: Mechanical, Compression, or Swaged as specified on the drawings.

2.6 WIRE

A. Material: Stranded Tinned coated copper.

B. Horizontal electrodes conductors: #4/0 AWG tinned coated copper or 500 kcmil tinned coated copper

C. Grounding conductors for equipment shall be soft drawn copper and shall be sized no smaller than the following:

1.	Switches & Grounding Platforms	#4/0
2.	Steel Structures/Columns	#4/0
3.	Switchgear Enclosure	#4/0
4.	Ground Grid	#4/0
5.	Conduit Grounds	#2
6.	Reactor Grounding Connectors	500 kcmil

All other grounds that may be necessary shall be size in accordance with NFPA 70.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify site is acceptable for installation of grounding system.

B. Commencement of work signifies acceptance of conditions.

3.2 APPLICATION

A. Exothermic-Welded Connections: Not allowed.

B. Equipment Grounding Conductor Terminations: Use bolted pressure connections to attach to equipment.

C. Underground connections shall be swaged type.

1. Bolted connectors shall not be utilized in below grade applications.

3.3 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of control house equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated on the drawings.

B. Install equipment grounding conductors in all feeder and branch circuits.

3.4 INSTALLATION

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

B. Coordinate ground grid installation with foundation, conduit and final grading.

C. Install rod electrodes in vertical position with bottom at least 10 feet deep.

D. Install interconnecting horizontal electrodes 24" min below finished grade.

E. All electrical equipment enclosures, equipment, and all metallic parts of the installation, including structures, pipe, conduit, wireways, frames, and metalwork, shall be grounded and connected to the nearest ground cable, even if such connection is not shown on Drawings.

F. Paint, scale, rust, corrosion, or other foreign matter shall be removed from the points of contact on metal surfaces before ground connections are made.

G. Precautions shall be taken to assure that no damage is done to grounding conductors or connections during construction. All existing grounding conductors damaged during construction work shall be replaced or repaired to comply with this section.

H. Exposed grounding conductors shall be supported on surfaces of the structures and on equipment with non-corrosive hardware, such as Everdur or equal, at not less than four foot intervals. Ground grid risers shall be visible for inspection.

I. Make ground tap connections to equipment at the points provided on the equipment for grounding in accordance with the equipment manufacturer's recommendations. Connections from ground conductors to the ground buses of switchgear, and/or panel boards shall be made by means of an acceptable bolted fitting.

J. All other electrical power equipment shall be provided with a grounded, identified grounding conductor. Power and control circuits will contain a grounding conductor.

3.5 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Not allowed.

C. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values.

D. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by

connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

E. Connections shall not be painted.

3.6 FIELD QUALITY CONTROL

A. Inspect all connections for tightness.

B. Any connection determined to be defective by Chugach shall be cut out and a new connection installed.

C. Testing: Perform tests as specified in Section 260550, Field Testing.

END OF SECTION 260526

SECTION 260533

RACEWAYS & BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Special Provisions, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

A. FMC: Flexible Metal Conduit.

B. LFMC: Liquidtight Flexible Metal Conduit.

C. LFNC: Liquidtight Flexible Nonmetallic Conduit.

D. RNC: Rigid Nonmetallic Conduit.

E. HDPE: High Density Polyethylene Conduit.

F. RGS or GRSC: Rigid Galvanized Steel Conduit.

1.4 SUBMITTALS

A. Submit the following in accordance with Special Provisions:

1. Product Data: For enclosure

a. Approval of submittals required when materials substitutions are made.

1.5 PROJECT RECORD DOCUMENTS

A. Submit As-built Drawings as specified in Special Provisions.

B. Accurately record actual sizes, locations, and depths of conduits on the drawings.

C. Accurately record any deviation from project drawings.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Comply with NECA 1.

1.7 COORDINATION

A. Coordinate layout and installation of surface mount boxes, enclosures, and cabinets, with other construction.

B. Coordinate layout and installation of underground conduits as shown on the drawings and to avoid intersection with other conduits and underground structures while maintaining specified conduit clearances and burial depths.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

A. As specified on the drawings and as approved by Chugach.

2.2 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit, Zinc Coated (RGS): ANSI C80.1.

B. LFMC: Flexible steel conduit with PVC jacket.

C. FMC: Zinc-coated steel or aluminum.

D. Fittings for Conduit (Including all Types and Flexible and Liquidtight): NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

2.3 NONMETALLIC CONDUIT AND TUBING

A. RNC:

1. PVC: NEMA TC 2.
2. PVC fittings: NEMA TC 3.
3. FIBERGLASS: NEMA TC 14.
4. HDPE: NEMA TC 7.

2.4 CONDUIT ADHESIVES

A. Bonduit by American Polywater Corporation.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. As specified on the drawings and approved by Chugach.

2.6 FACTORY FINISHES

A. Finish: Enclosure or cabinet components, except for stainless, shall be finished with the manufacturer's standard gray standard rust proof enamel applied to factory-assembled enclosures, and cabinets before shipping.

2.7 ACCESSORIES

A. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.

B. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."

C. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and shall not have any permanent property changes when exposed to temperatures below 35 deg F, recovering original workability characteristics above 35 deg F. Compound shall adhere to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

PART 3 -EXECUTION

3.1 APPLICATION

A. Outdoors where conduits are not specified on the conduit schedule:

1. Exposed: RGS.
2. Concealed: RGS.
3. Connection to Vibrating or Moving Equipment (Including reactor, circuit breakers and all outdoor equipment subject to seismic and/or frost jacking movements): LFMC
4. Boxes and Enclosures: NEMA 250, Type 4 stainless steel.

B. Indoors where conduits are not specified on the conduit schedule:

1. Exposed, Concealed, Dry, Damp or Wet Locations: RGS.

2. Connection to Vibrating Equipment (Including reactor and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.

C. Where conduits sizes are not specified, conform to requirements of NFPA 70 for conduits sizing.

D. Conduit Elbows

1. Elbow radius for underground 2" conduits shall be 24 inches or greater for vertical bends and horizontal bends.

2. Rigid galvanized steel Conduit: Use threaded rigid galvanized steel conduit fittings and factory elbows unless otherwise indicated.

3.2 INSTALLATION

A. Complete raceway installation before starting conductor installation.

B. Seal and bond conduits with approved adhesives.

C. Support raceways as specified and in conformance with NFPA 70.

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs and in the field.

F. Install conduits so curved portions of bends are not visible above the finished slab or outdoor grade.

G. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated. Each riser from the ground level to an outdoor piece of equipment shall include an offset equal to the diameter of the raceway between the end of the RGS conduit and the LFMC conduit.

H. Underground Conduits

1. Provide trenching and backfill as specified in section 312000 Earthwork.

2. Provide conduit depths, trench preparation, and backfill as shown on the drawings.

3. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line as shown in trench details. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

4. Where connected to Vibrating or Moving Equipment (Including Reactors, circuit breakers and all outdoor equipment subject to seismic and/or frost jacking movements) the rigid section of conduit shall be physically anchored to the device foundation prior to transition to flexible conduit.

I. Raceways Embedded in Slabs: As indicated on the drawings.

J. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

K. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors.

L. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

M. Install and leave pull cords in all raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

N. Stub-up Connections: Extend conduits through concrete floor and outdoor pad for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

O. Flexible Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

P. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. “Devcon” or equivalent zinc rich paint, or approved equal, shall be used to touch up damaged galvanizing and applied to exposed threads at all galvanized conduit couplings and connectors. Touch up may be done by either a spray or brush application.
2. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 260533

SECTION 260550

FIELD TESTING

PART 1 - GENERAL

This specification covers the field testing of the substation equipment and electrical systems installed or constructed by the Contractor. It is the intent of this specification that field testing be extensive and complete, as specified, to provide positive assurance of correct installation and operation of equipment. SUMMARY

A. This specification includes, but is not limited to, the following:

1. Testing of all wire, cable, electrical equipment and systems installed or connected by the Contractor to assure proper installation, adjustment, setting, connection, and functioning in accordance with the drawings, these specifications and the manufacturer's recommendations.
2. Furnishing of qualified personnel and labor required for, and incidental to testing.
3. Furnishing all test equipment required to perform all tests, including special equipment as required, and qualified operators for testing equipment.
4. This specification includes all testing required during installation and prior to energization of substation equipment and electrical systems installed or constructed by the Contractor. The scope of work does not include testing of equipment or systems off-site. The Contractor shall cooperate with and coordinate with Chugach for testing of systems and equipment that interface with Chugach's facilities that may be required to confirm phasing, rotation or other electrical characteristics.

1.2 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

1.3 REFERENCES

The latest and applicable sections of the following standards are to be used in the performance of the work:

A. NESC – National Electric Safety Code

B. NEC – National Electric Code

C. IEEE – Institute of Electrical and Electronics Engineers

D. REA Bul. 1724E-300 (Design Guide for Rural Substations)

E. REA Pub. 202-1 (List of Materials)

F. AEIC – Association of Edison Illuminating Companies

G. NEMA- National Electrical Manufacturer's Association

H. NECA- National Electrical Contractor's Association

I. NETA – International Electrical Testing Association

J. ANSI - American National Standards Institute

1.4 SUBMITTALS

A. If a Testing Subcontractor is used provide qualifications.

B. Testing plan and schedule for all conductors and equipment.

C. Certified test equipment calibration reports.

D. Test Reports:

1. The Contractor shall submit reports for all tests performed.
2. The Contractor shall maintain a written and electronic record of all tests showing date, personnel making test, equipment or material tests performed, and results. A copy of these reports shall be submitted to Chugach on a weekly basis.
3. Submit two written copies and one electronic copy of the final test reports, as specified.
4. The Contractor may use his standard report forms subject to the approval of Chugach.
5. Electronic documents shall be submitted in Word/Excel Microsoft Office 365, or earlier format, or in searchable unsecured PDF.

1.5 QUALITY ASSURANCE

A. The Contractor shall furnish the services of a testing supervisor who is a graduate electrical engineer or an approved technician, thoroughly familiar with substation relaying and controls who shall perform the following:

1. Be personally present on the jobsite during the testing of all wiring, controls, and systems furnished, installed, or connected by the Contractor and until they are all in complete and satisfactory operation, and the substation is ready for Chugach's personnel.
2. Conduct and direct the complete program of testing specified herein.

3. Check all wiring installed by the Contractor for proper connection according to the diagrams shown in the plans, connection diagrams, and the manufacturer's shop drawings.

B. The Contractor shall submit to Chugach a proposed testing plan. This plan will detail at a minimum the following:

1. Specific tests to be performed on each piece of equipment, cable, or system.
2. Testing procedures to be followed for each type of test.
3. List references and standards which require a specified test.
4. Provide a list of the manufacturers recommended tests and procedures.
5. List of testing equipment to be used and calibration certificates for proposed testing equipment.
6. List of personnel responsible for performing tests and their qualifications. Provide certifications and proof of training applicable to the tests and equipment to be provided under this contract. Provide resumes which show testing and commissioning experience.
7. Testing schedule based on the project schedules.

C. Follow recommendations and instructions of equipment manufacturer and NETA ATS in addition to requirements of drawings and specifications in testing of equipment.

1.6 COORDINATION

A. Coordinate tests with completion of equipment or system installation and with the completion of auxiliary or related equipment that may be effected by tests. Schedule testing and provide notification of testing to Chugach so as not to delay construction or system energization.

B. Notify Chugach two weeks prior to commencement of all testing.

1.7 EXAMINATION

A. Verify that field conditions are acceptable and are ready to be tested.

1.8 TESTS

A. The types of tests to be performed under this specification shall include, but are not limited to the following:

1. Power and control cable: All power and control cables installed by the Contractor shall receive a Megger test. Megger all 600 volt power and control cable with a 1000 volt megger for one minute. Values at the end of one minute must be as follows:

Conductor Capacity Amps	Minimum Resistance Ohms
0 – 24	1,000,000
25 – 50	250,000
51 – 100	100,000
101 – 200	50,000
201 – 400	25,000
501-800	12,000
Over 800	5,000

2. Instrument cable: No Tests are required.

3. Instrument Transformer Tests: No Tests are required.

4. Low Voltage Power shall be tested to ensure proper operation.

5. Continuity Tests – All power and control cables shall be tested for continuity between each termination point.

6. Phase Relationships tests: Connections to all equipment shall be checked and verified by the Contractor. Any device which could be damaged by the application of a voltage of reversed phase shall be disconnected prior to the check. Contractor shall be responsible for maintaining the phasing as shown on the Drawings.

1.9 TESTING EQUIPMENT

A. The Contractor shall provide all testing equipment required to perform tests.

B. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

1.10 PERFORMANCE OF TESTS

A. Testing requirements shall include all tests recommended by the equipment manufacturer for the lighting, high and low voltage power cable and instrumentation cable unless specifically waived by Chugach.

B. Additional tests shall be performed, as deemed necessary by Chugach, because of field conditions or to determine that equipment material and systems meet the requirements of the contract documents. The Contractor shall be responsible for all damage to equipment or material due to improper test procedures or test apparatus handling.

C. After completing testing and checkout of equipment, wiring, control schemes, and other items associated with individual systems, and believing a system to be ready for operation, the Contractor shall notify Chugach, who may elect to witness a final operational test of each individual system.

D. Test procedures, equipment, temporary circuits, etc., shall be designed and utilized to minimize danger to testing technicians and surrounding personnel; furnish and use safety devices such as rubber gloves and blankets, provide protective screens and barriers, yellow tape, and danger signs, to adequately protect and warn all personnel in the vicinity of the tests.

END OF SECTION 260550

SECTION 260553

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Identification for conductors and communication and control cable.
2. Underground-line warning tape.
3. Warning labels and signs.
4. Instruction signs.
5. Equipment identification labels.
6. Miscellaneous identification products.

1.2 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

D. Approval of submittals required when materials substitutions are made.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with NESC.

D. Comply with OSHA 29 CFR 1910.145.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

PART 2 - PRODUCTS

2.1 CONDUCTOR, COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Heat Shrink Wire Markers: Provide polyolefin heat shrink tubing makers. Printing shall be by thermal transfer with black characters/lettering on a white background. Heat shrink tubing shall be compatible with printing device used. Provide heat shrink labels from the following manufacturers:

1. Brady B-342 permasleeve markers.

2. Substitutions will be permitted at Chugach's discretion. Contractor shall provide a written request for wire label substitution. Chugach may request physical samples be submitted to approve a wire label substitution.

C. Cable Tags:

1. Provide Brady flame-retardant type B-145 polyethylene tag material with a grey background and black printed lettering. Cable tags shall be two-sided, oval-shaped measuring 1.75"W x 1.00"H. Cable tags shall be attached using Brady 81761 cable tag fasteners. Cable Number and To/From information shall be printed on both sides of the cable tag.

2. Substitutions for this tag type will be permitted at Chugach's discretion. Contractor shall provide a written request for cable tag substitution. Chugach may request physical samples be submitted to approve a cable tag substitution.

2.2 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.

B. Stenciled Legend: In non-fading, waterproof, black ink or paint. Minimum letter height shall be 2 inch (25 mm).

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.6 kg), minimum.
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. All wires and cables installed by the Contractor be labeled at their terminations as shown on the drawings and as approved by Chugach.

B. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use heat shrink markers. Identify each ungrounded conductor according to source and circuit number.

C. Wiring Devices: write panel and circuit number in inside on back side of cover-plate with indelible marker. Identify each ungrounded conductor according to source and circuit number with heat shrink markers.

D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of cable tags and heat shrink markers that is uniform and consistent with drawings or the system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

E. Equipment Identification Labels: On each unit of equipment, install unique designation label as shown on the nameplate drawings or provide label consistent with equipment designations on drawings or wiring schematics.

1. Labeling Instructions:

a. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Enclosures.

b. Access doors and panels for concealed electrical items.

c. Phasing on Transmission and Distribution Circuits.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Heat shrink wire markers: Markers shall be heat shrunk onto the wires so that the lettering is visible in the as-left condition.

D. Apply identification devices to surfaces that require finish after completing finish work.

E. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

F. Retain paragraph below for non-adhesive signs or labels.

G. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

1. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

END OF SECTION 260553

SECTION 261220

BUSWORK, CONDUCTORS, AND FITTINGS

PART 1 -GENERAL

1.1 SECTION INCLUDES

A. Jumper Conductor

B. Swaged, Bolted, and Compression Connections

1.2 DESCRIPTION OF THE WORK

A. This Section covers the material and installation of all jumpers, fittings and all hardware to form a complete system of current carrying paths connecting the equipment as shown on the Drawings.

1.3 SUBMITTALS

A. Shop Drawings and product data for all Contractor furnished equipment and materials.

1.4 PROJECT RECORD DOCUMENTS

A. Maintain accurate information of all installations on Drawings, product information, test reports and instruction manuals in accordance with Special Provisions.

1.5 QUALITY ASSURANCE

A. Use qualified crafts, trained in the specific task(s) to be performed.

B. Provide complete details of swaged procedures.

C. Operate swaged connection press in accordance with manufacturer's instructions.

1.6 FIELD MEASUREMENTS

A. Verify that all field measurements are as indicated on the Drawings.

B. Determine required location, arrangement and quantities of materials from the Drawings.

1.7 COORDINATION

A. Coordinate timing of installations with other trades.

1.8 TOOLS

A. Contractor shall provide a swaged press for use to construct bus for this project.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Not used.

2.2 CONNECTIONS

A. Bolted Connectors

1. As indicated on the drawings or approved equal.
2. Grade 8 Cad Plated or Stainless Steel should be used.

B. Swaged Connectors:

1. As indicated on the drawings or approved equal.
2. Swaged for jumper conductor terminations and tee taps.

C. Compression Connects:

1. As directed by the Project Engineer

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive the work.

B. Verify all dimensions prior to cutting bus section.

3.2 PREPARATION

A. Before assembly and erection thoroughly clean equipment of all protective coatings and foreign materials.

B. Aluminum to aluminum connections shall be prepared in conformance with the manufacturer's instructions. Then the surface shall be thoroughly cleaned with fine steel wool and bolted together without removing the compound (when required) from the contact surfaces. When making aluminum-copper connections place the aluminum above the copper.

C. Copper to copper connections shall be prepared by rubbing the tinned contact surfaces lightly with fine steel wool, covering them with "Penetrox A" and bolting together without removing the compound from the contact surfaces. If the copper terminals are not tinned, surfaces shall be prepared by cleaning with emery cloth down to bright metal and tinning before applying "Penetrox A".

3.3 INSTALLATION

A. Install conductors, jumpers, fittings, and all connectors in complete accordance with manufacturers' recommendations.

1. Swaged and Compression Connections
    a. Install per manufacturer's recommendations.
    b. Minimum distance between two compression type joints is 6 inches.

B. Bolted Connections

1. Use corrosion inhibiting compound (Penetrox-A) for all connections in conformance with manufacturer's instructions.
2. Use torque wrenches in accordance with manufacturer's recommendations for bolt installations.
3. Remove excess compound.
4. All bolts, nuts, washers, shall be Grade 8 Cad Plated or Stainless Steel.
5. Compression Connections for Flexible Conductors
    a. Install connectors with properly sized dyes in accordance with the manufacturer's instructions. All required dies and equipment are to be furnished by the Contractor.
    b. Apply oxide inhibiting compound compatible with the connections and surface conditions involved in conformance with manufacturer's instructions.
    c. Where inverted connections are required provide swaged connections with weep hole. Inverted compression type connectors are not acceptable.

6. Jumper Loops and Strings

   a. Flexible jumpers and flexible vertical cable taps shall be installed of such length and form as to maintain maximum clearance for surrounding objects and to give assurance that such contour will be stable. Cable for the jumper buses shall be the type and size shown on the Drawings. Jumper buses shall be smoothly formed, and adjacent runs shall be similarly and symmetrically shaped to provide a uniform and pleasing appearance throughout. Stranded conductor shall be installed without twists or kinks and shall be handled to avoid abrasion or other damage.

3.4 TOLERANCES

A. Not used.

3.5 FIELD QUALITY CONTROL

A. Chugach's Representative may inspect all swaged, compression, and bolted connections. Contractor shall assist by providing equipment and operators to access locations.

B. Radiographic tests may be performed by Chugach. Contractor shall provide assistance in performing such tests.

3.6 PROTECTION

A. Maintain safe clearances from all existing installations not part of this project.

B. Safeguard all existing facilities.

END OF SECTION 261220

SECTION 311000

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Special Provisions, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Protecting existing vegetation to remain.

2. Removing other vegetation.

3. Clearing and grubbing.

4. Temporary erosion and sedimentation control measures.

B. Related Sections include the following:

1. Section 312000, "Earthwork".

1.3 MATERIAL OWNERSHIP

A. Except materials indicated to remain Chugach’s property, cleared materials shall become Contractor's property and shall be removed from Project site.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag vegetation to remain.

C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

3.2 PRESERVATION

A. Only those areas designated shall be cleared. Slopes to remain shall be retained in their natural condition.

B. The Contractor shall exercise all due caution to avoid damage to trees and shrubs which are to remain in place.

3.3 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, organic material and other vegetation from project site to permit installation of new construction.

1. Do not remove shrubs and other vegetation indicated to remain or to be relocated.
2. Completely remove stumps, roots, topsoil, organic material, obstructions, and debris from the clearing limits shown on the drawings.

B. Fill depressions caused by clearing and grubbing operations with fill and backfill soil material unless further excavation or earthwork is indicated.

3.4 SITE IMPROVEMENTS

A. Remove existing improvements as indicated and as necessary to facilitate new construction.

3.5 TRASH

A. Remove all trash from the project site and legally dispose of them.

3.6 DISPOSAL

A. Disposal: Remove trees, brush, vegetation, surplus soil material, unsuitable soils, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Chugach's property.

END OF SECTION 311000

SECTION 312000

EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Special Provisions, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Classified Fill
2. Crushed Rock Surface Course.
3. Leveling Course.
4. Separation Geotextile.
5. Final Grading.
6. Excavating, backfilling, and compacting for foundations, pads, and other underground structures.

1.3 DEFINITIONS

A. Crushed Rock Surface Course: Crushed gravel or rock placed above subgrade on substation site. Shown as 'Crushed Rock' on drawings.

B. Excavation: Removal of material encountered below subgrade.

C. Backfill: Soil material used to fill an excavation.

D. Subgrade: Final surface or elevation after completing cut, or top surface of a fill or backfill that will be directly below topsoil, crushed rock surface, or leveling course.

E. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Geotextile.

B. Submit the following data that verify the products fully conform to the specifications and

plans before delivery of the product:

1. Particle Size Analysis according to ASTM D 422 for Classified Fill.
2. Laboratory density according to ASTM D 1557 for Classified Fill.
3. Existing Subgrade: One inspection per day for loose or deleterious soil is required of existing soils under Classified Fill.
4. Classified Fill Compaction: As specified in Section 3.9.

C. Submit a Soil Testing - Quality Control Plan for Chugach Approval which provides:

1. Independent Testing Agency Qualifications.
2. Qualifications of Contractor Personnel engaged in on-site soil compaction testing.
3. Sieve analysis sampling location and depth record keeping methodology.
4. Compaction Testing location and depth record keeping methodology.

1.5 QUALITY CONTROL/QUALITY ASSURANCE

A. Contractor shall provide his own quality control program for field density testing, as further specified in Article 3, of this Section. Chugach may, at their option, provide additional field density testing for quality assurance.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities unless permitted in writing by Chugach and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify Chugach not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Chugach's written permission.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. CLASSIFIED FILL

1. Classified Fill shall consist of sand and gravel material free from lumps, frozen material, balls of clay, organic matter, or other objectionable matter, durable and sound conforming to the quality requirements of AASHTO M-147 and shall meet the following washed sieve gradation. Municipality of Anchorage, Type II-A material qualifies as a Classified Fill.

Classified Fill	
Sieve Size	% Passing by Weight
3 inch	100
3/4 inch	50-100
#4	25-60
#10	15-50
#40	4-30
#200	0-6

B. CRUSHED ROCK

1. Crushed Rock shall consist of hard, angular crushed, washed natural stone uniform in density and quality, and free from thin and elongated pieces, friable materials and debris, dirt, and other objectionable material. At least fifty (50) percent of the coarse aggregate particles shall have two or more mechanically fractured faces. The aggregate shall meet the following washed sieve gradation as follows:

Crushed Rock	
Sieve Size	% Passing by Weight
2 inch	100
1 inch	30-80
3/4 inch	0-15
1/2 inch	0-5

C. LEVELING COURSE

1. Leveling Course shall consist of crushed gravel, rock, sand or other approved material. The aggregate shall be free from lumps, balls of clay, or other objectionable matter, and shall be durable and sound. The portion of the material retained on a No. 4 sieve shall be known as course aggregate. Both course and fine aggregates shall conform to the quality requirements of AASHTO M-147. The course aggregate shall have a percentage of weather not to exceed 50 after 500 revolutions, as determined by the current requirements of ASTM C-131. It shall consist of angular fragments uniform in density and quality, and free from thin and elongated pieces, dirt, and other objectionable material. At least fifty (50) percent of the coarse aggregate particles shall have two or more mechanically fractured faces. The fine aggregates shall consist of material free of organic or other objectionable matter. The fine aggregate, either naturally combined with the coarse aggregate or separately obtained and mixed therewith, shall be of such character that the composite material will conform to the following gradation:

Leveling Course	
Sieve Size	% Passing by Weight
1 inch	100
3/4 inch	70-100

3/8 inch	50-80
#4	35-65
#8	20-50
#50	10-30
#200	3-8

D. GEOTEXTILE

1. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
2. Tensile Strength: 180 lb; ASTM D 4632.
3. Elongation: 30%; ASTM D 4632.
4. Burst Strength: 400 psi; ASTM D 3786.
5. Trapezoid Tear: 70 lb; ASTM D 4533.
6. Puncture Strength: 70 lb; ASTM D 4833.
7. Apparent Opening Size: No. 50 sieve, maximum; ASTM D 4751.
8. Permittivity: 0.02 per second, minimum; ASTM D 4491.
9. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.

2.2 STOCKPILE MATERIAL

A. Stock Piled Material: None

PART 3 - EXECUTION

3.1 PREPARATION

A. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstruction, and deleterious materials from ground surface is specified in Section 311000, “Site Clearing.”

3.2 EXPLOSIVES

A. Explosives: Do not use explosives.

3.3 EXCAVATION

A. Prior to excavation the surface shall be cleared of all timber, brush and all debris.

B. The Contractor shall perform all excavation of every description and whatever substance

encountered including rock and permafrost. Excavation will be to the extent indicated on the drawings, and as staked in the field. All excavated materials suitable for use as Classified Fill shall be stockpiled for use during construction. Stockpiled material shall be placed in an orderly manner and placed at a distance from the excavation section which conforms to all State and/or Federal Safety codes.

C. Prior to filling or covering notify Chugach when excavations have reached required depth.

D. If Chugach determines that unsatisfactory soil is present, continue excavation as directed.

E. Reconstruct subgrade damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Chugach.

3.4 EMBANKMENT

A. This section applies to subgrade preparation and placement of Classified Fill.

B. Subgrade Preparation

1. All ground under Classified Fill shall be prepared as detailed on the plans, as specified in this section, or as directed by Chugach.
2. Do not allow water to accumulate in excavations. Remove and convey standing water from excavations by pumping if necessary.
3. Where unsuitable soils (loose, compressible, organic, or debris) are encountered, the unsuitable soils should be over-excavated and the unsuitable material should be removed and replaced with compacted Classified Fill at no additional cost to Chugach.
4. The prepared subgrade shall be inspected and approved by Chugach prior to placing Classified Fill.

C. Classified Fill Placement

1. The Classified Fill shall be placed in layers up to 9-inches maximum thickness, loose.
   a. Each lift of Classified Fill shall be spread in a uniform thickness before compacting.
2. The Classified Fill shall be compacted to at least 95 percent of the maximum density determined in accordance with ASTM D 1557. Route compaction equipment uniformly over the entire surface of each layer of Classified Fill.
3. Backfill around foundations and pipes carefully by hand if necessary to avoid damage to structure.

4. Moisture-condition by adding water or drying as necessary for compaction.
5. The Classified Fill shall be graded away from the face of the slope and rolled at the end of each work day to prevent ponding of water on surface of the reinforced soil zone or drainage over the crest onto the face of the slope.
6. Contractor shall confirm that as-built slope geometries conform to approximate geometries shown on construction drawings.

3.5 FOUDATION EXCAVATION

A. Non-pier foundations shall be over-excavated if silty, soft, or loose soils are encountered or as noted on the Drawings

B. Bottom of excavation for other non-pier foundations shall be scarified to a depth of 6 inches and compacted to not less than 95% of maximum dry unit weight according to ASTM D 1557.

3.6 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation with compacted Classified Fill material.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile excavated backfill materials and excavated soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust. Stockpile soil materials away from edge of excavations.

3.8 FILL AND BACKFILL

A. Place and compact backfill in excavations promptly.

3.9 CLASSIFIED FILL

A. Place fill and backfill in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers. Compact Classified Fill materials to not less than 95% of maximum dry unit weight according to ASTM D 1557.

B. Uniformly moisten or aerate fill layer before compaction to within 2 percent of optimum moisture content. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.10 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to contours indicated on the drawings.

B. Provide a smooth transition between adjacent existing grades and new grades surrounding all foundations and work areas.

C. Site Grading: Establish slope grades to pre-construction grades.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will perform field quality control testing. Chugach may, at their option, engage a qualified independent geotechnical engineering testing agency to perform field quality-assurance testing.

B. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed on each lift of material at the following frequency:

1. Footings – One test per every 200 Square feet of concrete footing, minimum of one test per concrete footing.
2. Site Utility Trenches – One test every 200 feet of trench.

C. When soils have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; re-compact and retest until specified compaction is obtained.

3.12 GEOTEXTILE

A. Separation Geotextile: Lay geotextile parallel to the slope at surface of subgrade. Stretch geotextile to remove any creases or wrinkles. Join edges by sewing a double-thread chain stitch or overlap a minimum of 3 feet. Sew or overlay areas torn or punctured.

3.13 CRUSHED ROCK

A. Place crushed rock surface course over separation geotextile.

B. Shape to required elevations.

C. Compact with a minimum of 6 passes of a 15-ton roller or other Chugach-approved vibrating equipment.

3.14 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions. Reshape and recompact as directed by Chugach.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus excavated material from the substation site.

END OF SECTION 312000

SECTION 316200

DRIVEN PILE FOUNDATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following:

1. Chugach-furnished steel piling.
2. Supplying all labor, materials, tools, and equipment required to install the Chugach-furnished piles to the indicated depths.
3. Welding Chugach-furnished top plates on piles.
4. Any obstruction removal necessary to install the piles to the specified depth.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Special Provisions, apply to this Section.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM A500, Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
2. ASTM A252, Welded and Seamless Steel Pipe Piles
3. ASTM A572, High-Strength Low-Alloy Columbium-Vanadium Structural Steel

B. American Welding Society (AWS)

1. D1.1 - Structural Welding Code

1.4 QUALITY ASSURANCE

A. If an unanticipated condition is encountered that could affect the design of the foundation, do not proceed with Work until resolution is provided in writing. This is not intended to direct the means or methods of installation, but to notify Chugach of conditions that may require a change in design.

1.5 SUBMITTALS

A. Preliminary Submittal

1. At least seven working days prior to starting construction, submit a written description of all equipment, techniques, and access proposed for use in the installation of the pipe piles. Include manufacturer's specifications for the pile hammer including type, energy capacity, wave analysis, and operating instructions, procedures for driving piles, procedures for penetration or removal of obstructions, and procedures to relieve soil friction in the event soil consolidation prevents piles from being driven to the specified depth.

B. Welding Procedures

1. Submit written welding procedures, including sketches, for review. The welding procedures shall meet AWS D1.1 and describe the means and methods by which the Contractor shall perform the welding. Welding procedures shall cover such items as welding methods, backing plate metal, filler materials, joint design, preheating base metals, and required procedures to field-test the quality of the welds.

C. Welder Qualifications

1. Provide AWS Welder Qualifications for all welders to be used on this project. Welders shall be qualified in accordance to AWS for the type and position of welds.

D. Submittals Required After Pile Installation

1. Accurately record the following data for each pile and submit no later than two (2) days after driving:
   a. Project name, contract name and number, and contractor name.
   b. Location of pile (structure and foundation ID).
   c. Pile diameter and wall thickness for pipe piles.
   d. Bottom of pile elevation.
   e. Top of pile elevation, before and after cut off.
   f. Bearing strata description and elevations (for pre-drilling and excavations).
   g. Nature and locations of obstructions.
   h. Type, size and rate of operation of equipment used for driving piles.
   i. Continuous record of number of blows for each foot of penetration for impact hammers and the number of seconds to advance each foot for vibratory hammers.

j. Measurement data for plumbness and horizontal location of pile centerline.
k. Description of pre-drilling methods and result of pre-drilling.
l. Record of all deviations in methods and results.
m. Description of driving shoe if used.

1.6 QUALIFICATIONS AND INSPECTIONS

A. Contractor shall qualify his welding procedures in accordance with AWS D1.1. All welders shall be qualified in accordance with AWS D1.1 Welding Code, specifically for the materials used on this project.

B. The Contractor shall at his expense secure the services of an inspector/supervisor from a qualified third party testing laboratory. The inspector/supervisor shall supervise all welding performed on the piles by the contractor. Additionally the inspector/supervisor shall inspect, test and certify that all welds are in conformance with the welding procedures approved for the work. Contractor shall assist the inspector/supervisor as necessary with any testing procedures.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chugach-furnished pipe piles are the sizes shown on the list of Chugach-furnished materials. Materials for pipe conform to ASTM A252 Grade 3, or ASTM A500 Grade B or Grade C.

B. Contractor may, at his option, install driving shoes to the piles at no additional cost to Chugach.

2.2 EQUIPMENT

A. Driving Equipment

1. It shall be the Contractor's responsibility to furnish equipment of sufficient size to install the piles as specified without damaging piles or adjacent structures. The equipment shall be maintained in good operating condition at all times during installation and shall be able to operate at its full-rated capacity. Pre-drilling equipment shall be available as necessary at no additional cost to Chugach.

2. Driving Caps

a. Impact hammers shall be equipped with cast steel or structural steel driving caps, with grooved bases conforming to the pile shape.

3. Driver Leads

   a. Fixed or rigid pile driver leads that shall hold the pile firm in position and alignment, and in axial alignment with the hammer, shall be used. The leads shall be extended to within 2 feet of the elevation at which the pile enters the ground.

PART 3 - EXECUTION

3.1 EXAMINATIONS

A. Verify that all field conditions are acceptable and are ready to receive the work. Beginning installation means Contractor accepts existing conditions.

3.2 PREPARATION

A. Pile Length Markings: Each pile's length shall be marked with horizontal lines at 1-foot intervals and the number of feet from the tip at 5-foot intervals with white or orange indelible marker.

3.3 INSTALLATION

A. Driving Piles

1. Piles shall be installed at locations indicated on Drawings.
2. Each pile shall be driven without interruption until full depth is obtained.
3. Protect the pile head during driving. Provide full bearing on the piles for distribution of the hammer blow. Do not damage piles during driving operations. Any hammer that causes damage to the piles during driving operations shall be substituted with an acceptable alternate hammer.
4. Impact hammers shall be supplied with new capblock cushions, which shall be changed at the manufacturer's recommended cycle.
5. Where piles are installed in backfill material, the backfill material shall be placed and compacted in accordance with Section 312000, Excavation and Fill.
6. The Contractor may perform pre-drilling for pipe piles. The diameter of the pre-drill shall not exceed 80% of the pipe pile outside diameter below the top three feet of soil. Contractor may excavate a hole larger than the pile diameter in the top three feet of soil provided the material is backfilled and compacted around the pile after pile driving is completed.

7. Carefully maintain pile centerline location. Carefully plumb leads and pile before driving.
8. When handling and driving piles, take special precautions to ensure against overstress or leading away from true position when driving.
9. Should any obstructions be encountered which threaten to damage the pile so as to make it unsuitable or cause a pile to drift from its required location, and cannot be removed through pre-drilling, cease driving and immediately notify Engineer.
10. Piles shall be driven to minimum required embedment shown on the Drawings.

B. Damaged or Misdriven Piles

1. Damaged piles and piles driven outside the required driving tolerances will not be accepted and shall be removed. Damaged piles are defined as piles that exhibit variations beyond mill tolerance limits.
2. Piles rejected after driving may be withdrawn and reinstalled at the correct location provided they are not damaged.
3. Solidly fill spaces left by withdrawn piles that will not be filled by new piles, using structural backfill. The backfill material shall be compactable and suitable for providing a dense, supportive soil mass, free of voids, not frozen. Backfill shall be placed in the void left by withdrawn pile in layers not exceeding six inches in depth, with each layer mechanically tamped before the next layer is added. The backfill shall be compacted to a density equal to or greater than that of the surrounding undisturbed soil.

3.4 TOLERANCES

A. Install piles and top plates, within the following maximum tolerances:

1. Location of foundation piles: as shown on the Drawings.
2. Pile variation from vertical: two (2) percent in any direction.
3. Top elevation of piles for structures using leveling nuts: ± 1/2 inch.
4. Top elevation of piles for structures without leveling nuts (Foundation F12): + 0, - 1/4 inch.

3.5 CUTTING OFF

A. Pipe piles shall be installed to depths that require no more than six (6) inches of pile top cut off.

B. Cuts shall be neat and square to the axis of the pile. Pile ends shall be beveled if required by the approved welding procedure. Dispose of excess materials as required by local and state law.

3.6 WELDING

A. All welding shall conform to the requirements of AWS D1.1 Welding Code by welders qualified in accordance with AWS for the type and position of welds.

B. Preheat and shelter requirements shall conform to AWS D1.1 and the approved welding procedure.

C. Flux coated welding electrodes shall be purchased in hermetically sealed containers. Immediately after opening of the sealed container, electrodes shall be stored in ovens at temperatures specified in the approved welding procedure and AWS D1.1. Electrode exposure to the atmosphere shall not exceed the time specified in the approved welding procedure and AWS D1.1. Electrodes that have been wet shall not be used.

D. Base metal shall be preheated as specified in the approved welding procedure.

E. Splices shall be welded to produce a straight pile alignment through the splice and developing full strength of the pile in both tension and bending.

F. Foundation top plates shall be welded in accordance with the detail shown on the Drawings.

3.7 EXAMPLE PILE DRIVING RECORD

A. See Appendix G for an example of an acceptable pile driving record.

END OF SECTION 316200

SECTION 337253

SHUNT REACTOR

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. New Reactor

1.2 DESCRIPTION OF THE WORK

A. This section covers installing the new reactor. Work also includes making all connections necessary to other equipment to provide a functioning electrical installation. Major equipment to be installed under this section includes:

1. 230kV Reactor, 30 MVAR

1.3 SUBMITTALS

A. Welder's certificate of fitness and welding procedures

1.4 PROJECT RECORD DOCUMENTS

A. As-built Drawings as specified in Special Provisions.

1.5 QUALITY ASSURANCE

A. Follow manufacturer's instructions in transporting, handling and installing the equipment.

B. Employ only qualified crafts.

C. Provide adequate means of handling of the installation of the equipment.

D. Verify that field conditions are acceptable and are ready to receive equipment.

E. Begin installation only after examination is complete and site is in all respects, ready for equipment installation to proceed.

F. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 COORDINATION

A. Coordinate all equipment transfer and installation activities with Chugach. Chugach to commission all equipment. Coordinate with Chugach for commissioning of installed equipment.

B. Reactor shall be commissioned by Chugach personnel. Coordinate all activities through Chugach's Site Representative.

PART 2 - PRODUCTS

2.1 REACTOR

A. Reactor listed under description of work is Chugach furnished. Product information is included on the project Drawings.

2.2 CONTRACTOR FURNISHED MATERIAL

A. Contactor shall supply and install all additional materials for complete installation of reactor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Visually inspect equipment for physical damage.

B. Verify dimensions as shown on the Drawings.

C. Assure work of other trades is complete and site is ready to receive the equipment.

3.2 PREPARATION

A. Clean placement surfaces of debris.

B. Remove protective coverings.

C. Clean all insulators.

D. Contractor shall verify allowed angle from vertical for oil filled devices. Contractor shall not exceed allowed angles during transport and placement of oil filled devices.

3.3 INSTALLATION

A. This section covers installation of Chugach-furnished reactor.

1. The reactor will be off-loaded and set on the reactor foundation by the Manufacturer's representative and the Contractor shall assist the Manufacturer's representative in placing the reactor on the pad in the correct location.
2. The Contractor shall direct the placement of the reactor onto the correct position on the pad, secure the reactor to the pad, and install ground connections.
3. Welding shall be performed by qualified personnel in accordance with AWS D1.1 and D1.8. Provide welded attachment to foundation embedded steel.
4. Provide temporary dunnage to store reactor radiators, bushings, conservator, oil containers, surge arresters, and other equipment the near reactor location. Provide labor and equipment to offload radiators, bushings, conservator, oil containers, surge arresters, and equipment.
5. The Contractor shall install the radiators, bushings, conservator, surge arresters and equipment under the direction of the reactor manufacturer's representative.
6. The Contractor shall pull and hold the vacuum on the tank as long as the reactor manufacturer representative requires and fill the oil under the direction of the reactor manufacturer's representative.
7. The Contractor shall install the ac power and grounding connections as shown in the drawings.

3.4 TOLERANCES

A. Alignment 1/2 inch horizontal, 1/2 inch vertical

3.5 TESTS

A. Testing and Commissioning of the reactor will be performed by Chugach Electric.

3.6 PROTECTION

A. Assure adequate protection from the environment until all covers, valves and etc. are installed and functioning.

END OF SECTION 337253