TECHNICAL SPECIFICATIONS

FOR

2018 EARTHQUAKE REPLACEMENT - POINT MACKENZIE SUBSTATION
&
POINT MACKENZIE SUBSTATION 138kV SYNCHRONIZING PT'S UPGRADE

W.O. E1820056 & E1920055

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SECTION 024155

MISCELLANEOUS DEMOLITION

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 dispose 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.

2 PRODUCTS - NOT USED

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 bench marks, property corners, existing structures and improvements to remain from damage or displacement.

D. Provide continuous vehicle access and egress.

3.3 DEMOLITION

A. Demolish and remove existing construction only to the extent required by new construction and as indicated.

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

C. 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.

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

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

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

G. 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.

H. Anchors to be retired shall be completely removed. Cutoff anchor rods will not be acceptable.

I. Poles to be retired are to be completely removed and disposed of as required by law.

J. Do not burn or bury materials on site.

K. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.4 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 REMOVED AND REINSTALLED ITEMS

A. Clean and repair items to functional condition adequate for intended reuse.

B. Pack or crate items after cleaning and repairing. Identify contents of containers.

C. Protect items from damage during transport and storage.

D. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.7 EXISTING ITEMS TO REMAIN

A. Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Chugach, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.8 USE OF EXPLOSIVES

A. Use of explosives will not be permitted.

END OF SECTION 024155

SECTION 260500

COMMON WORK RESULTS FOR ELECTRICAL

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. 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.

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

C. Coordinate installations of Chugach-furnished materials with Chugach personnel.

2 PRODUCTS

2.1 CONTRACTOR-FURNISHED EQUIPMENT AND MATERIALS

A. Unless otherwise specified, the Contractor shall furnish all fittings, hangers, conduit, 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.

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 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.

3.5 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

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 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 also includes high voltage cable installation, cable terminations, splices and wiring connectors and connections.

1.3 REFERENCES

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

1. NEMA WC7 - Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and distribution of Electrical Energy.
2. IEEE Standard 400 - IEEE Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems Rated 5 kV and Above.

1.4 SUBMITTALS

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

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

1.5 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.

1.6 PROJECT RECORD DOCUMENTS

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

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

C. Accurately record any deviation from project drawings.

1.7 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.

1.8 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.

1.9 COORDINATION

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

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.

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.

2.3 TERMINATIONS (1000 V AND ABOVE)

A. Modular terminators suitable for cables described under 2.1 of this section. Manufacturer: As specified on drawings.

B. Connectors, NEMA 2 and 4 hole pads, as specified on drawings.

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 raceway 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 conductors information on these limitations will be furnished by Chugach at the time of construction.

D. Ground cable shield only at switchgear enclosure end termination.

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

F. Clean conductor surfaces before installing lugs and connectors.

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

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

I. Use pulling lubricants where necessary.

1. Use only lubricants approved for use with cable types specified that do not leave flammable residue or support flame propagation.
2. Pulling lubricants shall not deteriorate conductor or insulation.
3. Soap/wax based lubricants shall not be used.
4. Use Polywater J or equivalent where compatible with cable types installed as specified by the lubricant manufacturer.
5. Use Polywater LZ or equivalent for Low Smoke Zero Halogen (LSZH) cables.

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

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

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. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
2. Inspect wire and cable for physical damage and proper connection.
3. Inspect shield grounding, cable supports, and terminations for proper installation.

END OF SECTION 260513

SECTION 260526

GROUNDING AND BONDING

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

B. This section covers:

1. Connectors
2. Conductors

1.3 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

E. Motorola R56 - Standards and Guidelines for Communication Sites

1.4 SUBMITTALS

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

B. Product Data: For each type of product indicated.

C. Approval required when materials substitutions are made.

D. Product Data: For the following:

1. Grounding connectors
2. Ground wire

E. 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 locations of electrodes and connections.

1.6 QUALITY ASSURANCE

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

B. Employ only qualified crafts for and adequate means of handling of the installation of the equipment.

1.7 COORDINATION

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

1.8 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.

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 260513 "Conductors and Cables."

B. Material: 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 copper cable.

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

G. Copper Bonding Conductor: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
2. Bonding Conductor: No. 4 or No. 10 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

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 CONNECTORS

A. Material: Bronze or copper.

B. Below Grade: Swaged.

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

2.5 WIRE

A. Material: Stranded copper.

B. Horizontal electrodes: #4/0 AWG copper, minimum.

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

1. Steel Structures #4/0
2. Ground Grid #4/0
3. High-Voltage Switch and Grounding Platform #4/0
4. All other grounds that may be necessary shall be size in accordance with NFPA 70.

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. In raceways, use insulated equipment grounding conductors.

B. Exothermic-Welded Connections: Not allowed, unless specifically approved by Chugach.

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

D. 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. 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.

C. The electrical continuity of wireways, pipes, rails and enclosures shall be maintained by bonding. Bonding of electrical raceway and enclosures shall assure electrical continuity and the capacity to conduct safely any fault current that could be imposed. Bonding shall comply fully with Article 250 of NFPA 70.

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

E. 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.

F. 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.

G. 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 swaged fitting.

H. 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. 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, unless specifically approved by Chugach.

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.

END OF SECTION 260526

SECTION 261210

SWITCHES

1 GENERAL

1.1 SECTION INCLUDES

A. Disconnect Switches

1.2 DESCRIPTION OF THE WORK

A. This section covers receiving and installing hand operated disconnect switches and all connections to other equipment necessary to provide a functioning electrical installation. Major equipment to be installed under this section includes:

1. Disconnect Switch: 230 kV

1.3 SUBMITTALS

A. None.

1.4 PROJECT RECORD DOCUMENTS

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

B. Test reports.

C. Operating and installation manuals.

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.

1.6 COORDINATION

A. Switches shall be installed by the Contractor. Coordinate all equipment transfer and installation activities with Chugach.

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

2 PRODUCTS

A. Switches 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 and interconnection as shown on the Drawings.

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.

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

3.2 PREPARATION

A. Clean placement surfaces of debris.

B. Clean all insulators.

C. Remove protective coverings.

3.3 INSTALLATION

A. Switches

1. This section covers installation of Chugach-furnished power transformer.
    a. Contractor shall load, transport and offload each Switch.
    b. Install the Switches on the structures as indicated on the Drawings. Provide all required field drilling of steel, brackets, piping, couplings, nuts, bolts, washers and other necessary hardware to complete the installation.
    c. The Contractor shall direct the placement of the Switch onto the correct position on the structure, secure the Switch to the structure, install ground connections, and install operating mechanism.
    d. The Contractor shall be responsible for any and all modifications to the steel structures to install a complete working disconnect switch assembly. Final touch-up painting shall be applied to switch base parts and/or structure where required.
    e. Switch handles and operating platforms shall be arranged and aligned to ensure the proper switching of the unit from the platform.
    f. Align the Switch contacts for proper operation.
    g. Gang operated switches shall be installed such that the blades open and close simultaneously. The Switches will be manually operated until approved by the Chugach. The Contractor shall adjust all cam, spare contacts, and limit switches in accordance with the drawings and maintenance instructions.

h. DO NOT pierce operator rods with piercing screws. Final adjustments, setting of piercing screws and commissioning shall be performed by Chugach.

i. Provide all equipment ground connections.

j. Final adjustments and commissioning shall be performed by Chugach.

k. Provide temporary dunnage to store Switches near installation location. Provide labor and equipment to off load Switches. Switches and other equipment associated with the Switches shall be the Contractors responsibility until after the Switch is installed and commissioned. If any of the above equipment is damaged during this time period the contractor shall replace it with no additional compensation.

3.4 TOLERANCES

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

3.5 TESTS

A. Chugach to test and commission equipment. No tests required.

3.6 PROTECTION

A. None.

END OF SECTION 261210

SECTION 261220

BUSWORK, CONDUCTORS AND FITTINGS

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 specification includes, but is not limited to, the following:

1. Rigid bus
2. Flexible bus
3. Swaged, Bolted, and Compression Connections

1.3 DESCRIPTION OF THE WORK

A. This Section covers the material and installation of all buswork including rigid buses, flexible jumper buses, cable jumpers, fittings and all hardware required to form a complete system of current carrying paths connecting the equipment as shown on the Drawings.

1.4 SUBMITTALS

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

1.5 PROJECT RECORD DOCUMENTS

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

1.6 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.

1.7 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.

1.8 COORDINATION

A. Coordinate timing of installations with other trades.

1.9 TOOLS

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

2 PRODUCTS

2.1 MATERIALS

A. Tubular Bus: Extruded aluminum seamless pipe made of 6063-T6 alloy, ANSI schedule and size as indicated on the Drawings. Tubular bus shall be manufactured and supplied in conformance with ASTM B-241.

2.2 CONNECTIONS

A. Bolted Connectors: As indicated on the drawings or approved equal.

B. Compression Connectors:

1. As indicated on the drawings or approved equal.
2. Swaged for tubular and flexible jumper bus conductors.

C. Fasteners: All bolts, washers, and lock washers for bus connections shall be Grade 8 Cad Plated or Stainless Steel (300 series CRES) and provided by Contractor. All nuts shall be silicone bronze. Aluminum is not acceptable. All conductors at joints and fittings shall be clean and free of foreign matter. Excluding DMC Power swaged connections, an oxide-inhibiting compound (Burndy "Penatrox A" or an approved equal) shall be used at all connections involving aluminum conductor and fittings.

D. 230 kV Bus: Swaged compression type as shown on Drawings.

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. When aluminum bus is prepared for shipment by wrapping in paper or packaging in cardboard cartons, the bus finish may be damaged if such materials are allowed to become wet and remain on the bus. The Contractor shall unpack, clean, and check aluminum bus immediately upon receipt from the carrier. Contractor shall remove all materials which might damage the bus finish and store the bus in such a manner that the finish will be protected.

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

C. Aluminum to aluminum connections made with DMC Power swaged connectors do not require contact surfaces to be prepared with any compounds. Follow manufacturer’s instructions for surface preparation.

D. Aluminum to aluminum connections shall be prepared by covering the contact surfaces with “Penetrox A”. Then the surface shall be thoroughly cleaned with fine steel wool and bolted together without removing the compound from the contact surfaces. When making aluminum-copper connections place the aluminum above the copper.

E. 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 buses, damping conductors, cable jumpers, fittings, and all connectors in complete conformance with manufacturers' recommendations.

B. Tubular Bus

1. All bus shall be field cut and trimmed to the required configurations. Bus supports shall be adjusted so that the centerline of the bus is uniform, in alignment, and fits snugly in its saddle. Placement of shims may be necessary. Skewing will not be permitted, and there shall be no offsets where joints are made. Vertical bus or risers shall be perpendicular to, and in alignment with, lower bus. Bus to equipment shall be carefully formed prior to installation by field cutting and bending so as to eliminate any strain on the porcelain equipment bushings from "forced" connection.
2. Where possible, the Contractor shall install bus conductor such that runs between fittings and terminal connectors shall be one continuous run without joints.
3. Care shall be exercised in handling bus to prevent damage to the surface such as nicks and abrasions. Sharp edges and protrusions shall be ground smooth in order to prevent corona discharge from the bus.
4. The Contractor shall drill weep holes in all bus risers, bends, A-frames, and horizontal runs at the lowest practical point to drain moisture accumulation. Unless otherwise noted on the Drawings, the size of weep holes shall be 1/4-inch diameter for bus 4-inch IPS. All holes shall be reamed to remove sharp edges.
5. All tube cutting shall be done with an approved pipe cutter. Flame cutting will not be permitted.
6. Use extreme care not to scratch or mar aluminum surfaces. Contractor shall replace all damaged buswork and fittings without additional compensation.
7. Expansion joints will be shipped unassembled and shall be installed to the configuration as shown on the Drawings.
8. All tubular bus connectors shall be DMC Power swage fittings. Bus couplers shall be installed as specified on the Drawings within the first quarter span either side of a bus support. Bus couplers outside of the first quarter span are not approved.

C. Swaged and Compression Connections

1. Install per manufacturer's recommendations.
2. Minimum distance between two swaged fittings is 6 inches.

D. Bolted Connections

1. Use corrosion inhibiting compound (Penetrox-A) for all connections, except where using DMC Power swaged connectors.
2. Use torque wrenches in accordance with manufacturer's recommendations for bolt installations.
3. Remove excess compound.

4. All bolts, washers, and lock washers for bus connections shall be Grade 8 Cad Plated or Stainless Steel (300 series CRES) and provided by Contractor. All nuts shall be silicone bronze. Aluminum is not acceptable. All conductors at joints and fittings shall be clean and free of foreign matter. Excluding DMC Power swaged connections, an oxide-inhibiting compound (Burndy "Penatrox A" or an approved equal) shall be used at all connections involving aluminum conductor and fittings.
5. Bolts installed vertically shall have the bolt head oriented gravitationally down (nut on top).
6. No more than three and no less than one thread shall be showing when the nut is attached and tightened to the correct torque value.

E. Compression Connections for Flexible Conductors

1. Install connectors with properly sized dyes in accordance with the manufacturer's instructions. All required dies and equipment is to be furnished by the Contractor.
2. Apply oxide inhibiting compound compatible with the connections and surface conditions involved.
3. Where inverted connections are required provide swaged connections with weep hole. Inverted compression type connectors are not acceptable.

F. Jumper Loops and Strings

1. 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 aesthetically pleasing appearance throughout.
2. Stranded conductor shall be installed without twists, kinks, or "bird-caging" and shall be handled to avoid abrasions or other damage. No splices shall be allowed in overhead strain buses.

3.4 TOLERANCES

A. Horizontal Bus: 1/8 inches per 10 Feet length.

B. Vertical Bus: 1/8 inches per 10 Feet length.

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 and/or infrared 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 261225

INSULATORS

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 specification includes, but is not limited to, the following:

1. Station Post Insulators
2. Auxiliary Equipment and Interconnections

1.3 DESCRIPTION OF THE WORK

A. This section covers receiving and installing insulators and their mounting and all connections necessary to other equipment to provide a functioning electrical installation.

1.4 SUBMITTALS

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

1.5 PROJECT RECORD DOCUMENTS

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

1.6 QUALITY ASSURANCE

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

B. Employ only qualified crafts for and adequate means of handling of the installation of the equipment.

1.7 COORDINATION

A. Coordinate all activities through Chugach's Site Representative.

2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: As specified on the drawings or approved by Chugach.

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 Insulators.

3.3 INSTALLATION

A. Station Post Insulators

1. Install on support structures as shown on the Drawings.
2. Contractor to provide all required auxiliary equipment and materials required for mounting and interconnections.
3. Torque bolts to the manufacturer's instructions.
4. Make electrical connections in accordance with the Drawings.

3.4 TOLERANCES

A. Station post insulator alignment: 1/4 inches horizontal, 1/4 inches vertical.

END OF SECTION 261225

SECTION 312000

EARTHWORK

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. Final Grading.

1.3 DEFINITIONS

A. Excavation: Removal of material encountered below subgrade.

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

C. 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.

D. 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. None.

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. None.

1.5 QUALITY CONTROL/QUALITY ASSURANCE

A. None.

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.

2 PRODUCTS

2.1 SOIL MATERIALS

A. None.

2.2 STOCKPILE MATERIAL

A. None

3 EXECUTION

3.1 PREPARATION

A. Preparation of subgrade is not applicable as this substation is existing.

3.2 EXPLOSIVES

A. Explosives: Do not use explosives.

3.3 EXCAVATION AND INSPECTION

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

B. This project takes place in a historical substation where contaminated soils may exist. Should contaminated soils be encountered in the course of excavation, the Contractor shall cease excavation activities and notify Chugach.

3.4 FOUNDATION EXCAVATION

A. None.

3.5 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation with compacted native material.

3.6 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.

3.7 FILL AND BACKFILL

A. Place and compact backfill in excavations promptly.

3.8 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes.

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.

3.9 FIELD QUALITY CONTROL

A. None.

3.10 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 pre-construction grade 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 re-compact as directed by Chugach.

3.11 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

B. The Contractor shall remove contaminated soils from the excavation as directed by Chugach. Contaminated soils will be disposed of by Chugach.

END OF SECTION 312000

SECTION 316200

DRIVEN PIPE PILE FOUNDATIONS

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

1.3 REFERENCES

A. 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 Engineer 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.

2 PRODUCTS

2.1 MATERIALS

A. Chugach-furnished pipe piles are the sizes shown on the list of Owner-furnished material.

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.

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.

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, Earthwork.
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: + 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.

3.7 EXAMPLE PILE DRIVING RECORD

A. The following is an example of an acceptable pile driving record.

PILE DRIVING RECORD

Project:_____ **Contractor:** _____

Foundation ID: _____ **Date:** _____

Temperature:_____ **Weather:** _____

Pile Designation:_____ **Pile Size:** _____

Total Pile Length:_____ **Completed Pile Depth:**_____ **Completed Pile Reveal:** _____

Equipment Used **Type** **Ft/Lbs** **or** **Horsepower**

Comments:

Foot Marker	Elapsed Time	Segment Time	Blows (Impact)	Foot Marker	Elapsed Time	Segment Time	Blows (Impact)
1				21			
2				22			
3				23			
4				24			
5				25			
6				26			
7				27			
8				28			
9				29			
10				30			
11				31			
12				32			
13				33			
14				34			
15				35			
16				36			
17				37			
18				38			
19				39			
20				40			

Nature and location of Obstructions:

Performed By:_____

Witnessed By_____

END OF SECTION 316200