CHUGACH
POWERING ALASKA'S FUTURE

INTERNATIONAL SUBSTATION 138KV FACILITIES RETIREMENT

W.O. E1720055

Project Book

BID PACKAGE FOR:

INTERNATIONAL SUBSTATION 138KV FACILITIES RETIREMENT

W.O. E1720055

TABLE OF CONTENTS

Chugach Electric Association, Inc. **Via e-mail**
INVITATION TO BID
April 6, 2021

TO: Chugach Electric Association, Inc., 2019-21 Outside Electrical Line Construction Contract

You are invited to submit a proposal for Chugach Work Order E1720055, International Substation 138kV Facilities Retirement

The existing facilities at INSS were used to protect the two 138/34.5 kV transformers and allowed for switching the 138 kV lines that come into the substation. With the installation of ITSS, these facilities are no longer necessary. Now that many of these facilities have been removed, the relocation of the two 138/34.5 kV transformers can occur. This relocation will provide enough space between these pieces of critical infrastructure such that a cascading failure would be unlikely. In addition, oil containment that currently does not exist will be added. The existing 138kV /34.5KV transformers will be relocated away from the 34.5 kV switchgear building to minimize damage in the event of a failure, and new deadend structures will be installed to connect INSS to ITSS at 138 kV.

Existing 138kV and 34.5kV capacitor banks and their associated breakers, circuit switchers, and PTs were no longer being used; and it was determined beneficial to mitigate fire hazards and provide oil containment for the 138/34.5kV power transformers T1 and T2. The retirement of the 138kV and 34.5kV capacitor banks, and their associated breakers, circuit switchers, PTs, and foundations has been completed. The INSS 138kV retirement project will retire existing strain buses; relocate transformers T1 and T2 to new foundations; provide fire walls and oil containment provisions; remove the foundations of the retired and relocated equipment; and provide new 34.5kV cable from dead end structure to new location of new power transformers with strain buses, install new 138kV cable from ITSS to INSS, and associated structures and their foundations, and other required facilities.

This project is not subject to the union signatory sections of Chugach's Outside or Generation Agreements contained in Exhibit N of the 2019-21 Outside Electrical Line Construction Contract.

Please base your bids on the following conditions:

- All Contractor bids must be valid until 5:00 pm on May 20, 2021. After that time, the Contractor shall have the option of retracting its bid. Projects awarded as late as and including the last day the Contractor's bids are valid are not subject to contractor claim for delay of award.
- Contractor shall begin work within seven (7) calendar days of Notice to Proceed.
- Completion date for this project is September 30, 2021.
- No clearing is anticipated for this project.
- As-built drawings are required.
- A Bid Bond is required.

A bid bond in the amount of 10% of the bid shall be provided with the Bid documents. A certified check made payable to "Chugach Electric Association, Inc." may be substituted for the Bid Bond.

- Written releases of liens are required.

A Pre-Bid Conference is scheduled for 2:00 P.M. Anchorage time, April 13, 2021 on Microsoft Teams. Contractor representation and attendance of this Pre-Bid Conference is mandatory. The link to connect to the Microsoft Teams invite is : Pre-Bid Conference Meeting. If you have trouble connecting or using the link, please reach out to Jesse Moe by email at Jesse_Moe@chugachelectric.com or by phone at (907) 250-1851.

RFB documentation is available on Chugach's website at www.chugachelectric.com, under Inside Chugach, Bid Opportunities tab. Contractors can access the RFB documentation under the "View advertisement and associated documents" button in WO E1720055.

All bids delivered in person or by Fax (907)762-4699 must be received prior to 2:00 P.M. Anchorage time, April 20, 2021, at Chugach's Headquarters Building, first floor Purchasing Office, 5601 Electron Drive, Anchorage, Alaska.

Notice to Proceed shall not be issued until Chugach has received (1) all bonds required by this Invitation to Bid (ITB) in the required amounts and forms and properly executed by the appropriate individuals, (2) a site specific HSE plan, (3) all documentation required in the Bid Documents including insurance certificates, proof of builder's risk insurance, and an MS Project based schedule. The contract time allowed for completion of this contract shall not be extended or suspended by any delay by Contractor in providing these documents necessary for the Notice to Proceed to be issued. If the total total amount of the winning bid should exceed $1,000,000.00, the NTP will be delayed pending Chugach Electric Association's Board Approval.

No work shall begin until the successful bidder has been issued a written Notice to Proceed.

A Pre-Construction Conference will be required. Construction progress meetings will be held. Frequency and schedule of Construction progress meetings will be determined based on construction activity.

All work shall be performed in compliance with all applicable local, state and federal ordinances, orders, statutes, rules and regulations.

The Contractor shall furnish all material required for the project that is not indicated on Chugach's material issue form. Chugach must approve all Contractor-furnished material prior to installation.

The Contractor shall secure locates and assume responsibility for damage to any and all overhead and underground facilities.

Construction of this project will involve work on or around energized equipment. Outages will be granted based on the outage schedule contained in the Contract Documents.

Outages will be subject to advanced coordination/notification and Chugach electrical system requirements in effect for the time period the outage is requested. Outages are subject to system conditions.

Contractor shall take delivery of all available materials within seven (7) days of Notice to Proceed.

Contractor's workmanship shall be warranted for two (2) years following Chugach acceptance of the project completion documentation.

The Contractor will not energize new or existing primary facilities in the absence of Chugach's Site Representative unless advanced written approval is secured from Chugach.

Payment for Contractor work is accomplished through use of a Completed Construction Report through prepared by Chugach's Site Representative and signed off by the Contractor's representative. Total payment is made on actual units completed not on estimated units stated in the bid documents unless otherwise stated in writing. Chugach has no obligation to subsequently reconcile or assist in reconciling the Contractor's billing records.

Chugach reserves the right to define and waive irregularities, to accept or reject any or all proposals/bids, in whole or in part, and to reissue, withdraw or cancel the solicitation/project in its entirety for any reason including its subsequent determination to perform the Work in-house without liability of any type to bidder/proposer, including but not limited to any costs associated with proposal/bid preparations and submittal.

All questions regarding the bid documents are to be directed to Chugach's Project Engineer, Jesse Moe, via email jesse_moe@chugachelectric.com. Questions shall be submitted no later than 12:00 PM, April 15, 2021.

CHUGACH ELECTRIC ASSOCIATION, INC.

Shawn Wendling, MSPM, PMP
Sr. Manager, PROJECTS

cc:
W.O. E1720055 File

- End of Invitation to Bid -

Bid Sheet

WORK ORDER NUMBER: E1720055 CONTRACTOR: _____

LOCATION: International Substation (INSS) DATE: April 6, 2021

BIDS ARE DUE PRIOR TO 2:00 P.M: April 20, 2021

This bid is submitted subject to the terms of the 2019-2021 Outside Electrical Line Construction Contract between Chugach Electric Association, Inc. and the undersigned for the above project as set out in the Invitation to Bid.

Project Bid Quotation: _____

Quotation Expires: May 20, 2021 5 P.M.

Contractor's Alaska License No.: _____

Insurance Expires: _____

Worker's Compensation: _____

Liability: _____

Automobile: _____

Contractor Sell Rate: _____

Contractor Labor Man-Hours: _____

EXCEPTIONS AND QUALIFICATIONS
Exceptions or qualifications taken by the Bidder to any of the documents furnished with this Invitation to Bid or clarifications to the Proposal shall be stated below and, if none, Bidder shall state "NONE".

_____

_____

SUBCONTRACTORS
The Bidder shall indicate below the Work intended to be subcontracted to others.

_____

_____

By Contractor: _____
Dated: _____

BID ACCEPTED SUBJECT TO TERMS AND CONDITIONS OF THE OUTSIDE ELECTRICAL LINE CONSTRUCTION CONTRACT

By Chugach Electric Association, Inc: _____
Dated: _____

INTERNATIONAL SUBSTATION 138KV FACILITIES RETIREMENT
BID SCHEDULE SUMMARY
W.O. E1720055

NEW CONSTRUCTION

Group A: STRUCTURES	_____
Group C: CIRCUITS AND BUSWORK	_____
Group F: FOUNDATIONS	_____
Group G: TRANSFORMERS	_____
Group K: CONDUIT AND CABLE	_____
Group M: SITE WORK	_____
Group O: GROUNDING	_____
Group S: STATION YARD LIGHTS AND RECEPTACLES	_____
TOTAL NEW CONSTRUCTION	_____

RETIREMENT

Group I: RETIREMENT	_____
TOTAL RETIREMENT	_____
TOTAL BID	_____

INSS 138KV FACILITIES RETIREMENT
BID SCHEDULE
W.O. E1720055

BID UNIT	DESCRIPTION	TAKEOFF QTY.	UNIT	UNIT LABOR	UNIT MATERIAL	UNIT LABOR & MATERIAL	EXTENDED COST
GROUP A: STRUCTURES							
A1	STEEL STRUCTURE, 138 kV/34.5kV, 2-BAY, H-FRAME, STRUCTURE	1	ea.				
A2	STEEL STRUCTURE, 34.5 kV 2-BAY H-FRAME, TERMINATION STRUCTURE	1	ea.				
						Total Group A:	
GROUP C: CIRCUITS AND BUSWORK							
C1	CIRCUIT, OVERHEAD OPEN WIRE 138kV CONDUCTOR WORK	1	lot				
C2	CIRCUIT, OVERHEAD OPEN WIRE 34.5kV STRAIN BUS #1	1	lot				
C3	CIRCUIT, OVERHEAD OPEN WIRE 34.5kV STRAIN BUS #2	1	lot				
						Total Group C:	
GROUP F: FOUNDATIONS							
F1	FOUNDATION WITH SECONDARY OIL CONTAINMENT AND FIREWALL FOR 138kV/34.5kV POWER TRANSFORMER #1	1	ea.				
F2	FOUNDATION WITH SECONDARY OIL CONTAINMENT AND FIREWALL FOR 138kV/34.5kV POWER TRANSFORMER #2	1	ea.				
F3	FOUNDATION, 138KV DOUBLE BAY H-FRAME CENTER LEG	1	ea.				
F4	FOUNDATION, 138KV DOUBLE BAY H-FRAME OUTSIDE LEG	2	ea.				
F5	FOUNDATION, 34.5KV DOUBLE BAY H-FRAME OUTSIDE LEG	2	ea.				
F6	FOUNDATION, 34.5KV DOUBLE BAY H-FRAME CENTER LEG	1	ea.				
F7	FOUNDATION YARD LIGHT, TYPE L7	4	ea.				
F8	FOUNDATION YARD LIGHT, TYPE L8	2	ea.				
						Total Group F:	
GROUP G: TRANSFORMERS							
G1	POWER TRANSFORMER, 138kV/34.5kV TRANSFORMER #1	1	ea.				
G2	POWER TRANSFORMER, 138kV/34.5kV TRANSFORMER #2	1	ea.				
						Total Group G:	

GROUP K: CONDUIT AND CABLE							
K1	CONDUIT, 2" RIGID STEEL CONDUIT	1	lot				
K2	CONDUIT, 2" HDPE	1	lot				
K3	CONDUIT, 2" HDPE WITH (1) 1-1/4" INNERDUCT	1	lot				
K4	CONDUIT, 4" HDPE WITH (3) 1-1/4" INNERDUCT	1	lot				
K5	CONDUIT YARD LIGHTS & RECEPTACLES	1	lot				
K6	MANHOUR	200	ea.				
K7	CABLE, CONTROL, 600V AC & DC	1	lot				

INSS 138KV FACILITIES RETIREMENT
BID SCHEDULE
W.O. E1720055

BID UNIT	DESCRIPTION	TAKEOFF QTY.	UNIT	UNIT LABOR	UNIT MATERIAL	UNIT LABOR & MATERIAL	EXTENDED COST
K8	CABLE, POWER, 600V AC & DC	1	lot				
K9	TEMPORARY STATION SERVICE	1	lot				
						Total Group K:	
GROUP M: SITE WORK							
M1	SWPPP, ADIMINISTRATION AND IMPLEMENTATION	1	lot				
M2	GEOTEXTILE FABRIC	1	lot				
M3	NFS SUBGRADE	1	lot				
M4	CRUSHED ROCK SURFACE COURSE	1	lot				
						Total Group M:	
GROUP O: GROUNDING							
O1	GROUNDING, SUBSTATION	1	lot				
						Total Group O:	
GROUP S: STATION YARD LIGHTS, RECEPTACLES AND SECURITY CAMERAS							
S1	STATION YARD LIGHTS	1	lot				
S2	STATION YARD RECEPTACLES	1	lot				
						Total Group S:	
	TOTAL NEW CONSTRUCTION						

INSS 138KV FACILITIES RETIREMENT
BID SCHEDULE
W.O. E1720055

BID UNIT	DESCRIPTION	TAKEOFF QTY.	UNIT	UNIT LABOR	UNIT MATERIAL	UNIT LABOR & MATERIAL	EXTENDED COST
GROUP I: RETIREMENT							
I-A1	RETIREMENT, 138kV LATTICE STRUCTURE	1	ea				
I-A2	RETIREMENT, WOOD, H-FRAME,138kV DEADEND/34.5kV BUS SUPPORT STRUCTURE	1	ea				
I-A3	RETIREMENT, 34.5kV WOOD BUS SUPPORT STRUCTURE	2	ea				
I-A4	RETIREMENT, WOOD STRUCTURES ITIN1 1-2	1	ea				
I-A5	RETIREMENT, WOOD STRUCTURE ITIN2 1-2	1	ea				
I-C1	RETIREMENT, 138kV SHOO FLY	1	ea				
I-C2	RETIREMENT, OVERHEAD OPEN WIRE 138kV CONDUCTOR WORK	1	lot				
I-C3	RETIREMENT, OVERHEAD OPEN WIRE 34.5kV STRAIN BUSES	1	lot				
I-F1	RETIREMENT, TRANSFORMER #1, FOUNDATION	1	ea				
I-F2	RETIREMENT, TRANSFORMER #2, FOUNDATION	1	ea				
I-F3	RETIREMENT, 138kV LATTICE FOUNDATION	2	ea				
I-F4	RETIREMENT, TEMPORARY EROSION AND POLLUTION CONTROL	1	lot				
I-K1	RETIREMENT, TEMPORARY STATION SERVICE	1	lot				
						Total Group I:	

TOTAL RETIREMENT COST

BID BOND

KNOW ALL MEN BY THESE PRESENT, That we, _____
_____
of _____
_____as Principal, and _____
_____a corporation organized under the laws of _____
_____
_____ and authorized to transact surety business in the State of Alaska, of_____ as Surety, are held and firmly bound unto Chugach Electric Association, Inc., as Obligee in the full and just sum of ($_____) dollars, lawful money of the UNITED STATES, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said Principal is herewith submitting its proposal for
_____
_____
_____
_____
_____

The condition of this obligation is such that if the aforesaid Principal will, within the time required, enter into a formal contract and give a good and sufficient bond to secure the performance of the terms and conditions of the contract, then this Obligation to be void; otherwise the Principal and Surety will pay unto the Obligee the amount stated above.

Signed, sealed, and delivered _____, 20___.

WITNESS AS TO PRINCIPAL:

_____

Signature:

_____

Print Name:

_____

Principal
By: _____

Title: _____

_____ (Seal)
Corporate Surety

_____
Business Address

_____

By: _____
Attorney-in-Fact

CONTRACTOR'S BOND **Bond Number: _____**

1. Know all men that we, _____, as Principal, and_____, as Surety, are held and firmly bound unto CHUGACH ELECTRIC ASSOCIATION, INC. (hereinafter "Chugach") and unto all persons, firms and corporations who or which may furnish materials for or perform labor on the Work for the Project known as awarded to Principal by Chugach under the Outside Electrical Line Construction Contract (OELCC) executed by the parties on _____, 20____ and to its successors in the penal amount of _____ dollars ($_____), as hereinafter set forth and for the payment of which sum well and truly to be made, we bind ourselves, our executors, administrators, successors and assigns jointly and severally by these present.

2. The condition of this obligation is such that if the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of the OELCC and any Projects thereunder and any amendments thereto, whether such amendments are for additions, decreases, or changes in materials, their quantity, kind of price, labor costs, mileage, routing or any other purpose whatsoever, and whether such amendments are made without notice to the Surety, and shall fully indemnify and hold harmless Chugach from all costs and damages which it shall suffer or incur by reason or any failure so to do, and shall fully reimburse and repay Chugach for all outlay and expense which Chugach shall incur in making good any such failure or performance on the part of the Principal and shall promptly make payment to all persons working on or supplying labor or materials for use in the construction of the Projects hereunder, in respect of such labor or materials furnished and used therein, to the full extent thereof, and in respect of such labor or materials furnished but not so used, the extent of the quantities estimated in the Projects to be required for the construction of the Projects, and shall well and truly reimburse Chugach for any excess in cost of construction of said Projects over the cost of such construction as provided in the Projects, occasioned by a default of the Principal under the Projects, then this obligation shall be null and void but otherwise shall remain in full force effect.

3. It is expressly agreed that this bond shall be deemed automatically and immediately amended, without formal and separate amendments hereto, upon any amendment to this Contract or the Projects hereunder so as to bind the Principal and the Surety to the full and faithful performance of the Projects as so amended provided only that the total amount of all increases in the costs of construction shall not exceed twenty percent (20%) of the amount of maximum price set forth in the construction contract. The terms "Amendment" wherever used in this bond and whether referring to this bond or the Projects shall include any alternation, addition, extension, modification, amendment, rescission, waiver, release or annulment, or any character whatsoever.

4. It is expressly agreed that any amendment which may be made by agreement between the Principal and Chugach in the terms, provisions, and conditions of a Project, or to the terms, provisions, and conditions of this Contract shall not in any way release the Principal and the Surety, or either of them or their respective executors, administrators, successors or assigns, from liability hereunder. The Surety hereby acknowledges receipt of notice of any amendment, indulgence or forbearance, made, granted or permitted.0.0.

5. This bond is made for the benefit of all persons, firms and corporations who or which may furnish any materials or perform any labor for or on account of the construction to be performed on any projects, and they, and each of them, are hereby made obliges hereunder with the same force and effect as if their names were written herein as such, and they and each of them may sue hereon.

IN WITNESS WHEREOF, the undersigned have caused this instrument to be executed and their respective corporate seals to be affixed and attested by their duly authorized representative this day of _____, 20_____.

_____
Principal
By: _____

Attest: Its: _____

_____
Secretary

_____
Surety
By:_____

Attest: Its: _____

_____

_____
Address of Surety's Home Office

_____

By: _____
Resident Agent of Surety
(For service of process)

Signatures

The Contractor's Bond must be signed with the full name of the Contractor. If the Contractor is a partnership, a partner must sign the Contractor's bond in the partnership name. If the Contractor is a corporation, the Contractor's bond must be signed in the corporate name by a duly authorized officer and the corporate seal affixed and attested by the Secretary of the corporation. A typewritten copy of all such names and signatures shall be appended.

Power of Attorney

The Contractor's Bond must be accompanied by a power of attorney authorizing execution on behalf of the Surety by a duly authorized Alaska resident agent of the Surety.

INSS 138KV FACILITIES RETIREMENT
BID UNIT DESCRIPTIONS
W.O. E1720055

BID UNIT	UNIT DESCRIPTION
NOTES	GENERAL NOTES APPLICABLE TO ALL BID UNITS
	1. Cost for loading, transporting to construction site, and offloading of Chugach furnished material is incidental to the cost of the affected Bid Unit. No additional compensation will be paid for loading, transporting to construction site, and offloading of Chugach furnished material. Reference List Of Owner Furnished Material for materials furnished by Chugach and Bid Units affected by the Owner Furnished Material.
	2. Chugach will only furnish materials identified on the List Of Owner Furnished Material. All other materials required to complete the Work are to be furnished by the Contractor.
	3. Cost of dewatering is incidental to cost of affected Bid Units. No additional compensation will be paid for dewatering.
	4. Cost of surveying is incidental to cost of affected Bid Units. No additional compensation will be paid for surveying or surveying related expenses.
	5. Cost of grubbing, excavations, vacuum truck operations, restoration of disturbed ground to include the furnishing, installation and maintainence of top soil and hydro seed as well as backfilling, and including but not limited to those excavations provided for general excavation of the substation site, foundations, conduits, grounding, etc. shall include removal, from site, of excess or unusable excavated materials. The cost of this work shall be incidental to the Bid Units requiring the excavation effort. No additional compensation shall be paid for removal of excavation materials or for restoration of disturbed ground.
	6. Excavation in substation areas with existing conduit, cables, or other buried infrastructure that are to remain intact shall be done using a contractor supplied vacuum truck. The contractor shall provide a vacuum truck on this project for excavation between the equipment, locating underground facilities, and in areas in close proximity to energized cables and conductors. The cost of this equipment shall be considered incidental to the cost of the Bid Units requiring excavation.
	7. Mobilization is incedental in this contract. This work consists of furnishing and delivering to the site of all initially required materials; mobilization of all initially required construction equipment; having completed all Contract requirements to begin construction; having completed all Regulatory Agencies requirements to begin construction; provision of other supplies, appurtenances, and the like to begin construction; and provision of a manned crew, ready for commencing and prosecuting the work. This includes furnishing preparation of the Contractor's work and/or storage areas; the complete assembly, in working order, of equipment necessary to perform the required work; and all other preparatory work on construction items for which payment is provided under the Contract.
	8. Demobilization is incidnetal in this contract. The Contractor shall remove all equipment from the site, as well as any appurtanances, and the like used for the performance of the work, as well as restoration of the Contractor's work and storage areas, clean-up and disposal of all debris, spoils, and trash, in compliance with Regulatory Agencies' requirements and the Contract Documents, after all work is completed.
A1	STEEL STRUCTURE, 138 kV/34.5kV, 2-BAY, H-FRAME, STRUCTURE - This unit includes furnishing all labor, miscellaneous materials, and equipment required for the complete installation of one Owner Furnished 138 kV/34.5kV, 2-BAY, H-FRAME, STRUCTURE. The unit includes placement and adjustment in accordance with specifications, drawings, and manufacturer's instructions.
A2	STEEL STRUCTURE, 34.5 kV 2-BAY H-FRAME, TERMINATION STRUCTURE - This unit includes furnishing all labor, miscellaneous materials, and equipment required for the complete installation of one Owner Furnished 34.5 kV 2-BAY H-FRAME, TERMINATION STRUCTURE. The unit includes placement and adjustment in accordance with specifications, drawings, and manufacturer's instructions.

INSS 138KV FACILITIES RETIREMENT
BID UNIT DESCRIPTIONS
W.O. E1720055

BID UNIT	UNIT DESCRIPTION
C1	CIRCUIT, OVERHEAD OPEN WIRE 138kV CONDUCTOR WORK - This unit includes installing all overhead open wire 138kV tap work and re-work as shown on the drawings and detailed in the specifications, as well as furnishing all non-owner furnished material to do this work. This unit includes installing all required 795 ACSR DRAKE conductor as shown on drawings. This unit includes installing all required conductors, insulators, deadend assemblies, connectors, filler compounds, terminations, fasteners, clamps fittings, lugs, paddles, taps, jumpers, hardware, testing, and all miscellaneous labor and materials to provide complete functional conductor system installation, as well as furnishing all non-owner furnished material to do this work.
C2	CIRCUIT, 138kV CONNECTIONS - This unit includes installing all 138kV transformer connections, and re-work as shown on the drawings and detailed in the specifications, as well as furnishing all non-owner furnished material to do this work. This unit includes connections to existing overhead conductors and connections to the high side bushings, and surge arrestors of transformers #1 and #2 as shown on drawings.
C3	CIRCUIT, OVERHEAD OPEN WIRE 34.5kV STRAIN BUS #1 - This unit includes furnishing all non-owner furnished materials and installing all overhead open wire strain bus shown on the drawings and detailed in the specifications. This unit includes installing all required 1590 AAC COREOPSIS conductors as shown on drawings. This unit includes furnishing all non-owner furnished materials and installing all required conductors, insulators, deadend assemblies, connectors, filler compounds, terminations, fasteners, clamps fittings, lugs, paddles, splices, taps, tee-taps, cable spacers, jumpers, hardware, testing, and all miscellaneous labor and materials to provide complete functional 34.5kV strain bus installation. This unit includes connections to the low side bushings, and surge arrestors of relocated transformers #1, and all connections to the bushings of the existing 34.5kV switchgear, as shown on the drawings.
C4	CIRCUIT, OVERHEAD OPEN WIRE 34.5kV STRAIN BUS #2 - This unit includes furnishing all non-owner furnished materials and installing all overhead open wire strain bus shown on the drawings and detailed in the specifications. This unit includes installing all required 1590 AAC COREOPSIS conductors as shown on drawings. This unit includes furnishing all non-owner furnished materials and installing all required conductors, insulators, deadend assemblies, connectors, filler compounds, terminations, fasteners, clamps fittings, lugs, paddles, splices, taps, tee-taps, cable spacers, jumpers, hardware, testing, and all miscellaneous labor and materials to provide complete functional 34.5kV strain bus installation. This unit includes connections to the low side bushings, and surge arrestors of relocated transformers #1, and all connections to the bushings of the existing 34.5kV switchgear, as shown on the drawings.
F1	FOUNDATION WITH SECONDARY OIL CONTAINMENT AND FIREWALL FOR 138kV/34.5kV POWER TRANSFORMER #1 - This unit includes all material and labor to install one foundation with secondary containment and fire wall for 138/34.5 kV TRANSFORMER #1. The unit includes all required excavating, compaction, forming, and finishing; providing all testing services; furnishing and installing all rebar, concrete, classified fill, gratings, grating supports, and miscellaneous materials as required for a complete concrete foundation with a fire wall for TRANSFORMER #1.
F2	FOUNDATION WITH SECONDARY OIL CONTAINMENT AND FIREWALL FOR 138kV/34.5kV POWER TRANSFORMER #2 - This unit includes all material and labor to install one foundation with secondary containment and fire wall for 138/34.5 kV TRANSFORMER #2. The unit includes all required excavating, compaction, forming, and finishing; providing all testing services; furnishing and installing all rebar, concrete, classified fill, gratings, grating supports, and miscellaneous materials as required for a complete concrete foundation with a fire wall for TRANSFORMER #2.
F3	FOUNDATION, 138kV DOUBLE BAY, H-FRAME, CENTER LEG - This unit includes all material and labor to install one 138kV double bay, H-frame, center leg foundation. The unit includes all required excavating, compaction, forming, and finishing; providing all testing services; furnishing and installing all rebar, anchor bolts, concrete, classified fill, and miscellaneous materials as required for a complete concrete foundation.

INSS 138KV FACILITIES RETIREMENT
BID UNIT DESCRIPTIONS
W.O. E1720055

BID UNIT	UNIT DESCRIPTION
F4	FOUNDATION, 138kV DOUBLE BAY, H-FRAME, OUTSIDE LEG - This unit includes all material and labor to install one 138kV double bay, H-frame, outside leg foundation. The unit includes all required excavating, compaction, forming, and finishing; providing all testing services; furnishing and installing all rebar, anchor bolts, concrete, classified fill, and miscellaneous materials as required for a complete concrete foundation.
F5	FOUNDATION, 34.5kV DOUBLE BAY, H-FRAME, OUTSIDE LEG - This unit includes all material and labor to install one 34.5kV double bay, H-frame, outside leg foundation. The unit includes all required excavating, compaction, forming, and finishing; providing all testing services; furnishing and installing all rebar, anchor bolts, concrete, classified fill, and miscellaneous materials as required for a complete concrete foundation.
F6	FOUNDATION, 34.5kV DOUBLE BAY, H-FRAME, CENTER LEG - This unit includes all material and labor to install one 34.5kV double bay, H-frame, center leg foundation. The unit includes all required excavating, compaction, forming, and finishing; providing all testing services; furnishing and installing all rebar, anchor bolts, concrete, classified fill, and miscellaneous materials as required for a complete concrete foundation.
F7	FOUNDATION, LIGHT FIXTURE TYPE L7 - This unit includes all material and labor to install one Type L7 light fixture foundation. The unit includes all required excavating, compaction, forming, and finishing; providing all testing services; furnishing and installing all rebar, anchor bolts, concrete, classified fill, and miscellaneous materials as required for a complete concrete foundation.
F8	FOUNDATION, LIGHT FIXTURE TYPE L8 - This unit includes all material and labor to install one Type L8 light fixture foundation. The unit includes all required excavating, compaction, forming, and finishing; providing all testing services; furnishing and installing all rebar, anchor bolts, concrete, classified fill, and miscellaneous materials as required for a complete concrete foundation.
G1	POWER TRANSFORMER, 138/34.5 kV Transformer #1, 75/100/125 MVA - This unit includes disconnecting, assisting in transformer relocating, reinstalling, and reconnecting existing POWER TRANSFORMER #1. The unit includes placement of the transformer and welding the transformer to the foundation in accordance with specifications, drawings, and manufacturer's instructions. The unit includes coordinating with, providing personnel to facilitate, and assisting with the movement of the transformers with Other Contractor which will Jack and Roll transformer.
G2	POWER TRANSFORMER, 138/34.5 kV Transformer #2, 75/100/125 MVA - This unit includes disconnecting, assisting in transformer relocating, reinstalling, and reconnecting existing POWER TRANSFORMER #2. The unit includes placement of the transformer and welding the transformer to the foundation in accordance with specifications, drawings, and manufacturer's instructions. The unit includes coordinating with, providing personnel to facilitate, and assisting with the movement of the transformers with Other Contractor which will Jack and Roll transformer.
K1	CONDUIT, 2" RIGID STEEL CONDUIT - This unit includes furnishing and installing all 2" RGS conduits as shown on drawings and in conduit schedules. The unit includes furnishing and installing all couplings, fittings, elbows, bending, conduit supports, fasteners, grounding hardware, trenching, trench backfill, compaction and testing, and wall penetrations. This unit includes providing and installing conduit sealing bushings for spare conduits, and providing and installing pull ropes in all conduits. This unit includes all flexible liquid tight conduits and fittings for risers from RGS conduits to equipment cabinets and provision of entrance hole in equipment cabinets. This unit includes intercepting existing conduit and extending it or providing new conduit as noted on the conduit schedule. This unit includes all miscellaneous labor and material for a complete conduit system.

INSS 138KV FACILITIES RETIREMENT
BID UNIT DESCRIPTIONS
W.O. E1720055

BID UNIT	UNIT DESCRIPTION
K2	CONDUIT, 2" HDPE - This unit includes furnishing and installing all 2" HDPE conduits as shown on drawings and in conduit schedules. The unit includes furnishing and installing all couplings, fittings, elbows, conduit supports, fasteners, bending, trenching, trench backfill, and compaction and testing. This unit includes providing and installing conduit sealing bushings for spare conduits, providing and installing pull ropes in all conduits, installing cable locator disk, and provision of entrance holes in junction boxes, vaults, and hand holes as shown on the drawings. This unit includes all miscellaneous labor and material for a complete conduit system.
K3	CONDUIT, 2" HDPE WITH (1) 1-1/4" INNERDUCT - This unit includes furnishing and installing all 2" HDPE with (1) 1-1/4" conduits as shown on drawings and in conduit schedules. The unit includes furnishing and installing all couplings, fittings, elbows, conduit supports, fasteners, bending, trenching, trench backfill, and compaction and testing. This unit includes providing and installing conduit sealing bushings for spare conduits, providing and installing pull ropes in all conduits, installing cable locator disk, and provision of entrance holes in junction boxes, vaults, and hand holes as shown on the drawings. This unit includes all miscellaneous labor and material for a complete conduit system.
K4	CONDUIT, 4" HDPE WITH (3) 1-1/4" INNERDUCT - This unit includes furnishing and installing all 4" HDPE with (3) 1-1/4" conduits as shown on drawings and in conduit schedules. The unit includes furnishing and installing all couplings, fittings, elbows, conduit supports, fasteners, bending, trenching, trench backfill, and compaction and testing. This unit includes providing and installing conduit sealing bushings for spare conduits, providing and installing pull ropes in all conduits, installing cable locator disk, and provision of entrance holes in junction boxes, vaults, and hand holes as shown on the drawings. This unit includes all miscellaneous labor and material for a complete conduit system.
K5	CONDUIT YARD LIGHTS & RECEPTACLES - This unit includes furnishing and installing miscellaneous conduit at the yard lights, and at yard receptables. The unit includes furnishing and installing all couplings, fittings, elbows, conduit supports, fasteners, bending, trenching, trench backfill, and compaction and testing. This unit includes providing and installing conduit sealing bushings for spare conduits, providing and installing pull ropes in all conduits, installing cable locator disk, and provision of entrance holes in junction boxes, vaults, and hand holes as shown on the drawings, but not included in other Conduit Bid Units. This unit includes all miscellaneous labor and material for a complete conduit system.
K6	MANHOUR - This unit includes all labor and miscellaneous support tools required to perform one hour of Chugach-directed work.
K7	CABLE, CONTROL, 600V AC & DC - This unit includes installation of all new Owner Furnished 600V control cables as shown on drawings and in cable schedules. This unit includes providing and installing cable tags, cable ties, conduit sealing materials, testing, and all miscellaneous labor and materials to provide a complete cable installation. Provide 20' tails at both ends of cable runs. Chugach will land all control cables.
K8	CABLE, POWER, 600V AC & DC - This unit includes furnishing and installing all 600V power cables as shown on drawings and in cable schedules. This unit includes providing and installing power cables, terminations, cable tags, cable ties, conduit sealing materials, testing, and all miscellaneous labor and materials to provide a complete cable installation. Contractor shall land all power cables.
K9	TEMPORARY STATION SERVICE - This unit includes furnishing all labor and miscellaneous materials necessary to install temporary 1-phase 120/240V station service. This unit includes conduits, cables, trench, panelboard, and service hookup/metering coordination. This unit includes providing and installing terminations, cable tags, cable ties, conduit sealing materials, testing, and all miscellaneous labor and materials to provide a complete temporary station service installation to be used during construction.

INSS 138KV FACILITIES RETIREMENT
BID UNIT DESCRIPTIONS
W.O. E1720055

BID UNIT	UNIT DESCRIPTION
M1	SWPPP, ADMINISTRATION AND IMPLEMENTATION - This unit includes: application for, approval of, and implementation of a best practices Storm Water Pollution Prevention Plan. This Unit includes furnishing and providing all labor, equipment, and material required for the administration and implementation of the temporary erosion and pollution control for the substation area, temporary storage area, access roads, and other areas impacted by the project, and/or as required by Contract, Specifications, and Regulatory Agencies.
M2	GEOTEXTILE FABRIC - This unit Includes furnishing and installing all separation geotextile fabric required throughout the site, where existing geotextile fabric is encountered and disturbed by other work activities. Provide a 12" overlap with existing geotextile fabric when placing new geotextile fabric.
M3	NFS SUBGRADE - This unit includes furnishing, installing, and compacting one (1) ton of non-frost susceptible fill at locations where foundations are removed and elsewhere throughout site where subgrade materials are removed from site, as directed in writing by the Owners Representative.
M4	CRUSHED ROCK SURFACE COURSE - This unit includes furnishing, installing, and compacting one (1) ton of crushed rock surface course, to a depth of 6", at locations throughout the site, where existing crushed rock surface is disturbed and made unsuitable or removed by other work activities, as directed in writing by the Owner's Representative.
O1	GROUNDING, SUBSTATION - This unit includes furnishing and installing all ground grid conductors, ground rods, ground connectors, clamps, fitting, grounding lugs, hardware, fasteners, grounding supports, structure grounds, transformer grounds, and grounding jumpers as shown on the drawings, as detailed in the specifications, and in compliance with manufacturer's recommendations to provide a complete and functional grounding system.
S1	STATION YARD LIGHTS - This unit includes the installation of Owner Furnished steel light poles, yard lights, external mount vertical tenons, and pole adapter bracket; and furnishing and installing of all station yard lights appurtenances. Contractor shall furnish and install conduit, connectors, wire, cords, junction boxes, fittings, and photocells, and provide all testing services and all miscellaneous labor and material for a complete system of station yard lights as shown on the drawings and in the specifications.
S2	STATION YARD RECEPTACLES - This unit includes furnishing and installing all station yard receptacles. Contractor shall furnish and install receptacles, connectors, wire, cords, conduit, junction boxes, and provide all testing services and all miscellaneous labor and material for a complete system of station yard lights as shown on the drawings and in the specifications.
I-A1	RETIREMENT, 138kV LATTICE STRUCTURE - This unit includes all labor, equipment, and materials required for the removal of the steel lattice H-structure and its disposal in compliance with the Contract and all Regulatory Agencies' requirements. Unit includes the complete removal of all appurtenances and miscellaneous items attached to or associated with the structure as shown on the drawings or as detailed in the specifications.
I-A2	RETIREMENT, WOOD, H-FRAME,138kV DEADEND/34.5kV BUS SUPPORT STRUCTURE - This unit includes all labor, equipment, and materials required for the removal of the wood pole, H-frame 138kV deadend/34.5kV bus structure and its disposal in compliance with the Contract and all Regulatory Agencies' requirements. Unit includes the complete removal of all appurtenances and miscellaneous items attached to or associated with the structure as shown on the drawings or as detailed in the specifications.
I-A3	RETIREMENT, 34.5kV WOOD BUS SUPPORT STRUCTURE - This unit includes all labor, equipment, and materials required for the removal of the wood pole deadend, 34.5kV bus structure and its disposal in compliance with the Contract and all Regulatory Agencies' requirements. Unit includes the complete removal of all guys, anchors, appurtenances, and miscellaneous items attached to or associated with the structure as shown on the drawings or as detailed in the specifications.

INSS 138KV FACILITIES RETIREMENT
BID UNIT DESCRIPTIONS
W.O. E1720055

BID UNIT	UNIT DESCRIPTION
I-A4	RETIREMENT, WOOD STRUCTURE ITIN1 1-2 - This unit includes all labor, equipment and material necessary for the removal and disposal of the wood pole structure in compliance with the Contract and all Regulatory Agencies' requirements as shown on the drawings or as detailed in the specifications. Unit includes the complete removal of all appurtenances and miscellaneous items attached to or associated with the structure.
I-A5	RETIREMENT, WOOD STRUCTURE ITIN2 1-2 - This unit includes all labor, equipment and material necessary for the removal and disposal of the wood pole structure in compliance with the Contract and all Regulatory Agencies' requirements as shown on the drawings or as detailed in the specifications. Unit includes the complete removal of all appurtenances and miscellaneous items attached to or associated with the structure.
I-C1	RETIREMENT, 138kV SHOO FLY - This unit includes all labor, equipment and material necessary for the removal and disposing of all conductor, insulators, conductor ties, dead ends, filler compounds, fasteners, poles, guy wires, and miscellaneous materials necessary for complete removal of the 138 kV transmission shoo-fly between the tap structures.
I-C2	RETIREMENT, OVERHEAD OPEN WIRE 138kV CONDUCTOR WORK - This unit includes all labor, equipment and material necessary for the removal and disposing of all conductor, insulators, conductor ties, dead ends, filler compounds, fasteners, connectors, and miscellaneous materials necessary for complete removal of the 138 kV transmission facilities not required for the final configuration of the project's 138kV facilities.
I-C3	RETIREMENT, OVERHEAD OPEN WIRE 34.5kV STRAIN BUSES- This unit includes all labor, equipment and material necessary for the removal and disposing of all conductor, insulators, conductor ties, dead ends, filler compounds, fasteners, jumpers, connections, necessary for complete removal of the 34.5kV strain buses.
I-F1	RETIREMENT, TRANSFORMER #1, FOUNDATION - This unit includes all labor, equipment, and materials necessary for the foundation's complete removal, and its disposal in compliance with the Contract and all Regulatory Agencies' requirements, as shown on the drawings and in accordance with the specifications.
I-F2	RETIREMENT, TRANSFORMER #2, FOUNDATION - This unit includes all labor, equipment, and materials necessary for the foundation's complete removal, and its disposal in compliance with the Contract and all Regulatory Agencies' requirements, as shown on the drawings and in accordance with the specifications.
I-F3	RETIREMENT, 138kV LATTICE FOUNDATION - This unit includes all labor, equipment, and materials necessary for the foundation's complete removal, and its disposal in compliance with the Contract and all Regulatory Agencies' requirements, as shown on the drawings and in accordance with the specifications.
I-F4	RETIREMENT, TEMPORARY EROSION AND POLLUTION CONTROL - This unit includes all labor, equipment and material necessary for the removal and disposing of all the temporary erosion and pollution controls installed for the SWPPP, and in compliance with the SWPPP.
I-K1	RETIREMENT, TEMPORARY STATION SERVICE - This unit includes all labor, equipment and material necessary for the removal and disposing of all the temporary station service. This unit includes the removal and disposal of conduits, cables, trench, panelboard, and service de-energization coordination.

Owner Furnished Materials List
INSS 138 kV Retirement Project
E1720055

Drawing Item #	Description		Required	On Hand	Need to Order	Rcv'd	Issued to Contractor	Manufacturer Description	CAT#	MR	Purchase Order / Vendor	ETA / Status	Cost	Extended Cost
1	ROUND TAPERED STEEL LIGHT POLE, 20 FT TALL	EA	2	2	--	--		VALMONT/DS210 CUSTOM		38766	WESCO P.O. 90943	WHSE C	$2,000.00	$ 4,000.00
2	ROUND TAPERED STEEL LIGHT POLE, 30 FT TALL	EA	4	4	--	--		VALMONT/DS210 CUSTOM		38766	WESCO P.O. 90943	WHSE C	$2,500.00	$ 10,000.00
3	YARD LIGHT, 40 LED	EA	6	6	--	--		CREE - EDGE AREA LIGHT, ARE-EDG-4MB-AA-04-E-UL-SV-525		38766	WESCO P.O. 90943	WHSE C	$800.00	$ 4,800.00
4	YARD LIGHT, 160 LED	EA	4	4	--	--		CREE - EDGE AREA LIGHT, ARE-EDG-4MB-AA-16-E-UL-SV-350		38766	WESCO P.O. 90943	WHSE C	$2,050.00	$ 8,200.00
5	EXTERNAL MOUNT VERTICAL TENON, 180° TWIN, ROUND BASE, 2.375 INCH POLE SIZE, SILVER	EA	10	10	--	--		CREE - PB - 2R2.375-SV		38766	WESCO P.O. 90943	WHSE C	$300.00	$ 3,000.00
6	POLE ADAPTER BRACKET FOR 3 -6 INCH POLE, SILVER	EA	10	10	--	--		CREE -XA-TMDA8-SV		38766	WESCO P.O. 90943	WHSE C	$100.00	$ 1,000.00
124	3/4 INCH ANCHOR SHACKLE	EA	42		42			HUGHES 2865.3	956		TBD	6/7/2021	$25.00	$ 1,050.00
125	CONDUCTOR	FT	3000	3000	--	--		795 ACSR "DRAKE"	1237		TBD	WHSE C	$2.50	$ 7,500.00
126	COMPRESSION DEAD-END WITH TERMINAL, 795 ACSR CONDUCTOR, VERTICAL EYE	EA	12		12			HUBBELL A0112451	838		TBD	6/7/2021	$250.00	$ 3,000.00
127	Alternate, 138 KV SUSPENSION INSULATOR - Y-clevis on ground end, Y-clevis on line end	EA	12		12			HUBBELL (Ohio Brass) 5110071201 - Alternate part number (used with 12 alternate)	5781	42103	TBD	6/7/2021	$200.00	$ 2,400.00
128	Y-CLEVIS	EA	24	24	--	--		HUBBELL HYBC-30	948	38766	Potelcom P.O. 90924	WHSE C	$37.50	$ 900.00
129	4-HOLE SWAGED TERMINAL, 795 ACSR CONDUCTOR	EA	30		30			DMC POWER CPLK9442D09000		42103	TBD	6/7/2021	$92.00	$ 2,760.00
130	4-HOLE SWAGED TEE-TAP, 795 ACSR CONDUCTOR	EA	6	6	--	--		DMC POWER CPLK9514D09000		38766	Annixter P.O. 90923	WHSE C	$134.00	$ 800.00
131	COMPRESSION DEAD-END WITH TERMINAL, 1590 AAC CONDUCTOR, HORIZONTAL EYE	EA	24	12	12			DMC POWER DB99-225-55-H or HUBBELL C031616		42103	TBD	6/7/2021	$250.00	$ 6,000.00
132	CONDUCTOR	FT	2280	1600	680			1590 AAC "COREOPSIS"		42103	TBD	6/7/2021	$4.36	$ 10,000.00
133	YOKE PLATE, 8 INCH SPACING	EA	12	6	6			HUBBELL YPD5024685		42103	TBD	6/7/2021	$200.00	$ 1,200.00
134	CABLE SPACER, 1590 AAC CONDUCTOR, 8 INCH SPACING	EA	24	18	6			DMC POWER CL702D15900-8		42103	TBD	6/7/2021	$10.00	$ 6,000.00
135	CABLE SPACER, 1590 AAC CONDUCTOR, WITH TRANSVERSE 4-HOLE PAD, 8 INCH SPACING	EA	18	9	9			DMC POWER CL714D15900-8		42103	TBD	6/7/2021	$234.00	$ 4,200.00
138	35-46 KV SUSPENSION INSULATOR	EA	12	12	--	--		OHIO BRASS 4050031301	3317	38764	Potelcom P.O. 90890	WHSE C	$92.00	$ 1,100.00
163	4-HOLE SWAGED TERMINAL, (2) 1590 AAC CONDUCTORS	EA	24	11	13			DMC POWER CPLK9642D15900		42103	TBD	6/7/2021	$92.00	$ 2,200.00
165	SOCKET CLEVIS	EA	15	15	--	--		HUBBEL SC30	19839	38764	Annixter P.O. 90889	WHSE C	$27.00	$ 400.00
13	F6 FOUNDATION FOR 20' LIGHT POLE	EA	2		2					42103	TBD	6/7/2021	$1,500.00	$ 3,000.00
14	F7 FOUNDATION FOR 30' LIGHT POLE	EA	4		4					42103	TBD	6/7/2021	$1,800.00	$ 7,200.00
NA	138/34.5 KV STEEL H-FRAME STRUCTURE	EA	1	1				Custom Designed 138kV 2-Bay Steel H-Frame (Western Utility)			WUT P.0. 54138	WHSE C	$56,000.00	$ 56,000.00
NA	34.5 KV STEEL DEADEND STRUCTURE	EA	1		1			Custom Designed 2-Bay H-Frame (Western Utility)			WUT P.0. 93785	5/15/2021	$32,180.00	$ 32,180.00

TOTAL	$ 178,890.00

PART 1

SPECIAL PROVISIONS

FOR

INSS 138KV FACILITIES RETIREMENT

W.O. E1720055

April 6, 2021

TABLE OF CONTENTS

SPECIAL PROVISIONS

These Special Provisions supplement the provisions of the Chugach Electric Association, Inc.'s (Chugach's) 2019 -21 Outside Electrical Line Construction Contract (OELCC) and the Technical Specifications.

SECTION 1

SUMMARY OF WORK

1.1 SECTION INCLUDES

- Description of the project
- Work
- Contractor use of premises
- Permits and Licenses
- Contaminated Soils And Contractors Discharge Response Plan
- Supplementary Instructions to Bidders

1.2 DESCRIPTION OF THE PROJECT

The existing facilities at INSS were used to protect the two 138/34.5 kV transformers and allowed for switching the 138 kV lines that come into the substation. With the installation of ITSS, these facilities are no longer necessary. Now that many of these facilities have been removed, the relocation of the two 138/34.5 kV transformers can occur. This relocation will provide enough space between these pieces of critical infrastructure such that a cascading failure would be unlikely. In addition, oil containment that currently does not exist will be added. The existing 138kV /34.5KV transformers will be relocated away from the 34.5 kV switchgear building to minimize damage in the event of a failure, and new deadend structures will be installed to connect INSS to ITSS at 138 kV.

Existing 138kV and 34.5kV capacitor banks and their associated breakers, circuit switchers, and PTs were no longer being used; and it was determined beneficial to mitigate fire hazards and provide oil containment for the 138/34.5kV power transformers T1 and T2. The retirement of the 138kV and 34.5kV capacitor banks, and their associated breakers, circuit switchers, PTs, and foundations has been completed. The INSS 138kV retirement project will retire existing strain buses; relocate transformers T1 and T2 to new foundations; provide fire walls and oil containment provisions; remove the foundations of the retired and relocated equipment; and provide new 34.5kV cable from dead end structure to new location of new power transformers with strain buses, install new 138kV cable from ITSS to INSS, and associated structures and their foundations, and other required facilities.

One 138/34.5kV transformer, T1 or T2, must remain energized throughout the duration of the project. To achieve this requirement, the work will require a phased

construction and retirement schedule. Temporary 138kV structures, a 138kV shoo-fly structure, and two 34.5kV wood bus support structures have been installed to facilitate the phased work effort.

The work will include retiring a 138kV lattice structure, wood pole 138kV temporary structures, shoo-fly structure, two 34.5kV wood bus support structures, two 34.5kV strain buses, 138kV conductors that are not part of the final 138kV configuration, existing foundations for transformer T1 and T2, two 138kV lattice support structure foundations, conduits, grounding, and other related miscellaneous items.

The Contractor will install a steel 138/34.5kV double bay H-frame structure, a steel 34.5kV 2-bay H-frame termination structure, and steel yard-light structures.

The Contractor will provide foundations for: the steel 138/34.5kV double bay H-frame structure, a steel 34.5kV 2-bay H-frame termination structure, transformer T1, and transformer T2. The Contractor will assist to relocate 75/100/125 MVA transformers T1 and T2. Moving the transformers between the existing foundations and the new foundations will be accomplished by jack and roll procedures, performed by others. The Contractor will coordinate with and assist as necessary, or as deemed beneficial, the jack and roll personnel's moving of the transformers. The Contractor will provide two new 34.5kV strain busses including all related materials, and required connections, that are not included in the owner furnished materials list. The Contractor will install new 138kV circuits and will re-work existing 138kV circuits. The Contractor will provide all required conduit. The Contractor will install all required cabling for power and control. The Contractor will provide all required grounding. Also included in the work is all dirt work required to remove and install foundations, conduits, and grounding. Vac-Truck excavation shall be required throughout the site.

Construction at INSS will be performed in and around an energized substation. Transformer T1 or T2 will remained energized throughout the project.

Temporary station service will be installed at INSS by the Contractor for use during construction. The Contractor shall provide all miscellaneous power required for planned construction needs.

If during the course of construction, the Contractor chooses to remove any portion of the substation fence to provide construction access, the Contractor shall maintain security during construction activities and secure the fence opening while not in attendance, and return the substation fence to original condition after replacing portions removed.

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 and 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. No additional compensation will be made for costs associated with storage or work areas.

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. No additional compensation will be made for costs associated with the foregoing.

F. The Contractor shall maintain all best management practices (BMPs) required in the Contract Documents, in all areas affected by any construction activity. Cost of providing all measures required in the Contract Documents are considered incidental to the cost of the affected unit. No additional compensation will be paid for these 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. International Substation (INSS) is a historical site that may contain areas of contaminated soil located within the project area. If contaminated soils are encountered, contractor shall contact Chugach for further direction. It is anticipated that Chugach will coordinate the testing and removal of any contaminated soils in such a way as to mitigate the impact on the Work.

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 he 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, 3.3 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 therein.

E. All costs in connection with the Work specified herein will be considered to 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. Under the coordination of Chugach, the Contractor shall be responsible for the excavation, and "super-sacking" of an contaminated soils. Chugach will coordinate the disposition of the super sacks.

C. The disposition of surplus, non-contaminated soils will be coordinated through Chugach.

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

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

F. Contractor is responsible for coordinating with other entities for locates.

3.3 FIELD ENGINEERING

A. Survey Monumentation and control points will be provided prior to construction by CEA's contractor, Alaska Construction Surveys. Matt Crow with Alaska Construction Surveys can be reached by phone at (907)-344-5505 or by email at mcrow@akconstrsurveys.com.

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

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

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

E. Activities of the Surveyor are to be restricted to within the Chugach property boundary or public right-of-way. Obtain written permission for ingress or egress to Chugach property or public right-of-way where access to Chugach property or public right-of-way is across private property. Obtain written permission for use of private 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.

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

G. In addition to a signed, stamped paper copy of the as-built drawing, an electronic file containing the drawing information in an AutoCAD release compatible with AutoCAD Map 3D 2019, shall be submitted to Chugach. The file shall be accompanied by the layer naming convention and other information as necessary to allow Chugach to utilize the file. The file shall also contain a listing of all surveyed points with coordinate positions listed by point number and again by like items.

H. No Geotechnical information for INSS is provided. Geotechnical investigations can be performed by the Contractor if so desired with proper coordination. No additional compensation shall be made for such investigations.

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 maintained in a current condition at all times 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

Submit test and inspection reports per the following schedule and as specified elsewhere in the Technical Specifications.

1. Compaction test reports – Submit the day after test is completed.

2. Sag Reports –Submit after wire is pulled to final tension. Reports included in Appendix F.

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.

C. Schedule submittals to expedite the Project and deliver to Chugach. Coordinate submission of related items. Allow five (5) 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.

D. 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. Mobilization
2. Site Work
3. Foundations
4. Conduits
5. Ground Grid
6. Circuit De-Energization / Removal
7. Installation of Fabricated Steel Structures
8. Equipment Removal / Transport
9. Transformer Testing and Disassembly (CEA Substation Group)
10. Transformer Relocation (Done by Others, Contractor Assists)
11. Transformer Assembly and Testing (CEA Substation Group)
12. Foundation Removal
13. Equipment Installation
14. Circuit Installation / Energization
15. Installation and Energization of Yard Lights
16. De-Mobilization

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

B. 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.

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

D. 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 three paper copies of shop drawings.

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 three (3) copies 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 - Contract 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

5.2 TEMPORARY UTILITIES

A. Temporary Construction Power

Temporary construction power will be installed by the Contractor as described in the Temporary Station Service bid unit description.

B. Temporary Lighting

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

C. Site Office and Telephone Service

Contractor shall provide, maintain and heat an office for its use at the jobsite. Chugach or its representative shall have access to this office. Said office shall have a workspace set aside for Chugach or Chugach's representative.

D. Obtain Potable water as needed for the Work.

E. 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. A Storm Water Pollution Prevention Plan (SWPPP) has been prepared for this project, described in Appendix B. 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 during the draining of hydro-test water that are specified in the project Documents.

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 is 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

No traffic control plan is required for this project.

C. Dust and Mud Control

Dirt and mud shall not be tracked into or out of INSS facilities by the Contractor.

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 on Chugach property or in areas that the Contractor has obtained approval to park.

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 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, and 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 to not interfere with scheduled completion of the work.

6.3 PRODUCTS

Products include new material, machinery, components, equipment, fixtures, and systems forming the Work. Products does not include machinery and equipment used for preparation, fabrication, conveyance, 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 manufacturers' instructions.

C. Promptly inspect shipments to assure 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 manufacturers' 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.

6.5 OWNER FURNISHED MATERIAL

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 Drawings
- 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.

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 offloading Chugach-furnished material at the jobsite

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 Site 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

None Required

END OF SECTION

SECTION 8

CONTRACT CLOSEOUT

8.1 SECTION INCLUDES

- Closeout Procedures
- 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

INTERNATIONAL SUBSTATION

138KV FACILITY RETIREMENT PROJECT

W.O. E1720055

April 6, 2021

Table of Contents

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 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.

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

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

I. 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. ACI 301 - Standard Specification for Structural Concrete

B. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete

C. ACI 306 - Cold Weather Concreting

D. ACI 309 - Guide for Consolidation of Concrete

E. ACI 318 - Building Code Requirements for Structural Concrete

F. ACI 347 - Guide to Formwork for Concrete

G. ASTM A 36 – Carbon Structural Steel

H. ASTM A 123 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

I. ASTM A 156 – Zinc Coating (Hot-Dip) on Iron and Steel Hardware

J. ASTM A 615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

K. ASTM A 706 - Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

L. ASTM C 31 - Making and Curing Concrete Test Specimens in the Field

M. ASTM C 33 - Concrete Aggregates

N. ASTM C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens

O. ASTM C 42 - Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

P. ASTM C 94 - Ready-Mixed Concrete

Q. ASTM C 143 - Test Method for Slump of Hydraulic-Cement Concrete

R. ASTM C 150 - Portland Cement

S. ASTM C 171 - Sheet Materials for Curing Concrete

T. ASTM C 172 - Sampling Freshly Mixed Concrete

U. ASTM C 173 - Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

V. ASTM C 231 - Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

W. ASTM C 260 - Air-Entraining Admixtures for Concrete

X. ASTM C 309 - Liquid Membrane-Forming Compounds for Curing Concrete

Y. ASTM C 494 - Chemical Admixtures for Concrete

Z. ASTM C 618 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete

AA. ASTM C 881 - Epoxy-Resin-Base Bonding Systems for Concrete

BB. 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:

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

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

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

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

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

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 fluorosilicate hardener, waterproofing and preservative treatment.

I. Chemical Waterproofing: Xypex Concentrate or approved equal.

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

K. Anchor Bolts and Studs to be Embedded in Concrete: ASTM F1554, Grade 36 or Grade 55 hot dip galvanized in accordance with ASTM A156.

L. Plates, Structural Shapes, 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: 0.44. 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. 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, sinkage's, 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. Retighten 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, non-residual, 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 non-staining, 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, damp-proofing, 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 nonreinforced sections regardless of width, spalling, pop outs, 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 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 055120

STRUCTURAL STEEL AND LIGHTING POLES

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. Receiving, assembling and erecting Owner-furnished steel support structures, lighting poles, assemblies, and anchor bolts.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials as specified in Special Provisions Section 6 and 7.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Begin erection only after examination is complete and site is in all respects, ready for erection to proceed.

3.2 ERECTION

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

B. Torque bolts in accordance with approved Shop Drawings

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, punching, or burning is not permitted. Any parts which do not fit or are misaligned will be rejected. Drilling shall be permitted on light poles to install ground connections.

E. Field touch-up damaged galvanized coatings with manufactures recommend zinc-rich paint. Apply 2 coats at a dry film thickness of 2.0 mils each coat.

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

G. Erect structures with one set of nuts on the anchor bolts acting as leveling nuts.

H. Do not erect structures until concrete foundations have cured a minimum of 14 days.

3.3 ERECTION TOLERANCES

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

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

END OF SECTION 055120

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 raceways and 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 Contractors 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 material 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 raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, walls, 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, 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.

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, 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 grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

F. 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.

G. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.

H. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

I. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

J. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.5 SLEEVE-SEAL INSTALLATION

A. Install and seal underground, exterior wall penetrations.

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

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 building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

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

D. This section covers the termination and installation requirements for relaying, control and indication cables in the field equipment and control room.

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.

B. IEEE Standard 400 – IEEE Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems Rated 5 kV and Above.

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 and raceway 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. Switchboard Wiring
1. All switchboard wire shall be 600V UL type SIS 90°C, with gray XLP VW-1 insulation, flexible strand, with tinned copper conductor. An example of acceptable switchboard wire would be Houston Wire and Cable type HW052. The Contractor shall submit wire types to be used for Chugach approval.
2. Intra-panel current transformer circuits shall be #10 SIS wire. Intra-panel potential transformer circuits shall be #12 SIS wire. All other wire shall be #14 SIS except where specified.

G. 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.

H. 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 9 or Chugach approved equivalent. An example of an acceptable instrumentation cable would be Houston Wire and Cable type HW120. The Contractor shall submit cable types to be used for Chugach approval.

I. 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 #10 wire and smaller shall be made with the terminals shown in

E. Table I. All terminals for wire larger than #10 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
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.

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.

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 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.

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.

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

J. 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.

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

L. 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 than 6" intervals.

M. Wiring at Outlets: Install conductor at each outlet per NEC. Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

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 of medium voltage 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

D. Operator Platforms

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 SUBMITTALS

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

B. Product Data: For each type of product indicated.
   1. Approval required when materials substitutions are made.

C. Product Data: For the following:

   1. Ground rods

   2. Grounding electrodes

3. Grounding connectors

D. 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 COORDINATION

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

1.7 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: 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 GROUNDING ELECTRODES

A. Ground Rods: Sectional type; copper-clad.

1. Size: 3/4-inch diameter by 120 inches rods coupled with fittings authorized by the rod manufacturer.

2.5 CONNECTORS

A. Material: Bronze or copper.

B. Below Grade: Swaged.

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

2.6 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.	Switches & Grounding Platforms	#4/0
2.	Steel Structures	#4/0
3.	Switchgear Enclosure	#4/0
4.	Ground Grid	#4/0
5.	Conduit Grounds	#2
6.	12.47 kV Neutral Bus Jumpers	500 kcmil

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

2.7 OPERATOR PLATFORMS

A. As shown on drawings.

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. In raceways, use insulated equipment grounding conductors.

B. Exothermic-Welded Connections: Not allowed.

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. 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. All recloser, switch platform and switch handles shall be grounded and connected to the ground grid in at least two places.

G. 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.

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

I. 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.

J. 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

K. 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.

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

M. Connection of grounding conductors to substation fence shall be made with bronze mechanical connectors as shown on the drawings.

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, 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 OVERHEAD-LINE GROUNDING

A. Comply with IEEE C2 requirements.

B. Drive ground rods to a depth of 24 inches below finished grade in undisturbed earth.

C. Ground Rod Connections: Use swage type connectors listed for the purpose for underground connections and connections to rods.

3.7 UNDERGROUND STRUCTURE GROUNDING

A. Manholes, handholes, trenches and vaults: Provide two connections to the ground grid at each type of underground structure.

B. Connections to components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole, handhole, trench or vault to ground rod or grounding conductor. Make connections with No. 4/0 AWG minimum, stranded, soft-drawn copper conductor. Train conductors level or plumb around corners and fasten structure walls. Connect cable shields as recommended by manufacturer of splicing and termination kits.

C. Pad-Mounted Transformers and Switches: Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to ground grid in at least two places.

3.8 SERVICE GROUNDING

A. Provide neutral grounding as shown on the Drawings.

3.9 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 AND 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: Liquid-tight Flexible Metal Conduit.

C. LFNC: Liquid-tight 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 raceways and fittings, enclosures, and cabinets.

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 raceways, boxes, enclosures, cabinets, and suspension systems 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 (RGS), Zinc Coated: 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 Liquid-tight): 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. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1. Cast aluminum with factory finish and gasketed covers.

C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

D. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

E. Hinged-Cover and clamp cover Enclosures: Types and sizes and accessories as shown on drawings.

1. Interior Dry Locations: NEMA 250, Type 1, galvanized steel box with factory finish.

2. Exterior Cabinets: NEMA 250, Type 4 stainless steel.

F. Cabinets: Types and sizes and accessories as shown on drawings.

1. Interior Dry Locations: NEMA 250, Type 1, galvanized steel box with factory finish.

2. Exterior Cabinets: NEMA 250, Type 4 stainless steel.

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 35F, recovering original workability characteristics above 35F. 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 RACEWAY APPLICATION

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

1. Exposed: RGS.

2. Concealed: RGS.

3. Underground: RGS. HDPE schedule 40 shall be used for all conduits 4" diameter and greater unless otherwise noted on the drawings.

4. Connection to Vibrating or Moving Equipment (Including Transformers, circuit breakers and all outdoor equipment subject to seismic and/or frost jacking movements): LFMC

5. 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 Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.

3. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

    a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

C. Minimum Raceway Size: 3/4-inch trade size (DN 21).

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

E. Raceway Fittings: Compatible with raceways and suitable for use and location.

F. Conduit Elbows

1. Underground elbows for 4" diameter conduits or larger shall be fiberglass or RGS with factory installed couplers.

2. Elbow radius for underground conduits 4" diameter or larger shall be 3' or greater for vertical bends and 3' or greater for horizontal bends.

3. 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.

4. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

5. Where connected to Vibrating or Moving Equipment (Including Transformers, 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. The Contractor shall subcontract the services of a QUALIFIED testing firm or INDIVIDUALS, hereafter referred to as the "Testing Subcontractor" to perform all electrical testing specified herein.

1.1 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 Contractors Association

I. NETA – International Electrical Testing Association

J. ANSI - American National Standards Institute

1.4 SUBMITTALS

A. Testing Subcontractor qualifications.

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

C. Certified test equipment calibration reports.

D. Test Reports:

1. The Testing Subcontractor shall submit reports for all tests performed.
2. The Testing Subcontractor 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 Testing Subcontractor may use his standard report forms subject to the approval of Chugach.
5. Electronic documents shall be submitted in Word/Excel 2003, or earlier format, or in searchable unsecured PDF.

1.5 QUALITY ASSURANCE

A. The Testing Subcontractor 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 affected 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. Ground Tests. Test the substation ground grid resistance to remote earth using the four-point fall-of-potential method in accordance with the following: Extend an insulated conductor to a current electrode, 1000 feet diagonally away from one corner of the substation grid. Extend potential electrode to 800 feet from the corner of the substation fence and record resistance. Relocate potential electrode 50 feet closer to the substation corner and repeat test, continue in a like manner for ground tests until a distance of 200 feet away from the substation grid is reached for the potential electrode. Repeat the tests with the current probe 800 feet and 600 feet from the station. Record results on forms, compute the resistance of the station. Notify Chugach of the test results.

5. High Potential Tests. High potential tests shall be performed in accordance with the following: Observe all precautions to insure the safety of all personnel associated with and near the area of the test. Perform a visual inspection of equipment to be tested prior to the commencement of the test for dirt and moisture accumulation and to assure work is complete. Record air temperature, barometric pressure, and humidity prior to the test. Perform megger test prior to high potential test.

6. Power Cable. Medium voltage power cable for a new installation shall be performed as an acceptance test and shall be tested in accordance with IEEE Std. 400. In no case shall the cable manufacturer's maximum recommended test voltage be exceeded. Test Cable for 15 minutes with a dc test set only, from conductor to shield or armor with shield or armor grounded. Perform test with cable installed in permanent location, properly terminated, disconnected from equipment. Direct-buried cable shall be tested when the cable has a minimum 1 foot compacted permanent cover over the cable.

7. Low Voltage Power, station service, HVAC and lights. Station luminaires and switching shall be tested to ensure proper operation and directional aiming.

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

9. 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.

1.11 EQUIPMENT TESTS

A. Equipment tests shall be performed in accordance with the following:

1. Miscellaneous Equipment.

a. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

b. The Contractor shall perform tests on all equipment and systems installed by the Contractor. This shall include, but not be limited to, the following:

1) Exterior lighting: Verify normal operation of luminaries and controls.

2) Wiring Devices: After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

2. Auxiliary System Energization. The auxiliary systems shall include the substation ac service power and the dc control power. Chugach shall be advised two weeks prior to the energization of this equipment. This equipment may be energized from a backup or emergency source upon the concurrence of Chugach. The Contractor will be required to have concluded all testing and checkout of equipment prior to energization. Preliminary test reports are required to be submitted to Chugach prior to the energization of the equipment.

    a. The following procedure shall be followed when placing an auxiliary system in-service:

        1) Check all circuit connections and phase relationships immediately prior to energization.

        2) Megger all circuits phase-to-phase, phase-to-ground, wire-to-wire or wire-to-ground immediately preceding energization to assure temporary grounds have been removed.

        3) Disconnect all solid-state equipment and ground fault circuit interrupters before making cable tests. Contractor responsible for damage to any such equipment caused by cable tests.

        4) Energize equipment one stage, section, circuit, or piece at a time to minimize damage upon equipment failure and to aid in locating trouble areas.

        5) The Contractor shall be responsible for implementing the tagging procedure upon energization of equipment. He shall also verify that proper voltage levels, current levels, phasing and rotation have been achieved after each energization step. If necessary, corrections shall be made before proceeding to the next step.

        6) All measurements and tests shall be recorded. All cables tested and installed by the Contractor shall be noted on a set of Contractor mark-ups. The mark-ups shall clearly note the cables and conductors the Contractor has tested for continuity and megger. The date and testing person shall be clearly recorded on the mark-ups.

3. Power Cable Tests. The following tests and checks shall be performed on all 15 kV and 35 kV power cables installed under this contract.

    a. Hi-Pot and Insulation Resistance test

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 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.3 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.4 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 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 inches (25 mm).

2.6 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. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway or conduit systems. Install warning tape as shown on underground conduit details on drawings.

F. 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.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

END OF SECTION 260553

SECTION 260600

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior luminaires (yard perimeter lights)
2. Photoelectric switches.

1.2 RELATED SECTIONS

A. Section 055120; Structural Steel and Lighting Poles

1.3 REFERENCES

A. ANSI C78.379 – Electric Lamps – Incandescent and High-Intensity Discharge Reflector Lamps – Classification of Beam Patterns

B. ANSI C82.4 – Ballasts for High-Intensity – Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type).

C. IES RP-20 – Lighting for Parking Facilities

D. NFPA 70 – National Electric Code

E. IEEE C2 – National Electrical Safety Code

1.4 SUBMITTALS

A. Product Data: For each luminaire, arranged in the order of lighting unit designation. Include data on features, ratings, performance, accessories, finishes, and the following:

1. Physical description of fixture, including dimensions and verification of indicated parameters.
2. Luminaire dimensions, effective projected area, details of attaching luminaires, accessories, and installation and construction details.
3. Luminaire materials.
4. High-intensity-discharge ballasts.
5. High-intensity-discharge lamps.
6. Electrical and energy-efficiency data for ballasts.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For luminaires to include in maintenance manuals.

D. Manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 PROJECT RECORD DOCUMENTS

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

1.6 QUALITY ASSURANCE

A. Use qualified crafts, trained in the specific tasks to be performed.

B. 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.

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

D. Comply with IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: 2 for each type and rating installed

PART 2 - PRODUCTS

2.1 LUMINAIRES, GENERAL

A. Complying with UL 1598 and listed for installation in wet locations.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

2.2 EXTERIOR LUMINAIRES

A. As shown on the drawings or as approved by Chugach.

2.3 PHOTOELECTRIC RELAYS

A. UL 773 or UL 773A listed, factory mounted to the luminaire.

2.4 FACTORY FINISHES

A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Match luminaire finish to color of pole or support materials.

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 installing lighting equipment.

3.2 INSTALLATION

A. Install supports where indicated on the drawings.

B. Mount luminaires in as shown on the drawings and accordance with manufacturer's instructions.

C. Bond luminaires to branch circuit equipment grounding conductor and mounting structure. Size conductors per drawings or as required by the NEC.

D. Install controllers and sensors in accordance with the manufacturer's instructions and as shown on the drawings.

E. Connect luminaires to area lighting and working lighting circuits as indicated in the cable and conduit schedule.

F. Install lamps in each fixture.

G. Luminaire Attachment: Fasten to indicated structural supports.

H. Adjust luminaires that require field adjustment or aiming. Coordinate with Chugach for proper aiming of luminaires. Verify luminaries are not aimed directly at nearby roadways and approaching traffic.

3.3 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.

3.4 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Adjust aiming as required by Chugach.

C. Test luminaries and controls per section 260550, Field Testing.

3.5 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosure.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.6 PROTECTION OF FINISHED WORK

A. Relamp luminaires which have failed lamps at Substantial Completion.

B. Protect luminaires from damage by other activities in the area.

END OF SECTION 260600

SECTION 261200

TRANSFORMERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Power Transformer Relocations

1.2 DESCRIPTION OF THE WORK

A. This section covers relocating the power transformers. 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. Relocation of Two 75/90/125MVA 138/34.5kV Power Transformers

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 relocating, handling, and installing the equipment.

B. Employ only qualified crafts.

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

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

PART 2 - PRODUCTS

2.1 TRANSFORMERS

A. Transformers listed under description of work are 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 relocation of the power transformers.

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. Relocation of two 75/90/125MVA Power Transformers

1. The contractor shall relocate the transformers to the new foundation pad locations. Refer to station drawings and transformer relocation plan for removal and relocation details.
2. The Contractor shall direct the placement of the transformer onto the correct position on the pad, secure the transformer to the pad and install ground connections.
3. Install all high voltage connections as shown on the drawings.
4. Welding shall be performed by qualified personnel in accordance with AWS D1.1 and D1.8. Provide welded attachment to steel embedded in the foundation pad.

3.4 TOLERANCES

A. Alignment 1/16 inches horizontal, 1/16 inches vertical.

3.5 TESTS

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

3.6 PROTECTION

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

END OF SECTION 261200

SECTION 261220

BUSWORK, CONDUCTORS, AND FITTINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Strain bus

B. Swaged, Bolted, and Compression Connections

1.2 DESCRIPTION OF THE WORK

A. This Section covers the material and installation of all buswork including aluminum strain bus connections, 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. Flexible/Strain Bus: Conductor, 795 ACSR "Drake" and conductor 1590 AAC "Coreopsis" as indicated on the drawings.

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, stain, and jumper bus conductors.

C. Bolts: Grade 8 Cad Plated or Stainless Steel.

D. 34.5 kV Bus: Swaged compression type as shown on Drawings.

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 buses conductors, cable 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. Swaged and Compression Connections for Strain and Flexible Conductors

   a. Install connectors with properly sized dyes in accordance with the manufacturer's instructions. All required dyes 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 260220

SECTION 261225

INSULATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Station Post Insulators

B. Suspension Insulators

1.2 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. Major equipment to be installed under this section include:

1. Station Post Insulators.
2. Suspension Insulators

1.3 SUBMITTALS

A. Product data for each product supplied by the Contractor.

1.4 PROJECT RECORD DOCUMENTS

A. Submit 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 for and adequate means of handling of the installation of the equipment.

1.6 COORDINATION

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

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 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.

B. Suspension Insulators

1. Install on Deadend H-Frame and Transmission Structures in accordance with the Drawings.
2. Torque bolts to the manufacturer's instructions.
3. Orient cotter key eyes on insulators and hardware items toward the structure, or in such a way as to facilitate easy removal during hot line maintenance.

3.4 TOLERANCES

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

END OF SECTION 261225

SECTION 262726

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Single and duplex receptacles, ground-fault circuit interrupters.
2. Device wall plates.

1.2 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

1.3 REFERENCES

A. The references listed in Section 260500 shall apply.

1.4 SUBMITTALS

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

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and device plate from a single manufacturer.

B. Use qualified crafts, trained in the specific tasks to be performed. Certify special qualifications where required.

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

D. 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.

E. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Coordinate with Chugach to match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. As indicated on the drawings or approved by Chugach.

2.2 RECEPTACLES

A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.

B. GFCI Receptacles: Straight blade, feed-through type, Commercial grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter.

2.3 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Wet Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.4 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System at exterior locations: Devices shall be Ivory unless otherwise indicated or required by NFPA 70.

2. Wet location wall plates shall be the manufactures standard gray finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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 installations locations are correct prior to placement. Verify with plans and Chugach Representative.

3.3 INSTALLATION

A. Comply with NFPA 70.

B. Install devices and assemblies level, plumb, and square with building lines.

C. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top.

D. Remove wall plates and protect devices and assemblies during painting.

3.4 IDENTIFICATION

A. Comply with Section 260553 "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.5 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding."

B. Connect wiring according to Section 260513 "Conductors and Cables."

C. 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.

3.6 TESTS

A. Demonstrate functioning systems.

END OF SECTION 262726

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

1. Particle Size Analysis according to ASTM D 422 for Classified Fill and crushed rock.

2. Laboratory density according to ASTM D 1557 for Classified Fill.

C. Compaction density testing program and test equipment calibration certificate.

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 and required by Section 014000, Contractor Quality Control. 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 STRUCTURAL FILL

1. Classified Structural Fill shall consist of clean, non-plastic granular soil material free from lumps, frozen material, balls of clay, organic matter, or other objectionable matter, durable and sound and shall meet the following washed sieve gradation.

Classified Fill	
Sieve Size	% Passing by Weight
3 inch	100
3/4 inch	85-100
#4	50-90
#10	25-60
#40	4-30
#200	2-5

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 coarse aggregate. Both course and fine aggregates shall conform to the quality requirements of AASHTO M-147. The coarse 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: 180lb; ASTM D 4632.
3. Elongation: 30%; ASTM D 4632.
4. Burst Strength: 400 psi; ASTM D 3786.
5. Trapezoid Tear: 70lb; ASTM D 4533.
6. Puncture Strength: 70lb; 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. When required, preparation of subgrade for earthwork operations, including removal of vegetation, topsoil, debris, obstruction, and deleterious materials from ground surface is specified in Division 2 Section 311000, "Site Clearing."

3.2 EXPLOSIVES

A. Explosives: Do not use explosives.

3.3 EXCAVATION AND INSPECTION

A. Undeveloped areas to be graded shall be excavated minimum 12 inches below existing ground surface. Excavate additionally as required to expose planned subgrade, to remove frost susceptible (silty) soils within 30 inches of the depth below planned subgrade, or to completely remove organics, obstructions and debris.

B. Gravel surfacing within the existing substation pad shall be removed and disposed of. Re grade subsurface of existing pad to slopes and elevations shown on the Drawings.

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. Where frost susceptible (silty) soils are encountered in structural areas, place geotextile between the silty soils and backfill regardless of the depth to subgrade.

F. Where native soils are left at the subgrade surface in structural areas, subsurface shall be scarified to 6 inches depth and compacted to not less than 95% of maximum dry unit weight according to ASTM D 1557.

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

3.4 FOUNDATION 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.

3.5 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation with compacted Classified Fill 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 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.

3.9 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.

3.10 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 50 feet of continuous footing, one test per column footing. No testing required at drilled piers.
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.

3.11 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.

3.12 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.

3.13 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.

3.14 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

END OF SECTION 312000

SECTION 337149

OVERHEAD CONDUCTOR

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 covers the handling and installation of overhead conductors

1.3 REFERENCES

A. IEEE 524 – "Guide to the Installation of Overhead Transmission Conductors".

1.4 SUBMITTALS

A. Stringing Procedure: The Contractor shall submit a written description of equipment and techniques proposed for use in installation of the conductor. This procedure shall be submitted to Chugach for review and approval a minimum of 10 days prior to any wire work, and shall include the following:

1. A description of all major pieces of equipment to be used.
2. Number of crews and composition and responsibility of each crew.
3. Proposed equipment set-up locations.
4. Wire reel locations.
5. Locations of all splices.
6. Locations and descriptions of temporary snubs and anchors.

B. Sag and Tension Records: Submit Initial Sag and Tension Records form (provided by Chugach) with results of the conductor sagging procedures, also included in Appendix F.

PART 2 -PRODUCTS

2.1 MATERIALS

A. Overhead Conductor: Chugach-Furnished; as shown on the Drawings.

2.2 HANDLING AND STORAGE

A. It is very important to avoid damaging the wire or the associated fittings in any way. It shall be the Contractor's responsibility to protect the wire and the fittings against damage. If the wire and associated materials are damaged due to Contractor's mishandling or faulty equipment, the Contractor shall replace the damaged sections, including furnishing of necessary materials, in a manner satisfactory to Chugach and at no additional cost incurred to Chugach.

B. Prior to installation, reels of wire shall be stored off the ground and adequately supported so as to avoid damage to reel, lagging and wire. Wire and reels shall be kept free of standing water, dust and mud, and must be covered and stored no closer than 50 feet from any energized portion of a substation of transmission line.

C. Lagging or other protective covering shall be removed at the job site and the outside layer of each reel shall be examined by the Contractor and Chugach to be sure that the wire is in good condition and that no nails, staples, or other sharp objects which would damage the wire during unreeling protrude on the inside of the reel heads.

D. Identification tags and markers shall be retained on the reels.

E. Conductor reels should not be rolled. They shall be lifted or transported by a reel dolly. If they do need to be rolled to a location where they can be easily handled, they shall be rolled in the direction that would tend to tighten rather than loosen the conductor on the reel.

2.3 TOOLS AND EQUIPMENT

A. Tools and equipment for wire work shall be of the proper size and type for the job and shall be in good working condition. Sheaves, tensioners, pullers, wire grips, compressors and dies shall be properly sized for the specific wires to be installed. All tools and equipment shall receive the written approval of Chugach prior to their use.

B. Stringing blocks shall be neoprene lined, free running, and of the proper diameter and groove size for the wire being pulled.

C. Tensioner bull-wheels shall be neoprene lined and of the proper size and design for the wire being pulled.

2.4 GUARD STRUCTURES

A. Guard structures shall be furnished and installed by the Contractor, where required, to prevent the conductor from being pulled from coming into contact with or interrupting the use of existing electric supply lines, communication lines, roads, highways and parking lots crossed by the overhead line.

B. If not part of the right-of-way agreement previously executed and noted by Chugach on the drawings, written permission to install guard structures on private property or public highway right-of-way shall be obtained by the Contractor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The method of installing the conductor shall be controlled tension stringing. It shall be performed in accordance with IEEE 524, "Guide to the Installation of Overhead Transmission Line Conductors."

B. All conductor installation shall be done in accordance with the manufacturer's recommendations. IEEE 524 shall be used as a reference. If there is a discrepancy between IEEE 524 and the manufacturer's recommendations, the Contractor shall follow the manufacturer's recommendation.

3.2 STRINGING

A. Extreme care shall be exercised during the wire sagging operation to avoid damage to conductor strands. If damage is found, the stringing shall be stopped. Damage is defined as any deformity on the wire that can be detected by sight or touch. Kinked, twisted, abraded, "bird-caged", or flattened wire will not be allowed to remain on the line. Any wire so damaged, as a result of the Contractor's negligence shall be repaired or replaced by the Contractor at his own expense and to the satisfaction of Chugach

B. The Contractor shall continuously inspect the wire as it leaves the reels. If the wire has an accumulation of dirt, oil, grease or any other foreign substance, such substances shall be removed as the wire leaves the reels during the stringing operation by a method approved by Chugach.

C. Wire tension during stringing shall be high enough to ensure that the wire does not drag across the ground, underbrush, trees, towers, fences, guard structures, or any other surface other than the stringing sheaves. A stringing tension of not less than 50 percent nor more than 80 percent of the initial sagging tension should be used.

D. If the pulling tension does exceed 80 percent of the sagging tension, Chugach shall be informed of the magnitude and duration of the excess tension prior to sagging the conductor. Under no circumstances shall the pulling tension reach or exceed the sagging tension. During stringing operations, if the conductor is unattended, it shall be freely suspended between stringing sheaves so as to provide a safe clear distance over ground or obstructions.

E. Full tension compression splices shall not be pulled through the stringing blocks.

F. Wire shall not be pulled during adverse weather conditions or when such conditions are imminent as determined by Chugach. The contractor should plan for potential delays due to adverse weather.

3.3 SAGGING

A. Wires shall be sagged to the proper tensions in accordance with the initial stringing sag and tension tables provided by Chugach. Sags shall be checked by sighting with target and transit as indicated in the IEEE Standard 524, or other method approved by Chugach.

1. Calibrated electric load cell type dynamometers may be used where stringing tension does not exceed 600lb. Tensions determined by dynamometer shall be within plus or minus 2lb. Sags shall be within a tolerance of +3 and -0 inches of the specified values.

B. The air temperature and the conductor temperature at the time and place of clipping in shall be determined by the contractor using a certified thermometer. Conductor temperature shall be

determined using either approved commercially available sagging thermometers or certified thermometers inserted in 18-inch lengths of the conductor being sagged that have had the steel core wire removed. Thermometers shall be placed to have exposure to the wind and sun similar to that of the conductor being sagged. The temperature at which the conductor is sagged in and the spans in which sags are measured shall be recorded by the Contractor, and the information given to Chugach. If slack guys are found, they shall be readjusted so that all guys in any structure have approximately equal tension.

C. The Contractor shall select the length of each sag and the sag-checking spans, subject to the review and approval of Chugach. The Contractor's sagging method must result in uniform tensions throughout the sag and the allowable sag tolerances must not be exceeded.

D. The Contractor shall budget his time so that a run of wire is sagged within 72 hours, or as noted, after the start of the stringing operation.

E. The Contractor shall make any necessary adjustments in the wires or clamps at any time during the construction period to ensure that the wire is at the proper tension, sags are within tolerance, suspension insulator hang plumb, at no additional cost to Chugach.

3.4 CLIPPING, DEADENDING AND SPLICING

A. The Contractor shall be cognizant of and take into consideration the strength limitations of all structures in so far as the application of temporary wire stringing loads. All temporary back snubs and pull-downs on structures other than strain structures shall be carefully planned and all such proposed methods shall meet the approval of Chugach.

B. Use of wire reels shall be carefully planned to minimize the number of full tension splices. There shall not be more than one compression fitting per phase in any span and no splice shall be located within 25 feet of a conductor support. Splices shall not be located in spans over major highway, railroad crossings, and utility crossing, or where the conductor is to be terminated.

C. Compression deadends and splices shall be installed in accordance with the manufacturer's recommendations. Conductor strands within the splice area shall be carefully cleaned with a steel brush, cotton rags, and solvents. Filler compound shall be furnished and pressure installed by the Contractor. Special care shall be exercised in making compressions fittings to insure use of proper die size, accurate cutting of wire, complete insertion of the cable strands, and pressing to produce a straight, uniform fitting. The Contractor shall make up one splice and deadend to use as a sample in order to determine how much wire needs to be cut back.

D. After completion of the pressing operations, the Contractor shall clean the wire and fittings of excess grease and compound. All burrs and die flash marks shall be removed with emery cloth.

E. U-bolts on suspension clamps and strain deadend clamps shall be evenly torqued to the manufacturer's recommended values. Keeper plates shall be in place and properly seated. Conductor strands within the area of the fitting shall be clean. The cleaning method is to use a steel brush, cotton rags, and solvents.

F. Wires shall be clipped into insulator clamps within not less than 12 hours and not more than 72 hours after the start of each individual wire pulling operation. Conductors remaining in the blocks at stringing tension for more than 3 days shall be subject to inspection and possible replacement at the Contractor's expense. Cables shall be lifted from the sheaves using standard suspension

clamps or hooks to provide adequate support for the cables without damaging individual strands or kinking the wire.

3.5 JUMPERS

A. Jumpers shall be installed as shown on the drawings. Compression jumper terminals shall be used with compression deadends and compression jumper connectors shall be used with strain.

B. Jumper wire loops shall be of sufficient length to present a smooth, uniformly curving appearance, and which do not put the jumper insulators in compression. Excess length of conductor from the wire stringing operation may be used to make up the jumper loops.

3.6 TEMPORARY GROUNDS

A. During the wire work, the Contractor shall take all necessary steps to ensure proper temporary grounding of the structures, cables, and equipment. All applicable federal, state, Chugach, and local safety regulations shall be strictly adhered to.

B. A record of all temporary conductor grounds shall be kept with a copy supplied to Chugach to ensure that they are all removed and the line can be safely energized at the end of the construction period.

3.7 RESTORATION

A. After completion of all wire work, the Contractor shall remove the guard structures, fill and tamp all pole holes and restore the right-of-way and access to its original condition.

3.8 SPECIAL REQUIREMENTS

A. Where existing conductors require cutting and terminating at new attachment locations, Contractor shall sag and deadend the conductors to match the existing conductor tensions. This requires marking the conductor at adjacent structures, unclipping, and placing in sheaves, and sagging the new span such that the centerline of the conductor attachment at adjacent structures is maintained.

END OF SECTION 337149