

Sable Island National Park Reserve


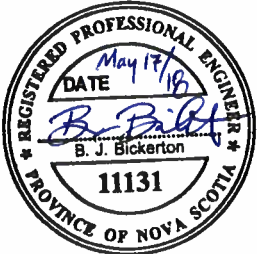


Water Infrastructure Upgrade

Issued for Tender

Sable Island National Park Reserve

Water Infrastructure Upgrade

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PART 1 - GENERAL

- 1.1 SUMMARY OF WORK .1 The Work takes place on Sable Island and generally consists of the replacement of the existing water treatment components of the water supply system that provides water to the Main Station located on the island.
- .2 The Work also includes the replacement of various electrical components, along with wiring to existing treatment system components. A floor drain in the building discharges directly underneath the building, near to the well itself; this drain is to be sealed, and the new system will drain to a new exfiltration trench to be constructed outside and away from the pumphouse. The well and water treatment equipment are located inside a concrete block building with slab on grade floor. A new connection to the treated water pipe outside the building will be made, and new fencing surrounding the pump house will be installed.
- 1.2 DRAWINGS .1 Drawing List:
- | <u>Drawing No.</u> | <u>Drawing title</u> |
|--------------------|--|
| 000 | Cover Sheet |
| Process | |
| P01 | Process Flow Diagram |
| P02 | Pump House Existing and Proposed Plans |
| Electrical | |
| E01 | Legend, Plans & Single Line Diagram |
| E02 | Schedules |
- 1.3 WORK BY OTHERS .1 Co-ordinate work with that of other contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to the Departmental Representative, in writing, any defects which may interfere with proper execution of Work.
-

- 1.4 CONTRACTOR USE OF PREMISES
- .1 Co-ordinate use of premises under direction of the Departmental Representative.
 - .2 The site is extremely sensitive and usage of the site will be, strictly governed by National Parks General Regulations (SOR/78-213) and the specific instructions as set forth herein and as communicated by the Departmental Representative.
- 1.5 EQUIPMENT DELIVERY, ACCOMMODATIONS, AND TRAVEL TO SABLE ISLAND
- .1 The Contractor will be responsible for transportation of tools, equipment, materials and workers to Sable Island to complete the scope of work. Accommodations for Contractor's staff and vehicles for transport of equipment once on-island will be provided by the Departmental Representative. Provide all meals for the duration of the work. Carefully plan to ensure all tools, equipment, materials and labour are brought to the island; including items which may or may not be required, contingent on conditions determined on-site or in the pre-construction period.
- 1.6 EXISTING SERVICES
- .1 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- 1.7 DOCUMENTS REQUIRED
- .1 Maintain at job site, one (1) copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.
 - .10 Health and Safety Plan and Other Safety Related Documents.
 - .11 Other documents as specified.

PART 1 - GENERAL

- 1.1 Description
- .1 This section covers the measurement of work done for payment purposes, and the scope of the work covered by the pay items in the Unit Price Table.
 - .2 It is the intention to provide for a finished piece of work, complete in all essentials and details, including all items reasonably inferable from the drawings and specifications.
 - .3 The aggregate of all unit prices and lump sum payments shall constitute full compensation for the entire work of the Contract, as shown, specified and intended, regardless of any omission in the tender documents of any items which are necessary for the completion of the work including temporary facilities, safety, etc.
 - .4 Should there be any discrepancy regarding measurement between the Measurement and Payment Section and any other section in the specifications, the Measurement and Payment Section shall overrule the other specification section.
 - .5 Unless otherwise specified, all materials necessary to complete the items listed in the Unit Price Table and the finished work are to be supplied by the Contractor and the cost of such material is to be included in the Contractor's prices. There will be no measurement for work not authorized in writing, or for work beyond authorized limits as determined by the Departmental Representative.
 - .6 All unit prices and lump sums shall include all costs applicable to the items, including labour, materials, equipment, transportation, ancillaries and all other applicable and relevant costs as intended and as required to complete the work to the full satisfaction of the Departmental Representative. The unit prices and lump sums indicated shall exclude HST.
 - .7 Where disposal of excess material or debris is included in an item this shall include disposal off site in an environmentally approved disposal site.
-

- 1.1 Description .8 The intent is to cover a range of required repair work as determined by the Departmental Representative on the site under established unit rates. Actual quantities may vary widely depending on the final scope of work and the condition of the various structures.
(Cont'd)
- 1.2 MOBILIZATION / DEMOBILIZATION .1 Unit of Measurement: Lump Sum (L.S.)
.2 This item includes all cost associated with mobilizing and demobilizing equipment, staff, provisions and all material to complete the Work as specified herein. 50% of this item will be paid upon the complete mobilization of forces to the Site and 50% will be paid upon complete demobilization from the Site.
- 1.3 REMOVALS .1 Unit of Measurement: Lump Sum (L.S.)
.2 This item includes: all excavation, hoarding and transport to the designated on-island disposal site of all items designated for removals as shown on the Project Drawings and as specified herein.
- 1.4 TREATMENT EQUIPMENT SUPPLY .1 Unit of Measurement: (L.S.)
.2 This item includes: excavation, bedding, backfilling, the supply of all treatment equipment including electrical and mechanical accessories as specified in the Project Specifications and as shown on the Project Drawings. This includes but is not necessarily limited to the packaged water treatment system, all associated piping, complete with insulation where shown, wiring, lighting, grounding, conduit, instrumentation, switches, wiring devices, electrical heaters, splitters and all other work as shown on the Project Drawings and as specified herein.
-

1.5 TREATMENT
SYSTEM INSTALLATION

- .1 Unit of Measurement: Lump Sum (L.S.)
- .2 This item includes: the installation of all treatment equipment including electrical and mechanical accessories as specified in the Project specifications and as shown on the Project Drawings. This includes but is not necessarily limited to the packaged water treatment system, all associated piping, complete with insulation where shown, wiring, lighting, grounding, conduit, instrumentation, switches, wiring devices, electrical heaters, splitters and all other work as shown on the Project Drawings and as specified herein.

PART 1 - GENERAL

1.1 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting four (4) days in advance of meeting date to the Departmental Representative.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants and, affected parties not in attendance.
- .8 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
 - .2 Senior representatives of Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
 - .3 Establish time and location of meeting and notify parties concerned minimum five (5) days before meeting.
 - .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
-

1.2 PRECONSTRUCTION .5
MEETING
(Cont'd)

- Agenda to include:
- .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work, including requirements for system shutdown/start-up.
 - .3 Schedule of submission of shop drawings and samples. Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences.
 - .5 Delivery schedule of specified equipment.
 - .6 Site security.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .8 Owner provided products.
 - .9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .10 Monthly progress claims, administrative procedures, photographs, hold backs.
 - .11 Appointment of inspection and testing agencies or firms.
 - .12 Insurances, transcript of policies.

1.3 PROGRESS .1
MEETINGS

- .1 During course of Work and weeks prior to project completion, schedule progress meetings monthly.
 - .2 Contractor, major Subcontractors involved in Work and Departmental Representative, are to be in attendance.
 - .3 Notify parties minimum seven (7) days prior to meetings.
 - .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within three (3) days after meeting.
 - .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems which impede construction schedule.
 - .5 Review of off-site fabrication delivery schedules.
 - .6 Corrective measures and procedures to regain projected schedule.
-

- 1.3 PROGRESS .5 (Cont'd)
MEETINGS .7 Revision to construction schedule.
 (Cont'd) .8 Progress schedule, during succeeding work
 period.
 .9 Review submittal schedules: expedite as
 required.
 .10 Maintenance of quality standards.
 .11 Review proposed changes for affect on
 construction schedule and on completion date.
 .12 Other business.

PART 1 - GENERAL

1.1 ADMINISTRATIVE

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
 - .2 Do not proceed with Work affected by submittal until review is complete.
 - .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
 - .4 Where items or information is not produced in SI Metric units converted values are acceptable.
 - .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
 - .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
 - .7 Verify field measurements and affected adjacent Work are co-ordinated.
 - .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
 - .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
 - .10 Keep one (1) reviewed copy of each submission on site.
-

1.2 SHOP DRAWINGS
AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
 - .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia of Canada.
 - .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
 - .4 Allow five (5) days for Departmental Representative's review of each submission.
 - .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to the Departmental Representative prior to proceeding with Work.
 - .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
 - .7 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
 - .8 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
-

1.2 SHOP DRAWINGS
AND PRODUCT DATA
(Cont'd)

- .8 (Cont'd)
 - .3 (Cont'd)
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
 - .9 After Departmental Representative's review, distribute copies.
 - .10 Submit one (1) electronic file in pdf file format of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request. Illegible pdfs will be returned unreviewed. Keep all electronic submission below 10Mb. If a submission is larger than 10Mb, break into multiple files.
 - .11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
 - .12 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within one (1) year of date of contract award for project.
-

1.2 SHOP DRAWINGS
AND PRODUCT DATA
(Cont'd)

- .13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative .
- .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
- .2 Certificates must be dated after award of project contract complete with project name.
- .14 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative
- .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Delete information not applicable to project.
- .17 Supplement standard information to provide details applicable to project.
- .18 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .19 The review of shop drawings by the Departmental Representative is for sole purpose of ascertaining conformance with general concept.
- .1 This review does not mean that Parks Canada approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
-

1.2 SHOP DRAWINGS
AND PRODUCT DATA
(Cont'd)

- .19 (Cont'd)
.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 CERTIFICATES
AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
.2 Submit transcription of insurance immediately after award of Contract.

PART 1 - GENERAL

1.1 RELATED
REQUIREMENTS

- .1 Section 01 33 00 Submittal Procedures.

1.2 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations including all regulations pursuant to the Code.
- .2 Province of Nova Scotia
.1 Occupational Health and Safety Act, S.N.S. - Updated 2013.

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to the Departmental Representative copies of reports or directions issued by Provincial Health and Safety Officer within 24 hours.
- .3 Submit copies of incident reports to the Departmental Representative within 24 hours of occurrence.
- .4 Comply with requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding training, use, handling, labelling, storage and disposal of hazardous materials and maintain (on site) WHMIS MSDS-Material Safety Data Sheets for all controlled products taken to the site by the Contractor.
- .5 The Contractor is solely responsible for construction Health and Safety.
- .6 The Departmental Representative makes no representation and provides no warranty for the accuracy completeness and legislative compliance of Health and Safety Plan.
- .7 The Contractor's responsibility for errors and omissions in the Health and Safety Plan is not relieved by review of Health and Safety Plan by Departmental Representative.
-

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS
(Cont'd)

- .8 Submit the name of the person assigned to the role of Health and Safety Coordinator along with the qualifications of this person.
- .9 Submit proof of coverage from the Nova Scotia Worker's Compensation Board (Worksafe Nova Scotia).

1.4 FILING OF
NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.5 SAFETY
ASSESSMENT

- .1 Upon arriving on the site, prior to conducting work activities, perform a site specific hazard assessment of the actual hazards related to project. Submit this assessment to the Departmental Representative within 24 hours of completion.
- .2 The Departmental Representative will provide information on hazards within the Site that are not readily apparent. Such information is to be incorporated into the hazard assessment noted above. Information provided to the Contractor shall not be construed as being complete and inclusive of the potential health and safety hazards encountered during Work.
- .3 Material Safety Data Sheets of pertinent hazardous and controlled products stored by the Owner on the site will be upon request.

1.6 MEETINGS

- .1 Schedule and administer Health and Safety meeting prior to commencement of Work with the Departmental Representative.

1.7 REGULATORY
REQUIREMENTS

- .1 Do Work in accordance to applicable Regulatory Requirements.
-

- 1.8 RESPONSIBILITY
- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
 - .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

- 1.9 COMPLIANCE REQUIREMENTS
- .1 Comply with Occupational Health and Safety Act, Occupational Safety General Regulations, N.S. Reg..
 - .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.
 - .3 Comply with the National Parks General Requirements.

- 1.10 UNFORESEEN HAZARDS
- .1 When unforeseen or peculiar safety related factors, hazards or conditions occur during performance of Work, the Contractor will assess the situation in accordance with applicable health and safety legislation and implement appropriate corrective measures to ensure no compromise to the health and safety of employees.

- 1.11 HEALTH AND SAFETY COORDINATOR
- .1 Employ and designate a competent person who will undertake the activities necessary to ensure the health and safety of persons performing work on the site, such as performing hazard assessments and holding daily safety meetings. This person may also perform other duties.

- 1.12 POSTING OF DOCUMENTS
- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.
-

- 1.13 CORRECTION OF NON-COMPLIANCE
- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction.
 - .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
 - .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

- 1.14 WORK STOPPAGE
- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

- 1.15 LOCKOUT/TAG-OUT
- .1 Perform lockouts in compliance with:
 - .1 Canadian Electrical Code.
 - .2 Federal Provincial Occupational Health and Safety Acts and Regulations as specified herein.
 - .3 Regulations and code of practice as applicable to mechanical equipment or other machinery being de-energized.
 - .4 Procedures specified herein.
 - .2 In event of conflict between any provisions of above authorities the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, Departmental Representative will advise on the course of action to be followed.
 - .3 Isolation of Existing Services:
 - .1 Conduct safe, orderly shut down of equipment or facilities, de-energize and isolate power and other sources of energy and lockout items in accordance with requirement stated herein.
 - .2 Determine in advance, as much as possible, in cooperation with the Departmental Representative, the type and frequency of situations which will require an isolation. Follow Departmental Representative's directives in this regard.
 - .4 Conduct hazard assessment as part of the planning process of isolating existing equipment and facilities. Hazard Assessments to conform with requirements of Health and Safety Section 01 35 29.
-

- 1.15
LOCKOUT/TAG-OUT
(Cont'd)
- .5 Use energy isolation lockout devices specifically designed and appropriate for type of facility or equipment being locked out.
 - .6 Use industry standard lockout tags.
 - .7 Provide appropriate safety grounding and guards as required.
 - .8 Prepare Lockout Procedures in writing. Describe safe work practices, work functions and sequence of activities to be followed on site to safely isolate all potential energy sources and lockout/tagout facilities and equipment.

PART 1 - GENERAL

- 1.1 GENERAL .1 The Contractor will be required to comply with Parks Canada Basic Impact Assessment, attached to this document as Appendix A.
- 1.2 REFERENCES .1 Definitions:
.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.
.3 U.S. Environmental Protection Agency (EPA)/Office of Water
.1 EPA 832/R-92-005-92, Storm Water Management for Construction Activities, Chapter 3.
.2 EPA General Construction Permit (GCP) 2012.
- 1.3 ACTION AND INFORMATIONAL SUBMITTALS .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit two (2) copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
.3 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review, approval by Departmental Representative.
-

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS
(Cont'd)

- .4 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
 - .5 Address topics at level of detail commensurate with environmental issue and required construction tasks.
 - .6 Include in Environmental Protection Plan:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations and EPA 832/R-92-005, Chapter 3.
 - .6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .7 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
 - .8 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
 - .9 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
 - .10 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
-

1.3 ACTION AND
INFORMATIONAL
SUBMITTALS
(Cont'd)

- .6 (Cont'd)
- .11 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
 - .12 Waste Water Management Plan identifying methods and procedures for management and or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
 - .13 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

1.4 FIRES

- .1 Fires and burning of rubbish on site permitted only when approved by Departmental Representative.
- .2 Where fires or burning is permitted, prevent staining or smoke damage to structures, materials or vegetation which is to be preserved.
 - .1 Restore, clean and return to new condition stained or damaged work.
- .3 Provide supervision, attendance and fire protection measures as directed.

1.5 DRAINAGE

- .1 Develop and submit an Erosion and Sediment Control Plan identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
 - .2 Provide temporary drainage and pumping required to keep excavations and site free from water.
 - .3 Ensure pumped water into waterways or drainage systems is free of suspended materials.
-

- 1.5 DRAINAGE
(Cont'd)
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.
- 1.6 SITE CLEARING
AND PLANT
PROTECTION
- .1 Protect plants on site and adjacent properties as indicated.
- .2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.
- .3 Protect roots of designated trees to drip line during excavation and site grading to prevent disturbance or damage.
.1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by Departmental Representative.
- 1.7 WORK ADJACENT
TO WATERWAYS
- .1 Construction equipment to be operated on land only.
- .2 Use waterway beds for borrow material only after written receipt of approval from Departmental Representative.
- .3 Waterways to be kept free of excavated fill, waste material and debris.
- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- 1.8 POLLUTION
CONTROL
- .1 Maintain temporary erosion and pollution control features installed under this Contract.
-

1.8 POLLUTION CONTROL
(Cont'd)

- .2 Control emissions from equipment and plant in accordance with local authorities emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
 - .1 Provide temporary enclosures where indicated directed by Departmental Representative.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

1.9 HISTORICAL/ARCHAEOLOGICAL CONTROL

- .1 Notify the Departmental Representative immediately if any archaeological resources are encountered/discovered.
- .2 Any artifact or items of historical significance uncovered as a result of the Work must not be touched or moved in any way and their location reported to the Departmental Representative. These artifacts are the property of the Federal Government.

1.10 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
 - .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative .
 - .1 Take action only after receipt of written approval from the Departmental Representative.
 - .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
 - .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.
-

- 1.11 WILDLIFE .1 Do not interact in any way with wildlife present on the Site. This includes a prohibition on feeding the wildlife. Any member of the Contractor's force caught violating these prohibitions will be removed from the Site at the Contractor's cost.

PART 2 - PRODUCTS

- 2.1 NOT USED .1 Not applicable.

PART 3 - EXECUTION

- 3.1 CLEANING .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.
 - .2 Bury rubbish and waste materials on site where directed only after receipt of written approval from Departmental Representative.
 - .3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
 - .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .5 Waste Management: separate waste materials for reuse and recycling in accordance with a Waste Management Plan.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

1.1 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

1.2 INDEPENDENT
INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
 - .2 Provide equipment required for executing inspection and testing by appointed agencies.
 - .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
 - .4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.
-

- 1.3 ACCESS TO WORK
- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
 - .2 Co-operate to provide reasonable facilities for such access.
- 1.4 PROCEDURES
- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
 - .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
 - .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.
- 1.5 REJECTED WORK
- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
 - .2 Make good other Contractor's work damaged by such removals or replacements promptly.
 - .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.
- 1.6 REPORTS
- .1 Submit one (1) electronic copy of inspection and test reports to Departmental Representative.
 - .2 Provide copies to subcontractor of work being inspected or tested manufacturer or fabricator of material being inspected or tested.
-

- 1.7 TESTS AND MIX DESIGNS
- .1 Furnish test results and mix designs as requested.
 - .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.
- 1.8 MILL TESTS
- .1 Submit mill test certificates as requested.
- 1.9 PERFORMANCE TEST
- .1 Upon completion of the Work, notify the Departmental Representative and arrange initiation of a performance test, as follows:
 - .1 Two (2) hours continuous operation, at the design (maximum) flow rate.
 - .2 48-hours of normal operation, whereby the contractor remains on-site to provide troubleshooting as required.

PART 1 - GENERAL

1.1 RELATED
REQUIREMENTS

- .1 Section 01 33 00 Submittal Procedures.

1.2 ACTION AND
INFORMATIONAL
SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Visual qualities of sight-exposed elements.
 - .4 Work of Owner or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.3 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.4 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
 - .2 After uncovering, inspect conditions affecting performance of Work.
-

1.4 PREPARATION
(Cont'd)

- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.5 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .6 Restore work with new products in accordance with requirements of Contract Documents.

1.6 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Waste Management Plan.

PART 1 - GENERAL

1.1 PROJECT
CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3 Provide on-site containers for collection of waste materials and debris.
- .4 Store waste materials and debris off site (on island) at location designated by the Departmental Representative.
- .5 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .6 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .7 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
 - .2 Prior to final review remove surplus products, tools, construction machinery and equipment.
 - .3 Remove waste products and debris other than that caused by Owner or other Contractors.
 - .4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
-

- 1.2 FINAL CLEANING
(Cont'd)
- .5 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
 - .6 Remove dirt and other disfiguration from exterior surfaces.
- 1.3 WASTE
MANAGEMENT AND
DISPOSAL
- .1 Separate waste materials for reuse and recycling in accordance with Waste Management Plan.
 - .2 Removal of waste materials from Sable Island will be by Owner. Remove waste materials from the work site and store on-island at location designated by Owner.

PART 1 - GENERAL

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 Request Departmental Representative's inspection.
 - .2 Departmental Representative's Inspection:
 - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Work: complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Departmental Representative and Contractor.
 - .2 When Work incomplete according to Owner and Departmental Representative, complete outstanding items and request re-inspection.
 - .5 Final Payment:
 - .1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.

1.2 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
-

PART 1 - GENERAL

1.1 AS -BUILT
DOCUMENTS AND
SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by the Departmental Representative.

1.2 RECORDING
INFORMATION ON
PROJECT RECORD
DOCUMENTS

- .1 Record information on set of black line opaque drawings, provided by Departmental Representative.
 - .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
 - .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
-

PART 1 - GENERAL

1.1 OBJECTIVE

- .1 The Commissioning Objectives are:
 - .1 To bring the mechanical, electrical and other systems and components from a state of "static completion" to a state of "dynamic operation".
 - .2 To verify conformance to Contract Requirements.
 - .3 To confirm the equipment meets the design intent of the Specifications and function in accordance with defined operational requirements.
 - .4 To ensure the completed facility meets user stated requirements.
 - .5 To provide all testing documents, certification and records.
 - .6 To fully train and equip personnel to operate, maintain and trouble shoot all systems.
- .2 The Contractor, Consultant and Owner will work together in a concerted effort to fully commission all systems in an organized manner and in a manner that will allow all to carry out their own obligations fully.

1.2 SUBMITTALS

- .1 Verification of the performance of the systems will be done by means of a commissioning process. Six (6) weeks prior to commissioning, provide commissioning plan including schedule of all commissioning-related activities as specified in individual sections.
- .2 Prior to start of Work, submit name of Equipment Supplier's personnel proposed to perform services. Submit documentation to confirm personnel compliance with quality assurance provision.
- .3 Commissioning services to be as described herein and as specified in the individual specification sections.

1.3 CX PLAN

- .1 Commissioning Plan, developed by the Contractor in collaboration with applicable equipment vendors, the Owner and the Consultant, consists of:
 - .1 Roles and responsibilities of the commissioning team during all phases of commissioning.
 - .2 Description of systems, intended operation and performance details.
-

- 1.3 CX PLAN .1 (Cont'd)
- (Cont'd)
- .3 Static testing and verification procedures.
 - .4 Functional performance testing procedures.
 - .5 Documentation requirements for test results.
 - .6 Seasonal or deferred commissioning.
 - .7 Training plan for operators.
 - .8 Preparation of the Final Commissioning Reports.
-
- 1.4 .1 Contractor's responsibilities:
- RESPONSIBILITIES
- .1 Prepare commissioning plan, with input from equipment vendors, Owner and Consultant and manage commissioning.
 - .2 Confirm subcontractors, including equipment suppliers, carry out applicable tests, procedures prior to Consultant's review.
 - .3 Arrange for walkthrough and commissioning reports, procedures and demonstration, after Work has been reviewed, tested and commissioned.
 - .4 Arrange for training sessions and schedule, including preparation and distribution of materials.
 - .5 Perform and document all preliminary tests, assembles manuals of completed test forms and verification forms.
 - .6 Provide assistance to equipment suppliers during start up to address installation concerns. Provide mechanical and/or electrical trades as required.
 - .7 Perform system start-up and testing.
 - .8 Fill out the commissioning data sheets and test forms/manual.
 - .9 Provide training and instruction and prepares Operating and Maintenance Manual for presentation to the operating and maintenance personnel.
 - .10 Is present for operation of system through tests with Consultant and Owner.
 - .11 Obtain all code-required inspections and certifications and approvals.
 - .12 Prepare as-built drawings and submit to Consultant for CAD drawing preparation.
 - .13 Obtain and submit all warranties to Consultant.
 - .14 Organize and submit Operating and Maintenance Manual from the subcontractors, suppliers and manufacturers to Consultant.
 - .15 Assemble and deliver all spare parts and special tools.
- .2 Consultant's responsibilities:
- .1 Inspect installation.
-

- 1.4 RESPONSIBILITIES
(Cont'd)
- .2 (Cont'd)
- .2 Certify completion of Contractor's commissioning.
 - .3 Receive all test reports from the Contractor and verify results.
 - .4 Participate in the equipment start-up testing conducted by the Contractor and verify results.
 - .5 Review shop drawings.
 - .6 Communicate apparent deviations from the specifications.
 - .7 Review the equipment operating and maintenance manuals prepared by the Contractor.
 - .8 Participate in the performance testing process.
 - .9 Review the as-built drawings.
 - .10 Provide technical assistance on plant operations to assist Contractor planning of Commissioning.
 - .11 Communicate requirement and coordinate activities relating to system integration work. The Consultant is carrying out system integration work as referenced in Section 26 90 00.
- .3 Owner's responsibilities:
- .1 Making staff available at appointed times for training by manufacturer's representatives and providing labour to conduct work within facilities that is not included in this Contract.
 - .2 Test and commission chemical feed systems that are Owner-supplied and installed.
- .4 Equipment vendor's responsibilities:
- .1 Perform and document all preliminary tests, assembles manuals of completed test forms and verification forms.
 - .2 Perform component start-up and testing with Contractors
 - .3 Manage installation of the systems.
 - .4 Perform system start-up and testing.
 - .5 Arrange for training sessions schedule, including preparation and distribution of materials.
 - .6 Provide training and instruction and prepares Operating and Maintenance Manual for presentation to the operating and maintenance personnel.
 - .7 Is responsible for filling out the commissioning data sheets and test forms/manual.
 - .8 Provide training and instruction and prepares Operating and Maintenance Manual for presentation to the operating and maintenance personnel.
 - .9 Be present for operation of system through tests with Consultant, Owner and Contractors.
-

1.4 .4 (Cont'd)
RESPONSIBILITIES .10 Assemble and deliver all spare parts and
(Cont'd) special tools to the Owner.

1.5 CX MEETINGS .1 Commissioning meetings: All parties to participate
in routine on-site meetings, specific commissioning
meetings throughout the period that commissioning is
taking place or being planned. Commissioning
meetings will be coordinated and chaired by the
Contractor. The Contractor will take minutes and
distribute minutes within three (3) working days of
the subject meeting. Update and circulate the
updated commissioning schedule one (1) working day
prior to commissioning meetings.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not applicable.

PART 3 - EXECUTION

3.1 NOT USED .1 Not applicable.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 ASTM B209-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .2 ASTM C449-07(R2013), Standard Specification for Mineral Fibre Hydraulic - Setting Thermal Insulating and Finishing Cement.
 - .3 ASTM C547-17, Specification for Mineral Fibre Pipe Insulation.
 - .4 ASTM C335-17, Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulations.
- 1.2 SHOP DRAWINGS
- .1 Submit shop drawings in accordance with Section 01 33 00.
 - .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

PART 2 - PRODUCTS

- 2.1 P-3 FORMED
MINERAL FIBRE C/W
VAPOUR BARRIER TO
85°C
- .1 Application: for piping, valves and fittings on:
 - .1 Potable water.
 - .2 Drain piping.
 - .2 Material:
 - .1 To ASTM C547, rigid mineral fibre sleeving for piping and CGSB 51-GP-52Ma, vapour barrier jacket and facing material.
 - .2 Acceptable Material: Owens Corning SSL-II; Knauf ASJ; Manson Alley-K-APT; Manville Micro Lok-AP-T; Fattal Fat-lock ASJ.
 - .3 Thermal Conductivity "k" must not exceed 0.035 watt/meter °k at 24°C mean temperature when tested in accordance with ASTM C335. Thickness:
-

| System | Nominal Pipe Sizes (NPS) | | | |
|---------------|--------------------------|--------------|--------------|---------------|
| | Thickness | 25mm & under | 32mm 50mm | 62mm 100mm |
| Potable Water | 25mm | 38mm | 38mm | 50mm |
| Drain | 25mm | 38mm | 38mm | 50mm |

2.2 FASTENINGS

- .1 For insulation systems:
 - .1 Tape: self-adhesive, 100mm wide, ULC labelled for less than 25 flame spread and less than 50 smoke developed.
 - .2 Acceptable Material: Compact; S. Fattal Insultape; TUCK.
- .2 Lap seal adhesive: quick-setting for joints and lap sealing of vapour barriers.
 - .1 Acceptable Material: Childers CP.82; Foster 85-75; Bakor 230-06, asbestos-free.
- .3 Lagging adhesive: fire retardant coating.
 - .1 Acceptable Material: Childers CP.50A-HV2; Foster 30-36; Bakor 120-09, asbestos-free.

2.3 INSULATION CEMENT

- .1 To ASTM C449
- .2 For installation at piping elbows and at ends of insulation.

2.4 JACKETS

- .1 Interior piping:
 - .1 All service jacket (ASJ).
- .2 Exterior piping: aluminum 0.40mm to ASTM B209. Metal jacket binding: stainless steel @ 300mm spacing.

PART 3 - EXECUTION

3.1 APPLICATION

- .1 Apply insulation after required tests have been completed and approved. Clean and dry insulation and surfaces before installation and during application of any finish. Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations and as specified herein.
- .2 On piping with insulation and vapour barrier or jacket, install high density insulation under hanger shield. Maintain integrity of vapour barrier or jacket over full length of pipe without interruption at fittings and supports.
- .3 Use piping saddles and shields. Clevis hangers must not penetrate the insulation. Use oversized clevis hangers.

3.2 INSTALLATION

- .1 Multi-layered: staggered butt joint construction.
- .2 Seal and finish exposed ends and other terminations with insulating cement.

PART 1 - GENERAL

- 1.1 PRODUCT DATA
- .1 Submit product data in accordance with Section 01 33 00.
 - .2 Submit product data sheets for unit heaters. Include:
 - .1 Product characteristics.
 - .2 Performance criteria.
 - .3 Mounting methods.
 - .4 Physical size.
 - .5 kW rating, voltage, phase.
 - .6 Cabinet material thicknesses.
 - .7 Limitations.
 - .8 Colour and finish.
 - .3 Submit product data sheets for unit heaters. Include product characteristics, performance criteria, physical size, limitations and finish.
- 1.2 RELATED SECTIONS
- .1 Electrical: Division 26
- 1.3 CLOSEOUT SUBMITTALS
- .1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Section 01 78 00.

PART 2 - PRODUCTS

- 2.1 UNIT HEATER
- .1 Electric unit heater to be horizontal, forced fan type of kW rating, voltage and phase as specified on the drawings.
 - .2 Heating elements: Element totally enclosed in a metal tubular sheath with spiral steel fins.
 - .3 Fan motor: totally enclosed, permanently lubricated ball bearing type. Fan shall be factory wired and shall be complete with built in fan motor thermal overload protection.
-

- 2.1 UNIT HEATER
(Cont'd)
- .4 Cabinet: die formed, steel, 18 gauge, complete with adjustable louvres.
 - .5 Provide unit heater complete with heavy duty, mounting bracket suitable for wall or ceiling mounting as indicated on the drawings.
 - .6 Finish: Polyester, epoxy powder coat paint finish, almond colour.
 - .7 Provide unit heater complete with the following controls and accessories:
 - .1 Automatic reset over temperature protection.
 - .2 Terminal blocks for all field wiring.
 - .3 Control circuit.
 - .4 Contactors.
 - .8 Unit heater must be suitable for operation by integral thermostat as noted on the drawings.
 - .9 Standard of Acceptance:
 - .1 Chromalox type EUH series.
 - .10 Additional acceptable manufacturers:
 - .1 Ouellet
 - .2 Q-Mark
 - .3 Steelpro
 - .4 CCI Thermal

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Install all electric heaters and controls as indicated and in accordance with manufacturer's instructions.
 - .2 Power and control connections: see Division 26.
- 3.2 FIELD QUALITY CONTROL
- .1 Perform tests in accordance with Section 26 05 00.
 - .2 Test cut-out protection when air movement is obstructed.
 - .3 Test fan delay switch to assure dissipation of heat after element shut down.
-

PART 1 - GENERAL

- 1.1 WORK INCLUDED .1 Provide all labour, tools, and equipment necessary to complete the electrical and instrumentation installations at the booster station site as indicated on the drawings and as specified herein.
- .1 Use existing 347/600VAC, single phase, two-wire power service to the Pump House, including a new splitter box and enclosed breaker as indicated on the drawings.
- .2 Provide and install power distribution equipment as indicated on the drawings, including but not necessarily limited to the following list: panelboards, disconnect switches, transformers, receptacles, splitter boxes.
- .3 Provide and install power and control/instrumentation wiring and conduits as shown on the drawings.
- .4 Provide and install instrumentation equipment as indicated on the drawings and specified herein.
- .5 Provide and install grounding necessary to satisfy the CEC - Part 1 and the local provincial inspection authority.
- .6 Install and interwire electrical/instrumentation for process and mechanical equipment specified in other divisions including all power, control and instrumentation cabling, conduit and required mounting hardware.
- .7 Document, test and calibrate to the satisfaction of the Departmental Representative all electrical and instrumentation equipment as specified herein and on the drawings.
- .8 Safely store all electrical, control and instrumentation equipment awaiting installation.
- .9 Protect equipment during construction.
- .10 Repair/replace equipment damaged during construction, or otherwise deemed defective or non-compliant with this specification, at no expense to the Contract. These expenses will include all material, labour and other fees.
- .11 Obtain any "scope of work" clarification prior to issuing their Tender. Any cost extras due to any misunderstanding/misinterpretation of the Scope of Work will not be entertained during the construction phase of the Work.
- .12 Coordinate and schedule with other trades to ensure that the construction proceeds in a timely and efficient manner.
-

- 1.1 WORK INCLUDED (Cont'd) .1 (Cont'd)
.13 Coordinate with the Departmental Representative, equipment suppliers and power authority having jurisdiction for proper set-up of controllers and equipment at the time of start-up, commissioning and the change over to the Pump House.
- 1.2 REFERENCES .1 CSA C22.1-2018, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
.2 CAN3 C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- 1.3 CODES AND STANDARDS .1 Do complete installation in accordance with CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations and local regulations, except where specified otherwise.
.2 Conform to CAN3 C235, Preferred Voltage Levels for AC Systems, 0 to 50 000V.
.3 Comply with CSA electrical bulletins in force at the time of tender submissions.
- 1.4 PERMITS, FEES AND INSPECTIONS .1 Submit to the Electrical Inspection Department, Municipal Authority and Supply Authority the necessary number of drawings and specifications, for examination and approval prior to commencement of work. Submit this information within thirty (30) working days of the award of Tender and provide the Departmental Representative with written notice at the time this has been submitted.
.2 Provide the Departmental Representative with a copy of the Electrical Inspection Department and Supply Authority Plans Review Report, immediately upon receipt. No shop drawings will be reviewed prior to receipt of the Plans Review Report from the Contractor.
-

1.4 PERMITS, FEES
AND INSPECTIONS
(Cont'd)

- .3 Obtain all necessary permits including an Electrical Wiring Permit for electrical work and Communications Cabling Permit for communications cabling Work from the authority having jurisdiction, prior to commencement of Work. Provide a copy of each permit to the Departmental Representative upon receipt. Display permits properly on the Work site.
- .4 Upon specific request, the Departmental Representative will provide, to the Contractor, up to a maximum of three (3) copies of the drawings and specifications required for submittal to the Electrical Inspection Department and Supply Authority. These drawings and specifications will be provided at no cost.
- .5 Arrange for all required inspections to be conducted by the authority having jurisdiction. Provide a copy of all inspection reports to the Departmental Representative immediately upon receipt. Notify the Departmental Representative immediately of changes required by the authority having jurisdiction, prior to making changes.
- .6 Furnish Certificates of Acceptance from authorities having jurisdiction upon completion of work. Include a copy in the Operation and Maintenance Manual.
- .7 Pay all associated fees.

1.5 SHOP DRAWINGS,
PRODUCT DATA AND
SAMPLES

- .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- .2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Include wiring drawings or diagrams showing interconnection with work of other Sections.

1.6 OPERATIONS AND
MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into operation and maintenance manual in accordance with Section 01 78 00.
-

- 1.6 OPERATIONS AND MAINTENANCE DATA
(Cont'd)
- .2 Include in operations and maintenance data:
- .1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of the installation.
 - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
 - .3 Wiring and schematic diagrams and performance curves.
 - .4 Names and addresses of local suppliers for items included in maintenance manuals.
 - .5 Copy of reviewed shop drawings.
- 1.7 CARE, OPERATION AND START-UP
- .1 Instruct operating personnel in the operation, care and maintenance of equipment.
 - .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.
 - .3 Except where note otherwise, provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.
- 1.8 VOLTAGE RATINGS
- .1 Operating voltages: to CAN3-C235.
 - .2 Motors, heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- 1.9 MATERIALS AND EQUIPMENT
- .1 Equipment and material to be CSA certified or certified by an agency approved by the Electrical Inspection Department.
-

- 1.9 MATERIALS AND EQUIPMENT
(Cont'd)
- .2 Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval, in writing, from Electrical Inspection Department.
 - .3 Factory assemble control panels and component assemblies.
 - .4 Use stainless steel fasteners throughout for all conduits, cables and equipment. Fasteners include nuts, bolts, screws and washers.
 - .5 Wall mount electrical distribution equipment in the Pump House on 21 mm thick fire retardant plywood backboards. Paint backboard with two (2) coats of fire retardant paint to match wall colour.
- 1.10 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS
- .1 Coordinate supplier and installer responsibility for mechanical and process equipment specified in other specification divisions to achieve a complete and functioning system.
 - .2 Confirm location of mechanical and process equipment and associated control devices specified in other divisions. Device locations may not be necessarily shown on the electrical drawings.
- 1.11 FINISHES
- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel.
 - .1 Paint indoor distribution enclosures light grey to EEMAC 2Y-1.
 - .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint to the satisfaction of the Departmental Representative. If not acceptable, replace equipment at no additional cost to the contract.
 - .3 Clean, prime and paint exposed hangers, racks, fastenings to prevent rusting.
- 1.12 EQUIPMENT IDENTIFICATION
- .1 Identify electrical equipment with nameplates as specified herein.
-

1.12 EQUIPMENT
IDENTIFICATION
(Cont'd)

- .2 Identification:
- .1 Provide panels, disconnect switches, receptacles, transformers, control panels, magnetic starters, etc. with "lamicoid" nameplates as further described herein. Take care to affix plates true and level, and plumb in all instances.
 - .2 Affix nameplates to all "metal" surfaces with steel type "pop-rivets".
 - .3 Affix nameplates to other types of surfaces with contact type cement.
 - .4 Affix nameplates to building "exterior" surfaces with nylon inserts and self tapping screws unless specifically indicated otherwise.
 - .5 Apply contact type cement to complete rear side of plate (battered), as opposed to several locations or areas on same.
 - .6 Lamicoid nameplates installed on distribution panelboards, and transformers, to indicate the following:
 - .1 Designated name of equipment.
 - .2 Amperage of overcurrent protection device.
 - .3 Voltages, number of phases and wires.
 - .4 Designated of power source.

PANEL C - 100 AMPS
120/208V - 3 PH - 4 2
FED FROM PANEL B

- .7 Lamicoid nameplates installed on combination starters, magnetic starters, manual starter and all various systems controls, control panels, disconnect switches, etc., to contain the following information:
- .1 Designated name of equipment or equipment being fed, whichever is applicable.
 - .2 Designated name of power source.
 - .3 Branch circuit breaker number(s) where possible.
 - .4 Voltage(s) and phase.

FAN NO. 5 SUPPLY FAN NO. 3
PANEL H - CKT.17 M.C.C. NO. 1
120V - 1 PH 600V - 3 PH

- .8 Lamicoid nameplates installed on fusible type disconnect switches to also indicate the maximum designated/designed fuse size.

1.12 EQUIPMENT IDENTIFICATION
(Cont'd)

- .2 (Cont'd)
 - .9 Install lamicoïd nameplates on all junction and pull boxes sized 150 mm x 150 mm and larger indicating name of system, designated panel name and electrical characteristics where applicable.
 - .10 Install lamicoïd nameplates above all types of receptacles and abutted directly to tops of their respective device plates. Identification is to indicate respective panel source complete with associated circuit breaker number(s). Lamicoïd plate to be 1.5 mm thick x 13 mm high complete with 6 mm black letters on white core, directly above all flush receptacles. Plate to be identical width as finish device plate and the top left and right corners are to be rounded off.
 - .11 Identify lamicoïd nameplates above 120V receptacles protected by GFCI circuit breakers, or GFCI type receptacles as per the following:
 - .1 1.5mm thick x 19mm wide complete with 6 mm black letters on white core above all receptacles. Identical width as finish device plate (EXAMPLE: GFCI Protected Panel H-26).
 - .12 Allow for an "average" of 40 letters for each lamicoïd nameplate.
 - .13 Lamicoïd to be 3 mm thick plastic engraving sheet, white face, black core, for all electrical systems.
 - .14 Lettering on lamicoïd nameplates must not "start", nor "end" nearer than 9 mm from either, or both ends of said plates.
 - .15 Size of lettering, including overall lengths of various plates to be as indicated in the following chart:

NOMINAL NAMEPLATE SIZES

| | | | |
|--------|--------------|---------|-------------------|
| Size 1 | 10mm x 50mm | 1 line | 5mm high letters |
| Size 2 | 13mm x 75mm | 1 line | 6mm high letters |
| Size 3 | 16mm x 75mm | 2 lines | 5mm high letters |
| Size 4 | 19mm x 90mm | 1 line | 10mm high letters |
| Size 5 | 50mm x 90mm | 2 lines | 13mm high letters |
| Size 6 | 25mm x 100mm | 1 line | 13mm high letters |
| Size 7 | 25mm x 100mm | 2 lines | 6mm high letters |
| Size 8 | 50mm x 150mm | 2 lines | 13mm high letters |
| Size 9 | 50mm x 100mm | 3 lines | 10mm high letters |

- .3 Wording on nameplates to be approved by the Departmental Representative prior to manufacture.

- 1.12 EQUIPMENT IDENTIFICATION
(Cont'd)
- .4 Coordinate names of equipment and systems with other trades to make equipment identification consistent.
 - .5 Identification to be English.
 - .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
 - .7 Install lamicoid nameplates on, or adjacent to, all various systems' control panels and/or cabinets. Nameplates to reflect individual systems assigned name and where applicable, must also indicate designated name of power source and branch circuit breaker number(s) and voltage(s) and phase.
 - .8 Provide clearly visible marking on electrical equipment to warn persons of potential electrical shock and arc flash hazards as specified in Section 2 of the Canadian Electrical Code.
 - .9 Provide terminal boxes, panels and miscellaneous equipment fed from two (2) or more sources with a warning nameplate prominently displayed: "CAUTION - MORE THAN ONE (1) SOURCE VOLTAGE".
 - .10 Terminal boxes, panels and miscellaneous wire ways containing intrinsically safe circuits shall be provided with a warning nameplate prominently displayed: "INTRINSICALLY SAFE CIRCUIT".
- 1.13 WIRING IDENTIFICATION
- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
 - .2 Maintain phase sequence and colour coding throughout.
 - .3 Colour code: to CSA C22.1.
- 1.14 WIRING TERMINATIONS
- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.
- 1.15 MANUFACTURERS' AND CSA LABELS
- .1 Visible and legible after equipment is installed.
-

- 1.16 WARNING SIGNS
- .1 Provide warning signs as specified and to meet requirements of Electrical Inspection Department. Include arc flash hazard equipment labels.
 - .2 Treated polyethylene plastic or coated rust free aluminum signs, minimum 180 x 250 mm.
- 1.17 MOUNTING HEIGHTS
- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
 - .2 If mounting height of equipment is not indicated verify before proceeding with installation.
 - .3 Install electrical equipment at the following heights unless indicated otherwise.
 - .1 Panelboards: as required by the code or as indicated.
 - .2 Wall receptacles: 400 mm AFF.
 - .3 Thermostats: 1500 mm AFF
 - .4 Lighting switches: 1350 mm AFF.
- 1.18 PROTECTION
- .1 Protect exposed live equipment during construction for personnel safety.
 - .2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage in English.
- 1.19 LOAD BALANCE
- .1 Measure phase current to panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Submit, at completion of Work, report listing phase and neutral currents on panelboards and transformers operating under normal load. State hour and date on which each load was measured, and voltage at time of test.
-

1.20 CONDUIT AND
CABLE INSTALLATION

- .1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .2 Arrange and pay for holes through exterior walls; provide flashings and make weatherproof.

1.21 FIELD QUALITY
CONTROL

- .1 Conduct and pay for tests of the following:
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters, and associated control equipment including sequenced operation of systems where applicable.
 - .2 Furnish manufacturer's, certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturers instructions.
 - .3 Insulation Resistance Testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
 - .4 Provide type-written tabular report indicating test results.
 - .4 Provide a typewritten tabular report indicating the normal field measured load current for all motors indicating the motor circuit over current protection settings. Indicate the motor nameplate current.
 - .5 Advise the Departmental Representative of dates when testing will take place. Provide five (5) days notice of such tests.
 - .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
 - .7 Submit test results for the Departmental Representative's review and approval.
-

- 1.22 COORDINATION OF PROTECTIVE DEVICES
- .1 Install circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings. Obtain motor data from the equipment supplier.
 - .2 Include over current trip settings in tabular format in Operations and Maintenance Manual.

- 1.23 CLEANING
- .1 Do final cleaning in accordance with Section 01 74 11.
 - .2 Clean the interior of all cabinets and control equipment.
 - .3 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.

- 1.24 QUALITY ASSURANCE
- .1 Instructions:
 - .1 Interferences: electrical drawings are generally of a diagrammatic nature. Plan and coordinate the Work to eliminate interferences with other trades. Provide all necessary raceway offsets, fittings, and boxes, adjust all equipment boxes, adjust all equipment locations and provide all supporting materials required for a planned, coordinated and neat installation. Where interferences occur, the Departmental Representative's authorized representative will decide which item must be relocated regardless of which was installed first.
 - .2 Electrical workmanship: provide workmanship of the highest quality. Sub-standard Work will not be accepted. Use only persons skilled in the trades involved.
 - .3 Electrical materials: provide all materials used in this work, unless particularly specified otherwise, that are new, free from flaws, or imperfections.
 - .4 Sleeves and inserts: furnish and locate all sleeves and inserts required for this work in accordance with drawings.
 - .2 Applicable standards:
-

- 1.24 QUALITY ASSURANCE
(Cont'd)
- .2 (Cont'd)
- .1 Electrical Work to conform with the requirements and recommendations of the latest edition of the Canadian Electrical Code and all local codes and ordinances. In conflicts between codes, the more stringent requirements will govern.
- .2 In no instance will the standard established by this specification be reduced by any of the codes or standards referred to in this specification.
- .3 Standards: the specifications and standards of the following organizations are by reference made as part of these specifications and all electrical Work, unless otherwise indicated, must comply with their requirements and recommendations wherever applicable.
- .4 Canadian Standard Association (CSA).
- .5 Institute of Electrical and Electronics Engineers (I.E.E.E.).
- .6 Instrument Society of America (I.S.A.).
- .7 American Society for Testing Materials (A.S.T.M.).
- .8 Insulated Power Cable Consultants Association (I.P.C.E.A.).
- .9 National Electrical Manufacturer's Association (N.E.M.A.).
- .10 National Fire Protection Association (N.F.P.A.).
- .11 Underwriter's Laboratories of Canada (U.L.C.).
- .12 Joint Industrial Council (JIC).
-
- 1.25 PROCESS/
MECHANICAL
EQUIPMENT PROCESSES
- .1 Coordinate electrical work with the process system vendors.
- .2 Verify connection details and requirements for interwiring process and mechanical equipment packages as specified in other divisions.
- .3 Refer to manufacturer's shop drawings for connection details and recommended installation details.
- .4 Supply and install cable, conduit, supports and miscellaneous hardware as per the requirements of this Specification.
-

1.26 RECORD
DRAWINGS

- .1 Record Drawings:
 - .1 After award of Contract, the Departmental Representative will provide a set of full-sized drawings for purpose of maintaining record drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by the Departmental Representative.
 - .2 Identify drawings as "Project Record Copy". Maintain in new condition and make available for inspection on site by the Departmental Representative.
 - .3 On completion of Work and prior to final inspection, submit record documents to the Departmental Representative.

1.27 WASTE
MANAGEMENT AND
DISPOSAL

- .1 Remove from site and dispose of all debris and waste materials at appropriate disposal/recycling facilities.
- .2 Separate and recycle waste materials in accordance with applicable Construction/Demolition Waste Management and Disposal Regulations.

PART 1 - GENERAL

- 1.1 REFERENCES
- .1 CSA C22.2, No. 65-13(R2018), Standard for Wire Connectors.
 - .2 CSA C22.2, No. 197-M1983(R2013), PVC Insulating Tape.

PART 2 - PRODUCTS

- 2.1 WIRE AND BOX CONNECTORS
- .1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.
 - .2 Tin-plated copper, colour keyed, crimp type compression connectors, (long barrel, two hole) with a straight, 45° or 90° lug tongue configuration as required.
 - .1 Acceptable products: Thomas & Betts "Colour-keyed" compression connectors or approved equivalent.
 - .3 Clamps or connectors for armoured cable, liquid tight, flexible conduit, as required.
 - .4 Wire connectors to be rated for operating voltage indicated.

- 2.2 ELECTRICAL TAPE
- .1 Vinyl Electrical Tape:
 - .1 Minimum 0.178mm thick, vinyl insulating tape per CSA standard C22.2 No. 197
 - .2 Temperature rating up to 105°C continuous.
 - .3 Tape to be conformable for cold weather application.
 - .4 Pressure sensitive rubber based adhesive.
 - .5 Suitable for wet and dry locations.
 - .6 Rated for 600V circuits and below.
 - .7 Flame retardant and UV resistant.
 - .8 Colour: Black.
 - .9 Acceptable Materials: 3M Scotch 33+ or approved equivalent.
 - .2 Rubber Insulating Tape:
-

- 2.2 ELECTRICAL TAPE .2 (Cont'd)
(Cont'd)
- .1 Highly conformable, ethylene propylene rubber (EPR), high voltage insulating and sealing tape (self bonding).
 - .2 Temperature rating up to 90°C continuous and 130°C short term overload service.
 - .3 Suitable for wet and dry locations.
 - .4 Rated for 600V circuits and below.
 - .5 Flame retardant.
 - .6 Colour: Black.
 - .7 Acceptable Manufacturers: 3M Scotch, or approved equivalent.

PART 3 - EXECUTION

- 3.1 WIRE AND BOX .1 Make connections and terminations electrically and
CONNECTORS mechanically secure. Sizes of connectors to be per
INSTALLATION manufacturer's recommendations for various sizes and
combinations of wire sizes.
- .2 Make joints required in branch wiring #8 and smaller utilizing "twist-on" type connectors as manufactured by "Ideal" (colour coded wirenut) or "Marrettes" #31, #33 or #35, or approved equivalents.
 - .3 Make branch wiring joints larger than #8 AWG utilizing colour keyed crimp type compression connectors (two hole, long barrel, tin-plated copper) complete with manufacturer approved compression tools. Compression connectors to be bolted together and torqued in accordance with manufacturer's recommendation. Install first layers of rubber insulating tape followed by additional layers of vinyl electrical tape in accordance with the manufacturer's instructions. Heat shrink can also be used.
 - .4 Plier tighten "twist-on" type connectors.
 - .5 For connections to equipment not provided with lugs, install colour keyed, crimp type compression connectors (long barrel, two hole, tin-plated copper, straight lug tongue) complete with manufacturer approved compression tools. Alternate lug tongue configurations (45° and 90°) will be accepted where required by application.

PART 1 - GENERAL

1.1 REFERENCES .1 CSA C22.2 No. 0.3-09(R2014), Test Methods for Electrical Wires and Cables.

1.2 PRODUCT DATA .1 Submit product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 BUILDING WIRES .1 Copper conductors: soft drawn, stranded for #12 AWG and larger. Minimum size: 12AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 - XLPE.

.3 Copper conductors: size as indicated, with 1000V insulation of chemically cross-linked thermosetting polyethylene material rated RWU90 - XLPE.

.4 Colour code wiring in accordance with the Canadian Electrical Code.

2.2 CONTROL WIRES .1 Stranded copper, minimum size #14 AWG with 600 volt chemically cross-linked thermosetting polyethylene material rated RW90.

.2 Analog Circuits: (minimum size): tinned stranded copper, minimum 16 AWG with individually twisted shielded pairs, chemically cross-linked thermosetting polyethylene insulation, overall shield, minimum 300V, overall PVC jacket.

.3 Type LVT: two (2) soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

PART 3 - EXECUTION

3.1 INSTALLATION
OF BUILDING WIRES
AND CONTROL WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.
 - .2 Install appropriately sized cable glands where cables enter panels and other enclosures.
 - .3 Install and secure surface cables directly to the underside of ceiling slabs. Run cables parallel and perpendicular to building lines.
 - .4 Support cables in accordance with the requirements of the manufacturer and the Canadian Electrical Code. Cables must be supported at intervals as recommended by the manufacturer, but in no case exceeding 2.0m.
 - .5 Supports must be made of appropriate materials such as copper, steel, or stainless steel and attached to a fire rated surface (such as concrete or masonry) equal to the cable rating. do not use supports or equipment installed for other systems.

PART 1 - GENERAL

- 1.1 PRODUCT DATA .1 Submit product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

- 2.1 EQUIPMENT .1 Direct buried grounding conductors: bare stranded copper of minimum 98% conductivity, un-tinned, soft annealed, size as indicated.
- .2 Insulated grounding and bonding conductors: soft-drawn, stranded copper of minimum 98% conductivity, un-tinned, type RW90 (green coloured insulation). Conductors to be FT4 rated when installed in free-air.
- .3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
- .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.
- .4 Rod electrodes, copper clad steel, 21mm diameter, 3m long.
- .5 Clamps for grounding of conductor, size as required to grounding electrodes.
- .6 Copper crimp type compression connectors (cable to cable, cable to ground rod).
- .7 Copper crimp type compression connectors (long barrel, one or two hole as space permits).
- 2.2 MANUFACTURERS .1 Acceptable manufacturers: FCI - Burndy Corporation, Erico Inc., Thomas & Betts, Ilsco.
-

PART 3 - EXECUTION

3.1 INSTALLATION
GENERAL

- .1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including conductors, connectors, accessories as indicated to conform to requirements of local authority having jurisdiction over installation.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .7 Make buried connections, and connections to electrodes, using copper welding by thermit process or inspectable copper, crimp type and compression connectors.
- .8 Provide an insulated copper bonding conductor in all conduit runs. Size bonding conductor per the Canadian Electrical Code (minimum size #14 AWG).

3.2 ELECTRODES

- .1 Bond separate, multiple electrodes together.
- .2 Use copper conductors, size as indicated, for connections to electrodes.
- .3 Install grounding triad near the electrical service entrance and connect to electrical grounding system with copper conductor, size as indicated on the drawings.

3.3 SYSTEM AND
CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of secondary systems.
-

3.4 EQUIPMENT
GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list: transformers, generators, pipe systems, frames of motors, starters, control panels and distribution panels.

3.5 FIELD QUALITY
CONTROL

- .1 Perform tests in accordance with Section 26 05 00.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of the Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault protection during tests.

PART 1 - GENERAL

1.1 NOT USED .1 Not applicable.

PART 2 - PRODUCT

2.1 SUPPORT CHANNELS .1 U shape, size 41 mm x 41 mm, 2.7 mm thick, surface mounted, suspended or set in poured concrete walls and ceilings unless otherwise indicated.

.2 Standard rolled structural steel shapes and plates or prefabricated structural systems.

.3 Unless otherwise indicated, use hot dipped galvanized steel (after fabrication) or stainless steel.

2.2 CABLE TIES .1 Nylon flame retardant, low smoke cable tie, size as required.

.2 Nylon flame retardant, low smoke cable tie mounting bracket. Mechanical fastening type only; adhesive mounts not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls with stainless steel toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

3.1 INSTALLATION
(Cont'd)

- .5 (Cont'd)
 - .1 One-hole straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole straps for conduits and cables larger than 50 mm.
 - .3 Conduit straps to match conduits in material and finish. Cable straps to be galvanized steel or stainless steel.
 - .4 Use heavy duty pipe clamps (with adjustable saddles) to secure conduits/cables to support channels.
 - .6 Suspended support systems for horizontal runs:
 - .1 Support individual cable and conduit runs with minimum 9 mm dia continuously threaded rods and spring clips.
 - .2 Support two (2) or more cables and conduits on channels supported by minimum 12 mm dia threaded rod hangers where direct fastening to building construction is impractical.
 - .3 Continuously threaded rods shall be zinc plated or stainless steel to match supporting hardware.
 - .7 For surface mounting of two (2) or more conduits and cable, use support channels spaced in accordance with the Canadian Electrical Code (maximum 1.5m spacing).
 - .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
 - .9 Provide adequate support for conduits and cables dropped vertically to equipment where there is no wall support.
 - .10 Do not use wire lashing or perforated strap to support or secure conduits or cables.
 - .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Departmental Representative.
 - .12 Provide fastenings and supports as required for each type of equipment, cables and conduits, and in accordance with manufacturer's installation recommendations.
-

3.1 INSTALLATION
(Cont'd)

- .13 Various suspended types of junction, pull and/or outlet boxes as well as conduits, are to be supported with minimum size 12 mm threaded rod, nuts and flat washers. Secure threaded rods to boxes with one (1) flat washer and nut installed on both sides of box.
- .1 One (1) rod required for all type boxes sized 150 mm x 150 mm and smaller.
- .2 Two (2) rods required for boxes sized 200 mm x 200 mm and larger, up to and including those sized 300 mm x 300 mm.
- .3 Minimum of four (4) rods required for all boxes sized larger than 300 mm x 300 mm.
- .4 Cut-off excess rod to within 12 mm of channel bottom.
- .14 In addition to C.E.C. minimum conduit spacing requirements, all suspended conduit runs containing horizontal or vertical elbows are to have one additional support rod installed not greater than 300 mm and mid point of "all" 90° bends. Maximum spacings between conduit support channels will be dictated by smallest size conduit(s) being supported and/or secured to same.
- .15 Where galvanized steel supports are exposed to moisture, touch-up all field cut surfaces with galvanizing paint.
- .16 Coordinate the location of electrical support systems with other trades before installation.

PART 1 - GENERAL

- 1.1 SHOP DRAWINGS AND PRODUCT DATA
- .1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00.

PART 2 - PRODUCTS

- 2.1 JUNCTION AND PULL BOXES
- .1 General: Provide outlet, tap, junction, pull boxes with covers. Junction and pull boxes longer than 500mm in any dimension shall be complete with continuously hinged cover.
 - .2 Size and Tap, Junction and Pull Boxes: in accordance with the latest edition of the Canadian Electrical Code.
 - .3 Provide NEMA Type 4 or 4X water-tight boxes with clamped, threaded or screw-fastened covers.
 - .4 NEMA 4 and 4X box external hardware (hinges, latches, etc.) to be stainless steel.

PART 3 - EXECUTION

- 3.1 JUNCTION AND PULL BOX INSTALLATION
- .1 Install junction and pull boxes in inconspicuous but accessible locations.
 - .2 Provide junction and pull boxes to suit field conditions and where required by the Canadian Electrical Code.
 - .3 Provide all required mounting hardware.

- 3.2 IDENTIFICATION
- .1 Provide equipment identification in accordance with Section 26 05 00.
 - .2 Install size 2 identification labels indicating voltage and phase.

PART 1 - GENERAL

1.1 REFERENCES .1 CSA C22.1-2018, Canadian Electrical Code, Part 1.

1.2 PRODUCT DATA .1 Submit product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES .1 General:
.1 Size boxes in accordance with CSA C22.1.
.2 100 mm square or larger outlet boxes as required for special devices.
.3 Gang boxes where wiring devices are grouped.
.4 Blank cover plates for boxes without wiring devices.
.5 Combination boxes with barriers where outlets for more than one system are grouped.
.2 Sheet steel outlet boxes:
.1 Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 75 x 50 x 38 mm or as indicated. 100 mm square outlet boxes when more than one conduit enters one side.
.2 100 mm square or octagonal outlet boxes for lighting fixture outlets.
.3 Surface mounted outlet boxes:
.1 Cast FS or FD copper free aluminum or ferrous alloy boxes (to match conduit material) with factory threaded hubs and mounting feet for surface wiring of switches, receptacles, thermostats, etc.
.2 NEMA 4X PVC outlet boxes in areas where PVC conduit is to be used.

2.2 FITTINGS-GENERAL .1 Bushing and connectors with nylon insulated throats.
.2 Knock-out fillers to prevent entry of debris.
.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Support boxes independently of connecting conduits.
 - .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of Work.
 - .3 Provide correct size of opening in boxes for conduit and cable connections. Reducing washers not allowed.

PART 1 - GENERAL

1.1 LOCATION OF CONDUIT .1 Drawings do not show all conduits. Those shown are in diagrammatic form only.

1.2 RELATED WORK .1 Fastenings and Supports: Section 26 05 29
.2 Outlet Boxes, Conduit Boxes and Fittings: Section 26 05 32

1.3 REFERENCES .1 CSA C22.2 No.45.1-07(R2017), Electrical Rigid Metal Conduit - Steel.
.2 CSA C22.2 No.45.2-08(R2013), Electrical Rigid Metal Conduit - Aluminum, Red Brass and Stainless Steel.
.3 CSA C22.2 No. 56-17, Flexible Metal Conduit and Liquid Tight Flexible Metal Conduit.
.4 CSA C22.2 No. 83-M1985(R2017), Electrical Metallic Tubing.
.5 CSA C22.2 No. 211.2-06(R2016), Rigid PVC (Unplasticized) Conduit.

PART 2 - PRODUCTS

2.1 CONDUITS .1 Rigid galvanized steel threaded conduit, fittings and connectors: to CSA C22.2 No. 45.1.
.2 Rigid aluminum threaded conduit, fittings and connectors: to CSA C22.2 No. 45.2.
.3 Rigid PVC conduit, fittings and connectors: to CSA C22.2 No. 211.2.
.4 Flexible aluminum conduit and liquid-tight flexible metal conduit: to CSA C22.2 No. 56.
.5 Minimum power and control/instrumentation conduit size for all areas: 21mm.

2.1 CONDUITS
(Cont'd)

.6 Rigid PVC conduit to be FT4 rated.

2.2 CONDUIT
FASTENINGS

.1 One (1) hole conduit straps to secure surface conduits 50 mm and smaller. Two (2) hole conduit straps for conduits larger than 50 mm.

.2 Heavy duty pipe clamps (with adjustable saddle) to secure conduits to support channels.

.3 Refer to specification Section 26 05 29 for suspended and surface support systems for conduits.

.4 Finish and material to match conduit.

2.3 CONDUIT
FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 27mm and larger conduits.

2.4 FISH CORD

.1 Polypropylene.

PART 3 - EXECUTION

3.1 CONDUIT
INSTALLATION

.1 General:

.1 Use rigid aluminum or rigid galvanized steel threaded conduit unless otherwise indicated.

.2 Use rigid PVC conduit for all direct buried underground services: minimum size 27mm diameter.

.3 Rigid PVC conduit is also permitted in the Pump House where not subjected to mechanical damage.

.4 Use liquid-tight flexible metal conduit for connection to vibrating equipment (motors, valves, transformers, motorized dampers, etc.) and instruments.

.5 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.6 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.7 Mechanically bend metal conduit over 21 mm dia

3.1 CONDUIT
INSTALLATION
(Cont'd)

- .1 (Cont'd)
 - .8 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
 - .9 Install polypropylene fish cord in all empty conduits. Cap and seal at each end.
 - .10 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.
 - .11 Dry conduits out before installing wire.
 - .12 Provide minimum 300 mm spacing between instrumentation/control conduits and 600V power conduits. Where possible, instrumentation control conduits to cross at right angles to 600V power conduits.

- .2 Surface conduits:
 - .1 Run parallel or perpendicular to building lines.
 - .2 Group conduits wherever possible on suspended or surface channels.
 - .3 Do not pass conduits through structural members except as indicated.
 - .4 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum 25 mm at crossovers.
 - .5 Fasten to flutes of metal roof deck when practical.
 - .6 Do not run conduits where they might obstruct lifting devices such as monorails.
 - .7 Install support channels on walls for vertical conduit drops.

PART 1 - GENERAL

- 1.1 RELATED WORK .1 Electrical General Requirements: Section 26 05 00
- 1.2 SHOP DRAWINGS AND PRODUCT DATA .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- 1.3 OPERATIONS AND MAINTENANCE DATA .1 Provide maintenance data for transformers for incorporation into manual as specified in Section 01 78 00.

PART 2 - PRODUCTS

- 2.1 TRANSFORMERS .1 Use transformers of a single manufacturer throughout project.
- .2 Design 1:
- .1 Type: dry
 - .2 1-phase, kVA as indicated, 600V input, 120/240V, output voltage, 60 Hz.
 - .3 Voltage taps: standard.
 - .4 Insulation: Class 185, 115°C temperature rise.
 - .5 Basic Impulse Level (BIL): standard.
 - .6 Hipot: standard.
 - .7 Average sound level: standard.
 - .8 Impedance at 170°C: standard.
 - .9 Enclosure: epoxy impregnated suitable for damp environment, complete with NEMA 3R enclosure.
 - .10 Mounting: floor or wall.
 - .11 Finish: in accordance with Section 26 05 00.
 - .12 All windings copper.
 - .13 Acceptable materials:
 - .1 Delta
 - .2 Siemens
 - .3 Hammond Power Solutions
 - .4 Rex Manufacturing
- 2.2 EQUIPMENT IDENTIFICATION .1 Provide equipment identification in accordance with Section 26 05 00.
-

2.2 EQUIPMENT IDENTIFICATION
(Cont'd)

.2 Label size: 9.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Securely mount dry type transformer as indicated.
- .2 Transformers containing electrical termination points located on the rear side are not acceptable.
- .3 Confirm adequate clearance around transformer for ventilation and fire separations in accordance with the Canadian Electrical Code and the electrical inspection department having jurisdiction.
- .4 Install transformers in level upright position.
- .5 Remove shipping supports only after transformer is installed and just before putting into service.
- .6 Loosen isolation pad bolts until no compression is visible.
- .7 Megger both primary and secondary windings with 1000 V and 500 V megger as recommended by manufacturer and report immediately any reading below 100 megohms. Submit test results for the Departmental Representative's review and approval.
- .8 Confirm transformer is on the correct tap.
- .9 Make primary and secondary connections in accordance with wiring diagram.
- .10 Connect transformer neutral and case solidly to ground.
- .11 Energize transformers after installation end testing is complete.

PART 1 - GENERAL

- 1.1 RELATED WORK
- .1 Electrical General Requirements: Section 26 05 00
 - .2 Moulded Case Circuit Breakers: Section 26 28 21
- 1.2 SHOP DRAWINGS AND PRODUCT DATA
- .1 Submit shop drawings and product data in accordance with Section 01 33 00.
 - .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.
- 1.3 OPERATIONS AND MAINTENANCE DATA
- .1 Provide maintenance data for panelboards for incorporation into manual as specified in Section 01 78 00.

PART 2 - PRODUCTS

- 2.1 PANELBOARDS
- .1 Panelboard:
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
 - .2 Bus and breakers rated for the interrupting capacity (rms symmetrical) as indicated on the drawings.
 - .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
 - .4 Panelboard: mains, number of circuits, and number and size of branch circuit breakers as indicated on the drawings.
 - .5 Provide two (2) keys for each panelboard and key panelboards alike.
-

- 2.1 PANELBOARDS
(Cont'd)
- .6 Tin-plated, copper busbars with neutral of same ampere rating as mains.
 - .7 Mains: suitable for bolt-on breakers.
 - .8 Trim with concealed front bolts and hinges.
 - .9 Trim and door finish: baked grey enamel.
 - .10 Panelboard to be complete with NEMA 12 enclosure.

- 2.2 BREAKERS
- .1 Breakers: as specified in Section 26 28 21.
 - .2 Bolt-on breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
 - .3 Lock-on devices for 10 % of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to the Departmental Representative.

- 2.3 EQUIPMENT IDENTIFICATION
- .1 Provide equipment identification in accordance with Section 26 05 00.
 - .2 Nameplate for each panelboard size 9 engraved.
 - .3 Complete circuit directory with typewritten legend showing location and load of each circuit.

- 2.4 ACCEPTABLE MANUFACTURERS
- .1 Cutler-Hammer, Square D, Siemens.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Locate panelboard as indicated and mount securely, plumb, true and square, to adjoining surfaces.
 - .2 Install surface mounted panelboards on painted (two coats of fire retardant paint, colour to match walls) plywood backboard. Mount panelboard at height indicated.
-

- 3.1 INSTALLATION
(Cont'd)
- .3 Connect panelboard to source transformer or circuit breaker as indicated.
 - .4 Connect loads to circuits.
 - .5 Connect neutral conductors to common neutral bus with respective neutral identified.

PART 1 - GENERAL

- 1.1 SUBMITTALS .1 Submit shop drawings, and product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

- 2.1 SWITCHES .1 Heavy duty, specification Grade, 20A, 120V, single pole switches as indicated, with the following features:
.1 Terminal holes approved for #10AWG wire.
.2 Silver alloy contacts.
.3 Urea or melamine molding for parts subject to carbon tracking.
.4 Suitable for back and side wiring.
.5 Ivory nylon, heavy duty toggle.
.6 Integral ground terminal.
.7 Standard of Acceptance: Hubbell #HBL1221I (single pole).
- .2 Toggle operated fully rated for lamps, and up to 80% of rated capacity of motor loads.
- .3 Provide switches of a single manufacturer throughout project.
- .4 Acceptable manufacturers: CWD (Copper Wiring Devices), Leviton, Hubbell, Pass & Seymour.
- 2.2 RECEPTACLES .1 Design R1:
.1 Heavy duty, specification grade duplex receptacles, CSA type 5-15R, 125V, 15A, U-ground, with following features:
.1 Urea molded housing, ivory colour.
.2 Suitable for #10AWG for back and side wiring.
.3 Break-off links for use as split receptacles as indicated.
.4 Eight (8) back wired entrances, four (4) side wiring screws.
.5 Triple wiper contacts and rivetted grounding contacts.
.6 Nylon face.
.7 Standard of Acceptance: Hubbell #HBL5262I.
-

- 2.2 RECEPTACLES
(Cont'd)
- .1 (Cont'd)
 - .1 (Cont'd)
 - .8 Acceptable Manufacturers: Hubbell, Pass & Seymour, Eaton Wiring Devices, Leviton.
 - .2 Provide other receptacles with ampacity and voltage as indicated.
 - .3 Provide the receptacles of a single manufacturer throughout project.

- 2.3 COVER PLATES
- .1 Provide cover plates for wiring devices.
 - .2 Cover plates from one manufacturer throughout project.
 - .3 Self-closing, weatherproof spring-loaded cast aluminum or PVC cover plates, complete with gaskets for duplex or single receptacles as indicated. Cover plates to be suitable for wet locations whether or not a plug is inserted into a receptacle.

PART 3 - EXECUTION

- 3.1 SWITCH,
RECEPTACLE AND
COVER PLATE
INSTALLATION
- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed
 - .2 Install switches in gang type outlet box when more than one (1) switch is required in one (1) location.
 - .3 Mount toggle switches at height specified in these Specifications or as indicated on the drawings.
 - .4 Install size 1 identification lamicaid for control switches for pumps, motors, and existing process equipment.
 - .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one (1) receptacle is required in one (1) location.
 - .2 Mount receptacles at height specified in these Specifications or as indicated.
 - .3 Cover plates:

3.1 SWITCH,
RECEPTACLE AND
COVER PLATE
INSTALLATION
 (Cont'd)

.3 (Cont'd)

.1 Install suitable common cover plates where
wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet
boxes on surface-mounted boxes.

PART 1 - GENERAL

- 1.1 PRODUCT DATA .1 Submit product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

- 2.1 BREAKERS GENERAL
- .1 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
 - .2 Common-trip breakers: with single handle for multi-pole applications.
 - .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .4 Circuit breakers to have interrupting rating (momentary RMS symmetrical) as indicated.
- 2.2 THERMAL MAGNETIC BREAKERS
- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
 - .2 Provide ground fault interrupter type for circuits so marked.
- 2.3 SOLID STATE TRIP BREAKERS
- .1 Moulded case circuit breaker to operate by means of solid state trip with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload conditions, and long time, short time and instantaneous tripping for short circuit protection. Trip unit shall have independent adjustable long time and short time pick-up and delay and instantaneous pick-up.
-

2.4 MANUFACTURERS .1 Acceptable manufacturers: Cutler-Hammer, Square D, Siemens.

PART 3 - EXECUTION

3.1 INSTALLATION .1 Install circuit breakers as indicated.
.2 Install new circuit breakers of the type and rating/characteristics indicated or as noted on the drawings.

PART 1 - GENERAL

1.1 RELATED WORK .1 Electrical General Requirements: Section 26 05 00

1.2 SHOP DRAWINGS AND PRODUCT DATA .1 Submit shop drawings and product data in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

- .1 Heavy duty, fusible and non-fusible, horsepower rated, disconnect switch in size and voltage as indicated.
- .2 Provision for padlocking in the off switch position by three padlocks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Fuses: size and type as indicated.
- .5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 ON-OFF switch position indication on switch enclosure cover.
- .8 Provide equipment identification in accordance with Section 26 05 00.
- .9 Provide switches complete with NEMA type 12 enclosure unless noted otherwise.
- .10 Provide disconnect switches serving motors controlled by soft starters complete with an auxiliary contact (10A @ 120Vac). Auxiliary contacts to make after and break before main switch contacts.
- .11 Switch to be suitable for service entrance where specified.

2.1 DISCONNECT SWITCHES
(Cont'd)

.12 Acceptable manufacturers: Square D, Cutler Hammer, Siemens.

PART 3 - EXECUTION

3.1 DISCONNECT SWITCH INSTALLATION

.1 Install disconnect switches complete with fuses as indicated on drawings.

.2 Install true, plumb and square to building lines.

.3 Confirm disconnect switch has proper clearance for operation of handle.

PART 1 - GENERAL

- 1.1 WORK INCLUDED .1 This section specifies requirements for the supply and installation of motor starters.
- 1.2 RELATED WORK .1 Electrical General Requirements: Section 26 05 00
- 1.3 SHOP DRAWINGS AND PRODUCT DATA .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- .2 Indicate:
- .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Schematic and wiring diagrams for each type of starter.
 - .6 Circuit breaker type.
- 1.4 OPERATION AND MAINTENANCE DATA .1 Provide operation and maintenance data for motor control centre for incorporation into manual.
- .2 Include data for each type and style of starter.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Starters: EEMAC E14-1.
- .1 Half size starters not acceptable.
 - .2 IEC equipment not acceptable.
 - .3 Minimum starter size 1.
- 2.2 MANUAL MOTOR STARTERS .1 Single phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
- .1 Switching mechanism, toggle type quick make and break.
-

- 2.2 MANUAL MOTOR STARTERS
(Cont'd)
- .1 (Cont'd)
 - .2 Overload heater(s), manual reset, trip indicating handle.
 - .3 Terminals: screw type, suitable for #10AWG (or smaller) copper conductors.
 - .4 Enclosure:
 - .1 NEMA Type 4X (stainless steel) in wet/damp areas.
 - .2 Accessories:
 - .1 Hand/Off/Auto switch labelled as indicated.
 - .2 Indicating light: standard, heavy duty, oil tight LED type and colour as follows: Green = Run/On.
 - .3 Locking tab to permit padlocking in "OFF" position.
 - .3 Acceptable manufacturers: Square D, Cutler-Hammer, Siemens.
- 2.3 FULL VOLTAGE MAGNETIC STARTERS
MAGNETIC STARTERS
- .1 Single phase magnetic or combination magnetic starters of size, type (non-reversing, reversing or multi-speed type), rating as indicated on the Drawings with components as follows:
 - .1 Enclosure:
 - .1 NEMA Type 4X (stainless steel) in wet/damp areas.
 - .2 120 V operating coil with primary and secondary fused control transformer where indicated. Provide control fuses for 120 V power supply circuit from panelboards.
 - .3 Power and control terminals.
 - .4 Wiring and schematic diagram inside starter enclosure in visible location.
 - .5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
 - .2 Combination type starters to include motor circuit interrupter or fused disconnect switch as noted on the Drawings and with operating lever on outside of enclosure to control disconnecting device and provision for:
 - .1 Locking in "OFF" position with up to three (3) padlocks.
 - .2 Independent locking of enclosure door.
 - .3 Provision for preventing switching to "HAND" position while enclosure door is open.
-

2.3 FULL VOLTAGE
MAGNETIC STARTERS
(Cont'd)

- .3 Accessories:
- .1 Selector switches: industrial heavy duty, Nema style, 30mm, watertight, corrosion resistant (NEMA 4X enclosure only), oil and dust tight, labelled as indicated.
 - .2 Indicating lights: industrial, heavy duty, NEMA style, 30 mm, watertight, corrosion resistant (NEMA 4X enclosure only), oil and dust tight, LED type, colour as indicated.
 - .3 Auxiliary contacts as indicated.
 - .4 Provide motor current transducers for starter units indicated on the drawings.
 - .5 Provide door mounted devices, terminal blocks, and auxiliary contacts as detailed on the Drawings.

2.4 EQUIPMENT
IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Magnetic starter designation label, white plate, black letters, size 9, engraved as indicated.
- .3 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

2.5 ACCEPTABLE
MANUFACTURERS

- .1 Allen Bradley.
- .2 Cutler-Hammer.
- .3 Square D (Schneider Canada).
- .4 Furnas (Siemens).

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install starters, connect power and control as indicated.
 - .2 Confirm correct breakers, fuses and overload devices elements are installed and set per manufacturer's recommendation for motor size and coordination study.
-

3.2 TESTS

- .1 Perform tests in accordance with Section 26 05 00 and the manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Confirm sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.
- .5 Confirm monitoring equipment is connected and properly working upon completion of installation. Simulate I/O from each unit and verify status and alarms.

PART 1 - GENERAL

- 1.1 RELATED WORK .1 Electrical General Requirements: Section 26 05 00
- 1.2 REFERENCES .1 IEEE C62.41.1-2002, Guide on the Surge Environment in Low-Voltage (1000 V and Less) A/C Power Circuits.
- 1.3 SHOP DRAWINGS AND PRODUCT DATA .1 Submit shop drawings and product data in accordance with Section 01 33 00.
- .2 Submit shop drawings for the following:
- .1 Luminaire.
 - .2 Lamp for each luminaire type.
 - .3 LED driver for each luminaire.
- .3 Shop Drawings:
- .1 Shop drawings to clearly indicate the following:
 - .1 Luminaire ID number as identified in contract documents.
 - .2 Fixture specification as identified in Part 2.
 - .3 Lamp specification as identified in Part 2.
 - .4 LED driver spec as identified in Part 2.
 - .5 Photometric data for each luminaire type.
 - .4 Catalogue cuts lacking sufficient detail to indicate compliance with Contract documents will not be acceptable.
 - .5 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by the Departmental Representative. Photometric data to include:
 - .1 VCP Table, spacing criterion;
 - .2 Total input watts;
 - .3 Candlepower summary, candela distribution, zonal lumen summary;
 - .4 Luminaire efficiency, C.I.E. type, coefficient of utilization;
 - .5 Lamp type;
 - .6 Lumen ratings; and
 - .7 Summary in accordance with IES procedures.

PART 2 - PRODUCTS

2.1 LAMPS

.1 Linear LED lamps.

| Lamp Wattage | Mount | Initial Lumens | Life h | Colour Temp | CRI | Additional Info |
|-----------------|--------------------------------------|-------------------|-----------|----------------|-----|---|
| 38W | Chain Hung or surface mount | 4000 | 60,000 | 3500K | >85 | Listed for installation in wet locations |

2.2 LUMINAIRES

- .1 LED Luminaire design L1:
- .1 Wall mounted LED luminaire suitable for outdoor mounting (wet location listed). Vapour proof.
 - .2 Input voltage: 120V, 60Hz.
 - .3 Nominal dimensions: 1219mm long, 140mm high and 240mm deep.
 - .4 Lamp: LED module, 35W, 4300K, 75CRI.
 - .5 LED driver:
 - .1 Less than 20% THD.
 - .2 Greater than 0.95 power factor.
 - .3 -30° minimum starting temperature.
 - .4 10kV, surge protector.
 - .6 Housing: die cast aluminum.
 - .7 Door frame: single piece die-cast aluminum, hinged closed and secured to the housing.
 - .8 Optics: full cut-off, glass lens, wide throw.
 - .9 Finish: polyester power coat, bronze colour.
 - .10 Options:
 - .1 Integral photocell control.
 - .2 Passive infrared (PIR) motion sensor (field adjustable). After a preset time delay (nominal 5 minutes), the fixture will reduce wattage levels to 10% ± and decrease the fixture light output accordingly.
 - .11 Acceptable material:
 - .1 Philips Gardco 121 LED services with motion response, or approved equivalent.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Connect luminaires to lighting circuits as indicated. Each light fixture must have a separate "fixture drop" installed and connected to a junction box located in the ceiling space.
 - .2 Install each luminaire properly and safely.
 - .3 Luminaires applied to a surface mounting outlet box, a finishing ring shall be utilized.
- 3.2 LUMINAIRE SUPPORTS
- .1 Support all luminaires independently of ductwork, piping.
 - .2 Chains shall be corrosion resistant design (hot dipped galvanized or stainless steel), rated for unit load and securely anchored to wooden frame ceiling or clamped/bolted to building supports.
- 3.3 LUMINAIRE ALIGNMENT
- .1 Align luminaires mounted individually parallel or perpendicular to building grid lines, or as indicated.
- 3.4 LUMINAIRE CLEANING
- .1 Clean all luminaires one week prior to Substantial Performance application.
 - .2 Replace blemished, damaged, or unsatisfactory luminaires as directed.
- 3.5 MAINTENANCE
- .1 Provide, for each type of luminaire, recommended maintenance information including:
 - .1 Tools required.
 - .2 Types of cleaners to be used.
 - .3 Replacement parts identification lists.
 - .4 Final, as-built shop drawings.

PART 1 - GENERAL

- 1.1 WORK INCLUDED
- .1 This section and specifies the requirements for the supply, calibration, storing, installation, cabling, termination, programming, testing and commissioning of the instrumentation and controls equipment required for the Pump House on Sable Island as indicated herein.
 - .2 Confirm the instrumentation and controls equipment/cabling termination details (for all instrumentation and controls cabling), to reflect the equipment and panels actually supplied (after shop drawing approval), and to match the intent as indicated or implied in the Contract Documents, to supply a complete and functioning booster station.
 - .3 Safely store on-site all instrumentation and controls equipment awaiting installation.
 - .4 Protect during construction all installed instrumentation and controls equipment.
- 1.2 RELATED WORK
- .1 Electrical General Requirements: Section 26 05 00
- 1.3 REFERENCES
- .1 Carry out the work under this section in accordance with all applicable Federal, Provincial, Municipal and other laws/ordinances, and with the latest edition of the following standards which will be deemed to be and form part of this specification:
 - .1 American Society of Mechanical Engineers.
 - .2 Institute of Electrical and Electronic Engineers.
 - .3 American Society for Testing Materials.
 - .4 Manufacturers Standardization Society.
 - .5 Canadian Standards Association.
 - .6 Instrument Society of America.
 - .7 Canadian Electrical Code.
 - .2 In the event of a conflict between the above mentioned standards, this specification, or the attached drawings, notify the Departmental Representative, who will then advise on which standard is to be followed.
-

1.3 REFERENCES
(Cont'd)

- .3 All Instrumentation and controls works (Instrumentation mounting, tubing, cabling, terminating, calibration, testing and commissioning) shall be carried out by certified inter-provincial ticketed Instrument Tradesmen and all works shall be verified/checked by its associated manufacturer's representative before putting in service.

1.4 SUBMITTALS

- .1 Submit equipment shop drawings in accordance with 01 33 00. Confirm shop drawings have been reviewed by the Departmental Representative before any equipment is ordered.
- .2 Instrumentation and controls equipment shop drawings shall include, but not be limited to, the following:
- .1 Complete model number of each instrument being proposed, with model number breakdown codes.
 - .2 Applicable instrument/equipment tag numbers shall be identified on every shop drawing.
 - .3 Equipment operational specifications.
 - .4 Equipment dimensions, weight, mounting details, and materials of construction.
 - .5 Equipment power requirements, air supply requirements, process signal type, etc.
 - .6 Electrical termination information specific to the device being purchased in this contract.
 - .7 Complete parts list with recommended inventory of spare parts.
 - .8 Frequency and method of calibration (if applicable).
 - .9 Manufacturer's installation recommendations/requirements.
 - .10 Any sizing calculations (if applicable).
 - .11 For relay control panels and field junction boxes, provide layout and wiring diagram, complete with detailed materials list.
 - .12 Upon request by the Departmental Representative, supply a similar application user list (at least two references), complete with contact names and phone numbers, for any proposed instrument the Departmental Representative has no experience with. Failure to produce a requested user list (within five (5) working days after request), or a bad review by a contacted user, will result in the automatic rejection of the proposed equipment.
- .3 Submit data for operations and maintenance manuals in accordance with Section 01 78 00. Include information based on the following requirements:
-

1.4 SUBMITTALS
(Cont'd)

- .3 (Cont'd)
- .1 Operation and maintenance instructions to be sufficiently detailed with respect to design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, calibration, maintenance and repair of the supplied equipment.
 - .2 Include names and addresses of local suppliers for all items included in maintenance manuals.
 - .3 Include all instrumentation calibration sheets.
 - .4 Include instrumentation and controls equipment termination drawing or termination schedules.

PART 2 - PRODUCT

2.1 GENERAL
INSTRUMENTATION

- .1 All instrumentation and controls equipment must be of a proven design for each application and designed, manufactured, inspected, and tested to comply with the applicable regulations, codes, and standards.
 - .2 Select instrumentation and controls equipment selected to suit the process and environmental requirements for each application as described or implied in this specification and the drawings.
 - .3 All instrumentation and controls equipment must be constructed to operate safely and reliably under all operating conditions without undue wear, vibration, heat, noise, or other operating problems. Parts subject to wear, corrosion, or other deterioration, or requiring adjustment, inspection or repair, shall be accessible and capable of convenient field maintenance.
 - .4 All proposed instrumentation and controls equipment must be certified by an agency (preferably CSA) recognized by the applicable provincial Electrical Inspection Department. Where there is no alternative to supplying equipment that is not appropriately certified, special approval from the applicable provincial Electrical Inspection Department will be required. Cover all costs associated with obtaining such approval at no additional cost to the Contract.
 - .5 All instrumentation and controls equipment shall have a minimum enclosure rating of NEMA 4X (IP66).
-

2.1 GENERAL
INSTRUMENTATION
(Cont'd)

- .6 The minimum instrumentation and controls equipment electrical connection size to be 13 mm NPT.
- .7 Instrumentation and controls equipment requiring a power supply to be 120 VAC, 60 Hz.
- .8 All "wired" instrumentation and controls equipment must have provision for externally grounding the instrument housing/enclosure.
- .9 Provide all instrumentation and controls equipment complete with a securely fastened manufacturer's nameplate indicating instrument model, serial number, calibrated range, etc., as required for ordering a replacement item.
- .10 All instruments not directly coupled to a process connection shall be mounted on manufactured instrument stands (2 NPS pipe construction with sealed ends, galvanized) or on a nearby wall. All mounting hardware for mounting instrument stands and instruments shall be 316 SS. Mount instruments as per manufacturer's recommendations.
- .11 Supply instrument tags for all plant instruments indicated on the Drawings. Affix a non-ferrous tag indicating the instrument tag number to the instrument using brass or stainless steel wire. Tag to be approximately 50 mm x 25 mm and stamped in a legible manner, with a minimum 10 mm character size, and in the same format as shown on the Drawings.
- .12 All instruments must be EMI and RFI protected.

2.2 PRESSURE
INSTRUMENTS

- .1 Select the range of pressure measuring instruments so that full scale reading will equal 200% of maximum operating pressure, or 120% of system design pressure, whichever is greater.
 - .2 Mount pressure gauges (complete with isolation valves) to the process connections and oriented for easy viewing by an operator. In areas of excessive vibration or inaccessibility, remote mount the gauges on an instrument stand (keeping process impulse line lengths to a minimum). General pressure gauge design and performance requirements will be as follows:
-

- 2.2 PRESSURE INSTRUMENTS
(Cont'd)
- .2 (Cont'd)
 - .1 115mm dial, glycerine filled, black thermoplastic or 304SS case construction, safety glass, with rear blow-out disc.
 - .2 316SS wetted parts and movement (unless specified otherwise).
 - .3 White dial with black scale and balanced pointer, dual scale (kPag and psig).
 - .4 13mm NPT bottom process connection.
 - .5 Minimum accuracy of $\pm 1.0\%$ of full scale (ASME B40.1, Grade 1A) or better.
 - .6 Capable of 150% overpressure for short durations without incurring damage.
 - .7 Acceptable manufacturers: WIKA, Ametek, Ashcroft, US Gauge, Winters.
 - .3 Mount pressure switches (complete with isolation manifolds) directly to the process connections where practical. In areas of excessive vibration or inaccessibility, remote mount switches on an instrument stand for easy viewing and adjustment by an operator. General pressure switch design and performance requirement to be as follows:
 - .1 13mm NPT bottom process connection.
 - .2 Repeatability of 1% of set point.
 - .3 Capable of 150% overpressure without incurring damage or requiring recalibration.
 - .4 Internally adjustable deadband to suite application.
 - .5 Fixed or adjustable deadband to suite application.
 - .6 Two (2) SPDT hermetically sealed contacts, rated for at least 5 amps @ 120 VAC (continuous use), with screw terminals. Mercury switches are not acceptable.
 - .7 Acceptable manufacturers: Unite Electric, SOR, Ashcroft, Dwyer or approved equivalent. Inclusion in this list does not exempt the requirement that any proposed model must be compliant with the equipment specifications.
-

- 2.3 MISCELLANEOUS
- .1 Field-mounted selector switches to be 30.5mm heavy duty, watertight/oiltight, front-mounted, two (2) or three (3) position (refer to control schematic drawings), minimum NEMA 4, and complete with one (1) normally open and one (1) normally closed contact per position. Acceptable materials: Allen Bradley 800T type or approved equivalent. Acceptable manufacturers: Allen Bradley, Crouse-Hinds, Telemecanique, Cutler-Hammer, Siemens, and Killark.
 - .2 Local control station enclosures to be the heavy industrial type, minimum NEMA 4, and sized to house the required number of pushbuttons, switches, etc., as indicated on the drawings. Acceptable manufacturers: Allen Bradley, Crouse-Hinds, Telemecanique, Cutler-Hammer, Siemens, and Killark.
- 2.4 INSTRUMENTATION CABLING/WIRING
- .1 120VAC instrumentation digital control cables: stranded copper, minimum size #14 AWG with 600 volt chemically cross-linked thermosetting polyethylene material rated RW90.
 - .2 24VDC instrumentation signal cables: tinned stranded copper, minimum size #16 AWG with individually twisted shielded pairs, chemically cross-linked thermosetting polyethylene insulation, overall shield, minimum 300V, overall PVC jacket.
 - .3 Handle, install and support cables in accordance with manufacturer's guidelines.
 - .4 Ground Field Control Panels and Junction Boxes to the building ground bar using a #6 green copper grounding cable.
 - .5 Cables and conduits to enter field instruments, control panels and junction boxes from the bottom only. Use grounding bushings when terminating in non-conductive boxes or plates.
 - .6 Supply and install 120VAC instrumentation digital control wiring conduits as per Section 26 05 34.
-

2.4 INSTRUMENTATION
CABLING/WIRING
(Cont'd)

- .7 Inside all Instruments, Control Panels, and Termination Junction Boxes, all cable conductors shall be identified using wire markers (Weidmuller PT transparent sleeves with TM-I labels, or approved alternate). Mark conductors with their corresponding instrument tag number and Instrument terminal block number (ex: HS3004/C, where HS3004 is the Instrument tag number, and "C" is the Instrument terminal block number the conductor is terminated on). This "conductor identifier" must remain the same through any intermediate junction boxes, etc., all the way back to its corresponding control cabinet.
- .8 Clearly identify cables at both ends with its cable number using flexible PVC slip-on wire markers. Labelling must be done at all cable terminal points and must be at the point of junction box/instrument entry.
- .9 Leave conductors being terminated within a junction box/control panel long enough to be removed from its assigned terminal block and reassigned to anywhere within the junction box/control panel.
- .10 Coil spare conductors of a cable together inside its associated junction box/control panel and clearly identify with the cable number (ex: Spare-JB3000), unless indicated to be terminated on spare terminals. Leave adequate length to run the spare conductors anywhere within the junction box/control panel. Terminate spare conductors where identified.
- .11 Fit stranded conductors with vinyl insulated wire end ferrules when terminating to terminal blocks, and vinyl insulated locking fork terminal connectors when terminating to screw terminals.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Execute work in a professional manner and so it presents a neat appearance when completed.
 - .2 All instrumentation and control equipment being supplied by, or issued to, the Contractor shall be installed where and as indicated on the drawings, and in accordance with the manufacturer's instructions. Manufacturer's installation instructions shall be strictly adhered to.
-

3.1 INSTALLATION
(Cont'd)

- .3 The Drawings indicate the extent and general arrangement of the instrumentation and controls equipment. Exact installation locations, distances and levels will be governed by actual field conditions and is subject to approval by the Departmental Representative; field verification of dimensions shown on drawings is obligatory.
 - .4 If any departures from the original intent of the Drawings and/or the Specifications are deemed necessary by the Contractor, submit details of such departures with Drawings if necessary, together with reasons for the departure to the Departmental Representative as soon as practical for approval. Do not make any such departure without prior written consent of the Departmental Representative.
 - .5 Unless otherwise specified, fabricate and erect all support brackets or mounting brackets required. Supply instruments with all necessary mounting brackets from the instrument vendor.
 - .6 Locate instruments to minimize the possibility of damage from high temperature, vibration or humidity, and not to interfere with, or be damaged by, maintenance of other equipment. Instrument installation must also provide for easy accessibility for operation, inspection, and maintenance purposes.
 - .7 Store materials in a manner to preserve their quality and fitness for the work, and to facilitate inspection by the Departmental Representative at any time. Keep instruments and equipment clean and protect against damages, dirt, and moisture.
 - .8 Protect installed equipment against water or dirt until it is commissioned. Use clear plastic sheeting of not less than 8-mil thickness for this purpose.
 - .9 Keep all enclosures, rooms, trenches, etc., free from construction debris, materials, dirt and water at all times during construction.
 - .10 Repair/replace equipment damaged during construction, or otherwise deemed defective or non-compliant with this specification, at no additional expense to the Contract. These expenses shall include all material, labour and other fees.
-

3.2 TESTING AND CALIBRATION EQUIPMENT

- .1 Calibrate all test and calibration equipment to an industry recognized standard and affix proof of calibration along with date of next calibration.

3.3 TESTING AND CHECK-OUT

- .1 Make all tests necessary to confirm material and workmanship are of the required degree of excellence, and that the supplied equipment will perform as specified and guaranteed (verify wiring, wire continuity checks, tubing leak tests, etc.).
- .2 All instruments, either purchased by or supplied to the Contractor must be calibrated before installation. Secure the services of qualified personnel (manufacturer's representative) and equipment to conduct field instrument calibration.
- .3 Document the results of all tests/calibrations and make available to the Departmental Representative and shall be included in the project "operations and maintenance manual" submission.
- .4 Coordinate with the Departmental Representative to schedule control and instrumentation suppliers for proper set-up.
- .5 Perform a series of starts/stops of the pumps under power from the Owners genset to confirm operation.
- .6 Program, test and calibrate all instruments.

3.4 COMMISSIONING AND START-UP

- .1 Arrange and pay for the services of a manufacturer's factory service representative to supervise the installation, start-up, check, adjust, balance and calibrate all supplied instruments, to the satisfaction of the Departmental Representative. Provide these services for such period, and for as many visits as necessary to put the installation in working order, and to ensure that the operating personnel are conversant with all aspects of equipment and operation.
 - .2 Submit a written report signed by the manufacturer's representative to the Departmental Representative stating the following:
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3.4 COMMISSIONING
AND START-UP
(Cont'd)

- .2 (Cont'd)
- .1 That a satisfactory installation of the equipment has been performed outlining modifications that have been made as a result of testing/commissioning the equipment; and
 - .2 That the maintenance instructions for the equipment have been presented to the Departmental Representative.
- .3 After the instrumentation and controls equipment have been installed, calibrated, checked out and tested, the control and systems testing/commissioning can begin. Carry out this phase of the work under the direction of the Departmental Representative. This will involve a point-by-point check for all monitored field I/O points, logic checks, complete controls integration, and equipment start-ups.
- .4 Provide technical personnel during this phase of the work for instrument recalibration, re-wiring, reprogramming, etc., as required until the integrated control system is deemed ready for Pump House operation.

PART 1 - GENERAL

- 1.1 SUMMARY OF WORK
- .1 This Section specifies the requirements to supply and install a water treatment system on Sable Island.
- 1.2 REFERENCES
- .1 AWWA C700-15, Cold-Water Meters-Displacement Type, Bronze Main Case.
- .2 NSF/ANSI 55-2017, Ultraviolet Microbiological Water Treatment Systems.
- .3 NSF/ANSI 61-2016, Drinking Water System Components - Health Effects
- 1.3 BACKGROUND INFORMATION AND EXISTING INFRASTRUCTURE
- .1 The capacity of the recommended Sable Island water treatment system has been established as per the capacity of the recommended well pump: 38 Lpm. The operation of the system will be controlled by the water pressure in the system, and the pump and treatment system will always operate at the same rate. On this basis the capacity of the water pumping and treatment system is rated at 38 Lpm) or 54,400 Lpd.
- .2 The water is provided by duplex shallow well jet pumps which draw from a groundwater well located underneath the pump house. Two (2) hydro pneumatic pressure tanks in the pump house regulate system pressure and minimize cycling of the well pumps.
- .3 The existing water treatment system consists two (2) 250mm diameter fiberglass tanks in series; one is a water softener and one is an iron filter. Following the filters, the water is disinfected by an ultraviolet irradiation (UV) unit. The treated water is discharged to a transmission line, which supplies the accommodation and operations buildings.
- .4 The existing electrical system includes a 600V service entrance which feeds a 600/208V transformer. All electrical components are tied to a 120/208V distribution panel, including lights, heat, pumps, and receptacles used for filter tank control valves and UV disinfection.
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1.4 ENVIRONMENTAL PROTECTION .1 The Contractor will be required to comply with Parks Canada Basic Impact Assessment, attached to this document as Appendix A.

PART 2 - PRODUCTS

2.1 SCOPE OF SUPPLY .1 A process schematic of the required water treatment system, including existing equipment, is shown on the Project Drawings, and is described as follows:

- .1 New shallow well jet pumps.
- .2 New raw water flowmeter with totalizer in m³.
- .3 New schedule 80 PVC piping and valves.
- .4 New air injection system.
- .5 New anthracite/sand multimedia filtration for iron/H₂S removal in FRP vessel.
- .6 New top-mounted multiport control valves for production/backwash flow control.
- .7 New 5-micron absolute cartridge filter and housing.
- .8 New 1-micron absolute cartridge filter and housing.
- .9 New NSF-55 Class A certified UV disinfection system.
- .10 New calcite contactor with fill port and top mounted control valve.
- .11 New treated water flowmeter with totalizer in m³.
- .12 New well building pressure tank with 90L drawdown (207/345 kPa).

.2 Mechanical, electrical and civil components to be included in the scope of the supply and installation include:

- .1 New Visitor's Quarter's pressure tank with 90 L drawdown (207/345) kPa.
- .2 New Visitor's Quarter's flowmeter with totalizer in m³.
- .3 New control devices.
- .4 New electrical distribution panel.
- .5 New transformer.
- .6 New treated water and drain piping, including exfiltration trench for drain.
- .7 New heat trace system for drain and treated water outlet pipes.

2.2 WELL
MODIFICATIONS AND
PUMPING SYSTEM

- .1 Pumping of the well water will be accomplished by two (2) jet pumps in parallel, supplied with the following characteristics:
 - .1 1.1 kW close coupled motor;
 - .2 Suction lift of 3 m;
 - .3 34 L/min @ 550 kPa discharge pressure;
 - .4 76 L/min @ 207 kPa discharge pressure;
 - .5 Shutoff discharge pressure 690-760 kPa;
 - .6 Motor controller to be provided for both pumps, allowing pump alternation, selection of duty and standby pumps with NEMA 4X enclosure;
 - .7 Disconnects provided for each pump motor with NEMA 4X enclosures;
 - .8 Acceptable pump model: Goulds HSJ-15N (or approved equivalent).

 - .2 New suction lift pipe and foot valve for well, schedule 80 PVC with foot valve and strainer. Foot valve to have PVC true-union body and ball check style, with EPDM seals, and be designed for use as a foot valve/strainer combination. Bottom of intake pipe to be set at same elevation as existing foot valve; top of the drop pipe and each 1500 mm section of drop pipe to be fitted with union for easy disconnection and removal of drop pipe and foot valve.

 - .3 Pumping system to include associated valves and piping indicated on the process flow diagram. These include inlet and outlet isolation valves on each pump, check valves on each pump discharge, a common pressure relief valve set to open at 690 kPa, common suction vacuum gauge, common discharge pressure gauge, common flowmeter with totalizer, and a common sample port. The specifications for these components are listed below:
 - .1 Isolation valves:
 - .1 Quarter-turn full port ball valves, PVC true union body with Schedule 80 socket ends, rated for minimum 1000 kPa working pressure at 20 degrees C.
 - .2 Check valves:
 - .1 Full port design, PVC true union ball-check valve with PVC ball and EPDM seals.
 - .3 Pressure relief valve:
 - .1 PVC body with true union socket ends, with adjustable spring-loaded PTFE diaphragm and EPDM seals.
-

- .2 Suitable for opening pressure at 690 kPa.
- .3 Acceptable model: Chemline SB11 series (or approved equivalent).
- .4 Vacuum and pressure gauges:
 - .1 -100 kPa to 210 kPa range for vacuum gauge.
 - .2 0 to 1000 kPa range for pressure gauges.
 - .3 115-mm, glycerin filled with face dial with black scale.
 - .4 Black thermoplastic or 304-SS case, 316-SS wetted parts.
 - .5 Minimum accuracy of +/- 1.0% full scale.
- .5 Flowmeter:
 - .1 Residential 16-mm nominal size, nutating disc style meter with direct-read magnetic digital register in m³.
 - .2 Accuracy +/- 1.0% at 20-80 L/min.
 - .3 Meets latest version of AWWA Standard C700.
 - .4 Acceptable model: Neptune T-10 or approved equivalent.
 - .5 Flowmeter model will be the same used for treated water and at Visitor's Quarters.
- .6 Sample port:
 - .1 6-mm PVC with EPDM or stainless steel quarter-turn mini-ball valve type with labcock/hose barb fitting, suitable for 1000 kPa operating pressure.
 - .2 Common to all sample ports, locations shown on the Project Drawings.

2.3 AIR INJECTION SYSTEM

- .1 Aeration will be accomplished by a venturi air injection system. A differential pressure relief valve will be used to ensure a set differential pressure is maintained across the venturi as the head losses build up in other processes in the system (i.e. filters). Maintaining a set differential pressure is required to ensure adequate air is added to the raw water. The air injection system components include the following specifications:
 - .1 Include air inlet tubing.
 - .2 Include acrylic rotameter suitable for 2.9 Nm³/h airflow with required fittings, including internal check valve to prevent water drain through the rotameter when suction is stopped.
-

- .1 Acceptable product: Mazzei venturi injector Model 0584 (or approved equivalent).
- .3 25-mm FNPT inlet and outlet connections on 100-01 Hytrol main valve;
- .4 Standard CDB-7 Differential Pilot valve with 35 to 170 kPa adjustment range
 - .1 Acceptable product: Cla-Val differential pressure control valve (DPCV) model 250 (or approved equivalent).
- .5 Automatic air release valve:
 - .1 Include minimum 3 m of pipe run between air injection and valve.
 - .2 Located at high point prior to filters.
 - .3 Air release valve type common to all locations shown on the Project Drawings.
 - .4 Acceptable model: A.R.I model S-050 with 13-mm NPT process connection.

2.4 DUAL ANTHRACITE/ .1
SAND MEDIA FILTRATION

- Pre-filtration of the raw water is required to reduce the particulate matter, which may include soil particles, debris, organics, etc. drawn into the raw water pump. This particulate matter may potentially also include pathogenic microorganisms, such as bacteria or cysts. Precipitated iron particles could also be removed by filtration, and dissolved iron and manganese can be removed by microbiological action. Pre-filtration will be accomplished by two (2) dual-media (anthracite-sand) pressure vessels plumbed in parallel with the following characteristics:
- .1 Logix 764 controller for twin parallel operation.
 - .2 68 L of anthracite in each vessel:
 - .1 Effective size range 0.8 to 1.1 mm.
 - .2 Uniformity Coefficient <1.65.
 - .3 Laboratory Analysis certificate required.
 - .3 34 L of silica sand in each vessel:
 - .1 Effective size range 0.45 to 0.55mm.
 - .2 Uniformity coefficient <1.65.
 - .3 Laboratory analysis certificate required.
 - .4 8.5 L of support gravel in each vessel.
 - .5 All wetted materials to be NSF 61 approved.
 - .6 Acceptable product:
 - .1 Pentair CH30868 Structural Polyglass pressure vessels (or approved equivalent).
-

.2 Pentair Autotrol Performa 273 3-cycle control valves (or approved equivalent).

2.5 CARTRIDGE
FILTRATION

- .1 Cartridge filtration will be used to remove the particulate matter that passes through the anthracite-sand filters, along with providing some removal for giardia cysts, which have removal standards in Parks Canada Agency's Potable Water Guidelines and Standards. One 5-micron cartridge filter and one 1-micron cartridge filter in series, along with cartridge housings will be used and will be required to meet the following requirements:
- .1 Cartridge filter with nominal pore size rating of 5 microns.
 - .2 Cartridge filter with nominal pore size rating of 1 micron.
 - .3 Filters to be cleanable/reusable cartridge type.
 - .4 Stainless Steel cartridge housings for each filter;
 - .5 Cartridge filters to be floor mounted;
 - .6 All wetted materials to be NSF 61 approved.
- .2 Approved equipment: Harmsco HC/40-5 filter and Harmsco HC/40-1 filter, each with a HUR 40 HP housing.

2.6 CALCITE CONTACTOR

- .1 An inline calcite media filter system will be provided to increase pH and boost treated water alkalinity, and to help reduce potential corrosion in the distribution mains. The system shall meet the following characteristics:
- .1 Supply with watertight dome opening for media reloading:
 - .1 Acceptable product: one (1) Pentair CH31053 Structural Composite vessel (or approved equivalent).
 - .2 14 L of gravel support media.
 - .3 57 L of calcite limestone media (minimum 95% CaCO₃) with NSF-60 certification.
 - .1 Acceptable product: Pentair Autotrol Performa 273 3-cycle control valve.

2.7 DUAL UV
DISINFECTION UNITS

- .1 To meet the log removal credits outlined in the Potable Water Guidelines and Standards, and avoid the use of chlorine for secondary disinfection, as requested by Parks Canada, the UV units will be required to achieve 4 log removal for both cryptosporidium and viruses (Adenovirus). The UV units shall meet the following requirements:
 - .1 All components wall mounted.
 - .2 Each UV unit sized to provide at least 186 mJ/cm².
 - .3 Continuous indirect monitoring of dose provided.
 - .4 Visual indication of adequate or inadequate dose provided.
 - .5 Automatic flow shutoff when dose drops below 186 mj/cm².
 - .6 Fully validated to UVDGM protocol for 4-log Adenovirus.
 - .7 Automatic reduced lamp output under no-flow conditions.
- .2 Approved equipment: Viqua Adenovirus PR024-186 System.

2.8 PRESSURE TANKS

- .1 Pressure will be maintained in the distribution lines to the buildings using two (2) pressure tanks, one (1) located in the water treatment building prior to discharge and one (1) located in the Visitor's Quarters building. Pressure tanks will meet following specifications:
 - .1 Composite, corrosion-proof tank materials, polyethylene interior/fibreglass exterior.
 - .2 Maximum operating pressure 860 kPa.
 - .3 300 L capacity.
 - .4 90L drawdown from 345 to 207 kPa condition.
- .2 Approved equipment: Wellmate model WM-23 captive air tank (or approved equivalent).

2.9 PIPING, VALVES
AND INSTRUMENTATION

- .1 Provide six (6) readily accessible laboratory sampling ports at the locations as indicated on the Project Drawings. Sampling ports to be quarter turn mini ball valves as described in Section 2.1.
 - .2 Provide one (1) vacuum gauge complete with stainless steel mini ball valve on the raw water
-

inlet line and five (5) pressure gauges complete with stainless steel mini ball valve located as described herein and indicated on the Project Drawings.

- .3 All major piping to be 38 mm diameter schedule 80 PVC, with reducers and fittings as required by equipment selected or as shown on the Project Drawings.
- .4 Provide air release valves at the locations indicated on the Project Drawings.
- .5 Additional piping, valves, and equipment must be suitable for an operating flowrate of 76 L/min and operating pressure of up to 690 kPa (unless otherwise specified). Pressure switches for controlling jet pumps, with 207/345 kPa setting to be mounted on pressure tank inlet at the pump house and on the pump discharge. Control to be arranged such that a low pressure on either the pump discharge or at the tank will start pumps, with a high pressure at the tank required to stop pumps. Switches to be field-adjustable.
- .6 Add clear labeling on each of the process unit vessels indicating media contents. Add flow direction arrows on piping at inlet pipes to building, and at inlet and outlet of anthracite/sand filters, calcite vessel. Label calcite filter effluent pipe with direction arrow and 'Treated'. Drain piping from each relevant treatment unit to be labelled 'To Drain'. Supply, install and commission the equipment to applicable electrical codes.
- .7 All wetted materials (pumps and equipment) must conform to AWWA NSF-61.

2.10 SHELF SPARES

- .1 Consumables and equipment requiring regular replacement will be provided under the contract for a five-year operating life. The following materials must be supplied as shelf spares and left at site by the contractor:
 - .1 Calcite: Provide 3 ft³ in 0.5 ft³ bags.
 - .2 Anthracite: Provide 50% in 0.5 ft³ bags.
 - .3 Ball valves: Provide five (5).
 - .4 Check valves: Provide two (2).
 - .5 Air release valve: Provide one (1).
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- .6 Pressure gauges: Provide two (2).
- .7 5-micron cartridge filters: Provide ten (10).
- .8 1-micron cartridge filters: Provide ten (10).
- .9 UV bulbs: Provide six (6).
- .10 UV sleeves: Provide two (2).
- .11 UV sensors: Provide two (2).
- .12 Sample port with mini-ball valve: Provide two (2).

2.11 HEAT TRACE SYSTEM

- .1 Provide heat tracing for the treated water outlet piping and drain piping where piping is outside of water treatment building and not buried.
 - .1 120V Heat trace, insulation and waterproof jacketed to be provided as indicated on the drawings.
 - .2 Automatic electronic heat trace system with thermostat to be provided to supply 12 W/m to exposed piping section.
 - .3 High and low temperature alarm indicators and system status to be provided in control box.
 - .4 Pre-engineered system to be provided. Confirm with heat trace manufacturer heating cable will not exceed maximum recommended for pipe material prior to ordering.
- .2 Acceptable model: Urecon UTC-2030 or approved equivalent.

2.12 ELECTRICAL

- .1 To Division 26.

2.13 FENCING

- .1 Galvanized steel T-bars and galvanized steel page wire fence.
 - .2 T-bars with 2.4 m total length to be buried to a 900-mm depth at 3 m spacing.
 - .3 33 T-bars total, with additional used to form gate for staff access to pump house.
 - .4 The total fence length will be approximately 94m.
 - .5 Page wire to be 12.5 AWG, 9/1200/150 (10 horizontal wire rows, 1200 total height with 150 mm vertical using including spacers).
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PART 3 - EXECUTION

3.1 EXCAVATION AND
CORE DRILLING

- .1 Route the treated water pipe through the building wall, as indicated on the drawings. Accomplish this by core drilling the existing concrete block wall. Provide heat tracing from the inner side of the wall through to the connection to the existing treated water outlet pipe (or until new pipe has minimum 1.2m of cover). Isolate and abandon the existing discharge pipe as indicated in the drawings.
- .2 The process wastewater will be discharged to an exfiltration trench as shown in the drawings. As with the treated water pipe, route this discharge through the building wall. The waste discharge pipe does not require heat tracing, but provide insulation for pipe outside the building. Route both treated water and waste discharge pipes through an insulated box, constructed from a sheet of 19mm plywood, and filled with fibreglass batt insulation, as indicated on the drawings. Extend the pipe to a depth of 600mm below grade. Excavate a shallow trench by hand to 600mm depth for the waste pipe. Extend 6m from the building. Cover the pipe on the top and sides using 50mm rigid insulation, as indicated on the drawings. Connect a 3m section of exfiltration pipe (EZflow or equivalent) to the end of the discharge pipe. Overlay exfiltration pipe with 600mm of cover and rigid 50mm fibreglass insulation as indicated on the drawings.

3.2 INSTALLATION

- .1 Supply, install and commission the equipment to applicable plumbing code.
- .2 Install package water treatment system in accordance with the manufacturer's written instructions.
- .3 Supply and install all wiring and cabling in accordance with applicable electrical codes, and as specified by equipment manufacturers.

3.3 FENCING

- .1 Construct a new fence around the pump house. The fence will encircle the pump house, keeping a 15m
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radius from the center of the pump house. Refer to the Project Drawings for details.

3.4 COMMISSIONING,
OPERATION AND
MAINTENANCE MANUALS

- .1 Provide Operating and Maintenance manuals for all new equipment. Provide two (2) hard copy sets and one (1) electronic file in pdf file format of operations, installation and maintenance information for each system. All such material must be new material. Photocopies of literature provided by manufacturers will not be accepted. Drawings to be unfolded and page size papers to be perforated at the binding edge if possible. Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times to Parks Canada personnel. Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction. Review contents of manual in detail to explain all aspects of operation and maintenance. Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions. Refer to Section 01 91 13 for commissioning/performance testing requirements.