2023-03-03

Seal #1	Seal #2	Seal #3
Brendan White PBX Engineering Ltd. Division 26 Specifications Permit to Practice: 1000208		

NOTES:

Each Engineer that has applied a seal above shall indicate which sections of the specifications he or she is certifying and the engineering company they work for. Alternatively, the Engineer may indicate which engineering discipline he or she is certifying as long as the name of the engineering company they work for (the source) is shown on the applicable technical specifications.

TABLE OF CONTENTS

Part 1 General 3
1.0 Documents 3
1.1 Related Sections 3
1.2 Regulatory Requirements 4
1.3 Technical Specification Includes 4
1.4 Scope 5
1.5 Removal of Redundant Material and Equipment 6
1.6 Definitions 6
1.7 Drawings, Measurements, and Notations 8
1.8 Responsibility and Coordination 8
1.9 Common Product Requirements 10
1.10 Testing, Operation and Set-Up 11
1.11 Permits, Fees, and Inspections 11
1.12 Evaluation of Contract Changes 11
1.13 Measurement and Payment 11
1.14 Review of Work 11
1.15 Scheduling of Work 11
1.16 Action and Informational Submittals 12
1.17 Shop Drawings 12
1.18 Closeout Submittals 13
1.19 As-Built Documents and Samples 13
1.20 Operation and Maintenance Manual 16
1.21 Delivery, Storage, and Handling 19
1.22 Quality Assurance 19
1.23 Safety and Precaution 19
1.24 Care, Operation, and Start-up 20
1.25 Approvals 20
Part 2 Products 21
2.0 Design Requirements 21
2.1 Materials and Equipment 22
2.2 Electric Motors, Equipment and controls 22
2.3 Warning Signs 22
2.4 Wiring Terminations 23
2.5 Equipment Identification 23

2.6 Wiring Identification 24
2.7 Conduit and Cable Identification 24
2.8 Finishes 24
Part 3 Execution 24
3.0 Examination 24
3.1 Installation 24
3.2 Namplates and Labels 25
3.3 Conduit and Cable Installation 25
3.4 Mounting Heights 25
3.5 Co-ordination of Protective Devices 25
3.6 Field Quality Control 25
3.7 Substantial Performance Review 25
3.8 System Start-up 26
3.9 Cleaning 26

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.1 RELATED SECTIONS

.1 Technical Specification 26 05 02 Seismic Restraint

.2 Technical Specification 26 05 05 Electrical Demolition

.3 Technical Specification 26 05 10 Testing and Commissioning

.4 Technical Specification 26 05 20 Wire and Box Connectors (0-1000V)

.5 Technical Specification 26 05 21 Wires and Cables (0-1000V)

.6 Technical Specification 26 05 28 Grounding - Secondary

.7 Technical Specification 26 05 29 Hangers and Supports for Electrical Systems

.8 Technical Specification 26 05 31 Splitters, Junction, Pull Boxes and Cabinets

.9 Technical Specification 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

.10 Technical Specification 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings

.11 Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts

.12 Technical Specification 26 05 80 Fractional Horsepower Motors

.13 Technical Specification 26 05 81 Motors 0.746 to 149kW

.14 Technical Specification 26 09 24 Lighting Control Devices – Low Voltage

.15 Technical Specification 26 22 19 Control and Signal Transformers

.16 Technical Specification 26 24 01 Service Equipment

.17 Technical Specification 26 24 02 Service Entrance Board

.18 Technical Specification 26 24 05 Switchboard TVSS Protection

.19 Technical Specification 26 24 16 01 Panelboards Breaker Type

.20 Technical Specification 26 27 16 Electrical Cabinets and Enclosures

.21 Technical Specification 26 27 26 Wiring Devices

.22 Technical Specification 26 28 16 02 Molded Case Circuit Breakers

.23 Technical Specification 26 28 23 Disconnect Switches – Fused and Non-Fused

.24 Technical Specification 26 29 01 Contactors

.25 Technical Specification 26 29 03 Control Devices

.26 Technical Specification 26 29 04 Transmitters and Indicators

.27 Technical Specification 26 29 10 Motor Starters to 600V

.28 Technical Specification 26 29 23 11 Variable Frequency Drive

.29 Technical Specification 26 50 00 Lighting

.30 Technical Specification 26 54 00 Heaters and Ventilation

1.2 REGULATORY REQUIREMENTS

.1 Definitions:

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in this Technical Specification, and on Contract Drawings, are those defined by IEEE SP1122.

.2 Reference Standards:

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

.2 CSA C22.2 No. 1-10, General Requirements - Canadian Electrical Code, Part 2, Current Edition.

.3 CAN3-C235-83, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, Current Edition.

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 Master Municipal Construction Documents Association (MMCDA)

.1 Master Municipal Construction Documents, Current Edition (MMCD)

1.3 TECHNICAL SPECIFICATION INCLUDES

.1 This Technical Specification covers items common to the Divisions 26 Technical Specifications. This Technical Specification supplements requirements of Division 1.

.2 This Technical Specification 26 05 00 refers to those portions of the Work that are unique to the supply and installation of all electrical, control, and instrumentation and related appurtenances. This Technical Specification must be referred to and interpreted simultaneously with all other Technical Specifications pertinent to the works described herein.

1.4 SCOPE

.1 This project involves the construction of a sanitary lift station located in the Resort Municipality of Whistler (RMOW).

.2 The electrical scope of the pump station includes, but is not limited to, the following items of work:

.1 Coordination with BC Hydro for a 600A, 120/240V service to the proposed Service Kiosk.

.2 Supply and installation of the proposed electrical kiosk.

.3 Supply and installation of the proposed service section equipped with the following equipment:

.1 BC Hydro service entrance equipment

.2 General distribution equipment

.3 Heating, lighting, and ventilation

.4 Supply and installation of the proposed pump control section equipped with the following equipment:

.1 General distribution equipment

.2 Pump control panel

.3 Wet well equipment cable termination junction boxes

.4 Wet well ventilation fan

.5 Heating, lighting, and ventilation

.5 Supply and installation of reinforced concrete foundation for the electrical kiosk including a gasket between pad and enclosure.

.6 Supply and installation of electrical grounding systems.

.7 Supply and installation of electrical instrumentation equipment within the wet well.

.8 Installation and integration of alarms to the existing alarm panel located in the washroom buildings

.9 Decommissioning of existing irrigation hut distribution equipment located in the washroom and refeeding from the proposed electrical kiosk.

.10 Supply and installation of underground electrical conduits.

.11 Supply and installation of all field wiring and interconnections.

.12 Trenching and backfilling for underground electrical duct work.

.13 Provision of testing and commissioning of the electrical services and systems provided under the Contract Documents.

.14 Provision of programming and testing services for miscellaneous items including VFDs, electronic breakers and other configurable components.

.15 Provision of all permits, licenses and fees required by applicable Governmental Authorities having jurisdiction.

.16 Provision of seismic engineering and associated materials and equipment as described herein.

.17 Provision of vibration isolation equipment and materials including seismic restraints and anchoring.

.18 Preparation of operations and maintenance manuals.

.19 Provision of training for the operation and maintenance teams.

.3 All work described herein shall be performed by qualified personnel.

1.5 REMOVAL OF REDUNDANT MATERIAL AND EQUIPMENT

.1 No used.

1.6 DEFINITIONS

.1 The word ‘Install’ means the Supply, delivery, and installation of device or equipment referenced to the level required to be complete and operational including unloading, unpacking, assembling, erecting, applying, finishing, protecting, and cleaning.

.2 The word ‘Supply’ means to obtain and deliver to the Site, ready for unpacking, assembly, and installation.

.3 AHJ: Governmental Authority having jurisdiction.

.4 Schematic or Elementary Diagram

.1 A schematic (elementary) diagram shows, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. The schematic diagram facilitates tracing the circuit and its functions without regard to the actual physical size, shape, or location of the component devices or parts.

.5 Single-Line Diagram

.1 A single-line diagram shows, by means of single lines and graphical symbols, the course of an electrical circuit or system of circuits and the components, devices or parts used therein. Physical relationships are usually disregarded.

.6 Block Diagram

.1 A block diagram is a diagram of a system, instrument, computer, or program in which selected portions are represented by annotated boxes and interconnecting lines.

.7 Wiring Diagram or Connection System

.1 A wiring or connection diagram includes all of the devices in a system and shows their physical relationship to each other including terminals and interconnecting wiring in an assembly. This diagram may be (a) in a form showing interconnecting wiring only by terminal designation (wireless diagram), or (b) by panel layout diagram showing the physical location of devices plus the elementary diagram.

.8 Interconnection Diagram

.1 An interconnection diagram shows all external connections between terminals of equipment and outside points, such as motors and auxiliary devices. References shall be shown to all connection diagrams which interface to the interconnection diagrams. Interconnection diagrams shall be of the continuous line type. Bundled wires shall be shown as a single line with the direction of entry/exit of the individual wires clearly shown. Wireless diagrams and wire lists are not acceptable. Each wire identification as actually installed shall be shown. The wire identification for each end of the same wire shall be identical. All devices and equipment shall be identified. Terminal blocks shall be shown as actually installed and identified in the equipment complete with individual terminal identification. All jumpers, shielding and grounding termination details not shown on the equipment connection diagrams shall be shown on the interconnection diagrams. Wires or jumpers shown on the

equipment connection diagrams shall not be shown again on the interconnection diagram. Signal and DC circuit polarities and wire pairs shall be shown. Spare wires and cables shall be shown.

.9 Arrangement, Layout, or Outline Drawings

.1 An arrangement, layout, or outline drawing is one which shows the physical space and mounting requirements of a piece of equipment. It may also indicate ventilation requirements and space provided for connections or the location to which connections are to be made.

1.7 DRAWINGS, MEASUREMENTS, AND NOTATIONS

.1 Contract Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work.

.2 The Contract Drawings show approximate locations of equipment and apparatus, but the right is reserved to make such changes in location before installation or performance of the work as may be necessary to meet the exigencies of construction in any way. No extra will be allowed and conversely, no credit shall be expected for such changes unless for each item of work the distance moved exceeds 3m prior to final installation of same.

.3 Take field measurements where equipment and material dimensions are dependent upon building dimensions.

.4 The Contractor shall supply and install all electrical equipment. Standard notations are used on the Contract Drawings to assist the Contractor in identifying what work needs to be done. These standard notations are defined as follows:

.1 “All equipment is proposed unless noted otherwise” – This notation is used on Contract Drawings where the majority of the equipment on the drawing is to be supplied and installed by the Contractor. The notation means that the Contractor shall perform all work shown on the Contract Drawing except for equipment shown as existing (i.e. to remain).

.2 “All equipment is existing unless noted otherwise”: - This notation is used on Contract Drawings where the majority of the equipment is existing. The notation means that the Contractor shall perform only the Work identified on the Contract Drawings.

1.8 RESPONSIBILITY AND COORDINATION

.1 Provide all labour, materials, equipment, tools, and incidentals necessary to provide a complete electrical installation as indicated on the Contract Drawings and as set out in these Technical Specifications.

.2 Without relieving the Contractor of his responsibilities, the Technical Specifications have been divided into approximate trade sections for convenience. The use of these sections do not, however, limit the responsibility of the Contractor or any Subcontractor or Supplier. The onus of defining the extent of the Subcontractors' work remains with the Contractor, who, when awarding subcontracts, will ensure that the area of responsibility of any particular Subcontractor is set out in full detail.

.3 The Contractor shall advise the Contract Administrator of any specified material or equipment which is either no longer available from manufacturers or whose delivery is likely to exceed the requirements of the anticipated Work Schedule. Failure of the Contractor to perform the above shall cause the Contractor to supply, at his own expense, alternate material or equipment as selected by the Contract Administrator at a later date. Alternatively, the Contractor shall procure the specified material or equipment at his own additional expense by means of air freight or other special means of transportation.

.4 Advise the Contract Administrator of any specified equipment, material, or installation of same which appears inadequate or unsuitable or which is in violation of Laws, ordinances, rules, or regulations of Governmental Authorities having jurisdiction. Provide all labour and materials which are obviously necessary or reasonably implied to be necessary to complete the work as if the work was shown on the Drawings and/or described in the Specifications.

.5 Check drawings of all trades and coordinate the installation of all material and equipment to ensure adequate space and free access and to maintain headroom limitations for all proposed and indicated future work. Work out jointly, with all Subcontractors on the Site, solutions to interference problems. Coordinate all work before fabricating or installing any material or equipment. It is incumbent on all Subcontractors on the Site to ensure that all materials and equipment fit into the allocated spaces and that all equipment can be properly inspected, serviced, and replaced if and when required. Advise the Contract Administrator of space problems before fabricating or installing any material or equipment. Demonstrate to the Contract Administrator on completion of its work that all equipment and material installed by the Contractor can be properly and safely serviced and replaced. Make no deviations from the intent of the design, or any involving additional cost, without the Contract Administrator's written direction.

.6 Ensure that any building structure loaded during the installation is adequate to carry such load.

.7 A contractor is entitled to engage in the regulated work for which the contractor is licensed.

.1 A licensed contractor must not:

.1 Manage or do regulated work that is:

.1 Outside the scope of the license,

.2 Contrary to any term or condition of the license, or

.3 Contrary to any term or condition imposed by the regulations on the use of the license, or

.2 Permit regulated work to be undertaken by persons under the control of the licensed contractor if they are not authorized.

.2 A licensed contractor must:

.1 Maintain current knowledge of the Applicable Laws, relevant regulations, relevant directives, relevant safety orders and any other relevant material that the minister makes publicly available, and

.2 Ensure that individuals who do regulated work for the licensed contractor maintain similar current knowledge.

1.9 COMMON PRODUCT REQUIREMENTS

.1 All products and warranties shall be registered in the Owner's name.

.2 Products shall be purchased through authorized supply chains to ensure that all warranties and technical support remain valid in British Columbia following installation of the products.

.3 Any products installed that had their warranties or technical support voided for any reason shall be replaced at the Contractor's expense with an identical replacement product that has a valid warranty in British Columbia. Any resulting costs from complications that require remediation from products with voided warranties or technical support shall be borne solely by the Contractor to make the Work good.

.4 Contractor is responsible to ensure that all products are purchased from the OEM or an OEM authorized supply chain/channel such as an authorized distributor or reseller. Any non-OEM products installed shall be replaced at the Contractor's expense, even if non-OEM products are discovered after completion of the project. Any resulting costs from complications that require remediation from the use of non-OEM products shall be borne solely by the Contractor to make the Work good.

.5 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections or field reviews. Inspection does not relieve responsibility, but is precaution against oversight or error. Contractor to

remove and replace defective products at own expense and is responsible for any delays and expenses caused by rejection.

.6 Contractor shall provide letters of assurance from the OEM manufactures identified throughout the specifications which assure that the products purchased as part of the project were purchased through an OEM authorized channel and that the products are new.

1.10 TESTING, OPERATION AND SET-UP

.1 Testing in accordance with Technical Specification 26 05 10 Testing and Commissioning.

1.11 PERMITS, FEES, AND INSPECTIONS

.1 Before commencing work obtain and pay for all necessary approvals and permits. The Contract Administrator shall provide any documents required by the Authority Having Jurisdiction to obtain such permits.

.2 Arrange for inspection of the work at rough-in completion, prior to Substantial Completion, and as otherwise required by all applicable Authorities Having Jurisdiction.

.1 Notify Contract Administrator of any changes required by the Authorities Having Jurisdiction prior to proceeding with changes.

.3 Provide Contract Administrator with a certificate of unconditional approval for all electrical work from the appropriate Authorities Having Jurisdiction. Final payment to the Contractor shall not be made prior to submission of the inspection certificate.

1.12 EVALUATION OF CONTRACT CHANGES

.1 In accordance with Division 1 specifications.

1.13 MEASUREMENT AND PAYMENT

.1 Payment for all work performed under this Section will be Lump Sum per the Schedule of Quantities and Prices.

1.14 REVIEW OF WORK

.1 In accordance with the General Conditions.

1.15 SCHEDULING OF WORK

.1 Work shall be scheduled as required to coordinate with other Divisions and Owner’s work restrictions.

1.16 ACTION AND INFORMATIONAL SUBMITTALS

.1 In accordance with Division 1 specifications.

1.17 SHOP DRAWINGS

.1 Provide digital copies of shop drawings in PDF format. Organize and separate shop drawings per Technical Specification for review.

.2 The Shop Drawing will be retained by the Contract Administrator for their office use and a copy will be marked and returned to the Contractor for correction if necessary, further reproduction, and distribution as required.

.3 Accompany submissions with transmittal letter, 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.

.4 Where specifically noted in other Technical Specifications in Division 26, submit drawings stamped and signed by Professional Engineer registered or licensed in British Columbia, Canada.

.5 Contractor shall review all Shop Drawings prior to submittal. All Shop Drawings shall be stamped and signed by the electrical Subcontractor engaged by the Contractor. Unstamped drawings will be marked “re-submit” (R3) without comment.

.6 All Shop Drawings shall use metric dimensions. Scaled drawings shall use metric scale.

.7 Each Shop Drawing shall clearly indicate the equipment ID and equipment type (e.g. Luminaire Type ‘A’, Panelboard SD-A) where applicable.

.8 Where manufactures’ brochures that include multiple equipment or device models are submitted, they shall be clearly labelled with the equipment model and options to be supplied. Submit relevant sections of manufacturer’s catalogues only. Submissions of complete catalogues will be rejected.

.9 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.10 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.11 Indicate on Shop Drawings clearance requirements for: operation, maintenance, and replacement of operating equipment devices.

.12 Submit complete Shop Drawing packages for each system. Partial submissions will be returned without comment.

.13 Review of Shop Drawings by the Contract Administrator is for the sole purpose of ascertaining conformance with the general design intent. The review shall not mean approval of the detail design inherent in the Shop Drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of its responsibility for errors or omissions in the Shop Drawings or of its responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub-trades.

.14 Shop Drawings stamped as “Revise and Resubmit” to be corrected and resubmitted by the Contractor within 10 days of the Shop Drawing review.

.15 Ensure that copies of all accepted Shop Drawings are available at the job site.

1.18 CLOSEOUT SUBMITTALS

.1 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

.2 Operation and Maintenance Manuals:

.1 Provide draft version of Operations and Maintenance Manual to Contract Administrator two weeks prior to Substantial Performance Review.

.3 Upon completion of all electrical, control, and instrumentation work, submit Record Drawings, including all as-built information and changes.

1.19 AS-BUILT DOCUMENTS AND SAMPLES

.1 Maintain at Site for Contract Administrator 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 in secure location.

.3 Label record documents and file in accordance with section number listings in list of contents of this project manual.

.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 Contract Administrator.

.6 Obtain and pay for three sets of white prints. As the project progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the Site at all times and present for scrutiny at each project meeting.

.7 Show on the Record Drawings the installed inverts of all services entering and leaving the building and the property. Dimension underground services at key points of every run in relation to the structure and building.

.8 Indicate exact location of all services for future work. Show and dimension all work embedded in the structure.

.9 Maintain in the site office in up-to-date condition, one (1) complete set of whiteprints of each of the electrical Contract Drawings and one (1) set of Technical Specifications, including revisions to the Contract Drawings, marked clearly and indelibly in red, indicating as-built conditions where such conditions deviate from the original directions of the Contract Documents, and indicating final installation of feeders and branch circuits.

.10 ”As-Built” markings shall include the following:

.1 All changes in circuiting.

.2 Size and routing of all conduits for branch circuits including power, lighting, and systems. Note that branch circuit wiring is generally not shown on Contract Drawings. Accurately record on "As-Built" drawings the size and routing of all installed raceways and cables.

.3 Number and size of conductors in raceways and cables

.4 Location of all junction and pull boxes

.5 Location of all access panels

.6 Location of all conduit or duct stubs, installed equipment, devices, and fixtures

.7 All changes to electrical installation resulting from Addenda, Change Orders, and Field Instructions (Architectural / Engineering Instructions)

.8 Exact location of all services left for future work

.9 Location by accurate horizontal and vertical dimensions of the routes and terminations of all raceways and cables installed underground beyond the building.

.10 Exact labeling of each communication system cable at each data outlet location. Locate label numbers adjacent each communication outlet indicated on Contract Drawings. Label numbers to match those at the communication room cable end.

.11 Where extensive changes have been made to an area to the point where it is not practical to update the original Contract Drawing, the area in question shall be enclosed with a heavy dotted line and reference made to the applicable Change Order, Instruction, and/or associated Revision Drawing.

.12 For each and every "As-Built" drawing, reference shall be neatly drawn inside the framed space above the title block, listing all Contemplated Change Orders, Instructions, and Revision Drawing Numbers applicable to the particular "As-Built" drawing in question.

.13 Each "As-Built" drawing as defined above shall bear the Contractor's identification and signature, the date of record, and the notation: "We hereby certify that these drawings represent the work as built."

.14 All Addenda and Revision Drawings not having their details transferred onto the submitted "As-Built" drawings shall be included in the submission using the same drawing format as previously described.

.11 Recording Information on Project Record Documents.

.1 Record information on set of Contract Drawings.

.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.

.4 Contract Drawings and Shop Drawings: mark each item to record actual construction, including:

.1 Changes made by Change Orders.

.2 Details not on original Contract Drawings.

.3 References to related Shop Drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and Change Orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, as required by Technical Specifications.

.7 Provide digital photos, if requested, for site records.

1.20 OPERATION AND MAINTENANCE MANUAL

.1 Submission:

.1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.2 Copy will be returned after final inspection, with Contract Administrator's comments.

.3 Revise content of documents as required prior to final submittal.

.4 As a condition of Substantial Completion submit to the Contract Administrator, four final copies of operating and maintenance manuals in English.

.5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.6 If requested, furnish evidence as to type, source and quality of products provided.

.7 Defective products will be rejected, regardless of previous inspections. The Contractor shall replace products at their own expense, with no increase to the Contract Price.

.8 Pay costs of transportation.

.2 Format

.1 Organize data in the form of an instructional manual.

.2 Provide a digital copy of the O&M manual in PDF format.

.3 Arrange content by systems under Technical Specification numbers and sequence of Table of Contents.

.4 Provide organized digital bookmarks for content by systems under Technical Specification Numbers and sequence of Table of Contents.

.3 Contents – Each Volume:

.1 Table of Contents: provide title of Project;

.1 Date of submission; names,

.2 Addresses, and telephone numbers of Engineer and Contractor with name of responsible parties;

.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of Subcontractors and Suppliers, including local source of supplies and replacement parts.

.3 Product Data

.1 Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings

.1 Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text

.1 As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

.6 Guarantees, Warrantees and Bonds

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List Subcontractor, Supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by Subcontractors, Suppliers, and manufacturers, within ten days after completion of the applicable item of work.

.4 Except for items put into use with Owner's permission, leave the date of when the warranty begins blank until the Substantial Completion Date is determined. The beginning date of the warranty will then be updated to state the Substantial Completion Date.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.7 Equipment and Systems:

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.12 Additional requirements: As specified in the Contract Documents.

1.21 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to Site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.1 Except for equipment intended for installation outdoors, store equipment indoors in dry location.

.2 Store and protect equipment and materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.3 Packaging Waste Management: remove and dispose of all packaging waste materials.

.1 Where possible, return packaging materials to supplier for re-use.

.2 Divert all recyclable materials from landfill.

1.22 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with the Contract and the Division 1 Technical Specifications.

.2 Qualifications: electrical work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Electrical Safety Regulation within the Electrical Safety Act and the Building Code and By-Laws.

.1 Employees registered in provincial apprentices' program: permitted, under direct supervision of qualified licensed electrician, to perform installation tasks.

.2 Submit list showing names and qualifications of key supervisory personnel.

1.23 SAFETY AND PRECAUTION

.1 Safety practices shall include the following requirements:

.1 Compliance with safety requirements provided in the Contract Documents

.2 Workers' Compensation Board Regulations

.3 Municipal By-Laws

.4 Canadian Electrical Code

.5 Electrical Safety Act of BC

.6 Municipal, Provincial and Canadian Building Code

.2 Tests shall be performed with apparatus de-energized unless otherwise specified (e.g., rotation, phasing).

.3 Power circuits shall have conductors shorted to ground by an approved hotline grounded device.

.4 In all cases, work shall not proceed until the Contractor's safety representative has determined that it is safe to do so.

.5 The Contractor shall have sufficient protective barriers and warning signs available, where necessary, to conduct specified tests safely.

.6 The Project safety procedures shall be reviewed and accepted by the Contractor and all sub-trades.

1.24 CARE, OPERATION, AND START-UP

.1 Instruct Contract Administrator and operating personnel in the operation, care and maintenance of systems, system equipment and components.

.2 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 all aspects of its care and operation.

1.25 APPROVALS

.1 Without limiting or restricting the contents of the Contract Documents, requests for approval of the substitution of materials pertaining to electrical work must be submitted to the Contract Administrator and the Owner in accordance with the Review Procedure.

.2 All submissions shall include the following information:

.1 Name and identification of specified item.

.2 Manufacturer, brand name, and catalogue number of the alternative item proposed.

.3 Detailed technical data and characteristics of alternative item such as dimensions, voltage, power requirements, performance characteristics, etc.

.4 Request for lighting fixture substitutions must be followed by photometric data and Shop Drawings.

.5 A list of any and all changes to the installation which may be required as a result of the substitution.

.3 Materials, equipment, apparatus, light fixtures, or other products specified by manufacturers' brand name, type, or catalogue number are so specified in one of two ways:

.1 Specified item followed by the words “or equal” or “approved equal” or preceded by the words “equivalent to” or “equal to”; when the Technical Specification is so worded, it is intended to establish a specific standard of quality and style but the item may be substituted for, provided the Contract Administrator provides its written approval. It is the responsibility of the Contractor to assure the Contract Administrator that all features of the specified items are supplied as part of the substitute item. If the Contract Administrator does not provide its written approval for a substitute item, the item shall be supplied precisely as specified in the Contract Documents.

.2 Specified items not followed or preceded by any such qualifying phrases: When the Technical Specification is so worded, the item shall be supplied as specified and no approved equals or equivalents will be allowed.

.4 Review by the Contract Administrator of alternate materials as permitted above is only a general approval in principal and shall not relieve the Contractor of its responsibility to ensure that any approved alternate materials perform in the same manner and with the same intent as the originally specified material would have otherwise performed.

.5 Where such substitutions alter the design or space requirements indicated on the Contract Drawings, include all material, labour, design, and engineering costs for the revised design and construction including costs of all other trades affected and those incurred by the Owner and Contract Administrator.

.6 It is the Contractor's responsibility to ensure substituted products are approved and that Suppliers have written approval indicating conditions of any such approval. Alternate manufacturers who do not have such approval shall not be used in the work. If requested by the Contract Administrator, the Contractor for Division 26 shall submit for inspection, samples of both the specified and the proposed substitute items on short notice.

Part 2 Products

2.0 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates for control items in English.

2.1 MATERIALS AND EQUIPMENT

.1 Equipment and material shall be new and certified by a certification body accredited by the Standards Council of Canada (SCC). Where there is no alternative to supplying equipment which is not certified, obtain special approval and pay all associated fees. Notify Contract Administrator prior to supplying material that is not SCC approved.

.2 Factory assemble control panels and component assemblies.

.3 Substitution of Products

.1 After acceptance of the list of products, no substitution of any item will be permitted unless the approved item cannot be delivered in time to comply with the work schedule and the Contract Administrator accepts the change in items.

.2 To receive acceptance, proposed substitutes must equal or exceed the quality, finish and performance of those specified in the Contract Documents and/or shown in the Contract Drawings, and must not exceed the space requirements allotted on the Contract Drawings.

.3 Provide to the Contract Administrator documentary proof of equality, difference in price (if any) and delivery dates, in the form of certified quotations from suppliers of both specified items and proposed substitutions.

.4 Include costs for any required revisions to other structures and products to accommodate such substitutions.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated in the Technical Specifications and Contract Drawings.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction and Contract Administrator.

.2 Decal signs, minimum size 175 x 250 mm.

2.4 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify equipment cabinets with nameplates as follows:

.1 Nameplates:

.1 Lamicoid 3 mm thick plastic engraving sheet, lettering accurately aligned and engraved into core, mechanically attached with self-tapping screws or permanent self-adhesive.

.2 Nameplate colours as follows:

.1 Normal Power Systems: black face, white core

.2 Emergency/Standby Power Systems: red face, white core

.3 Life Safety Systems: red face, white core

.4 Colours for other equipment as specified by the Contract Administrator.

.2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise in the Contract Drawings.

.3 Wording on nameplates to be approved by Contract Administrator prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

.1 Refer to Technical Specification 26 05 21 – Wires and Cables (0-1000V).

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Refer to Technical Specification 26 05 34 ‑ Conduits, Conduit Fastenings and Conduit Fittings.

2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

.4 Repair or replace any equipment or structures damaged by the Work, to its original condition at no cost to the Owner.

Part 3 Execution

3.0 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Technical Specifications are acceptable for installation in accordance with manufacturer's written instructions.

.2 Visually inspect substrate in presence of Contract Administrator.

.3 Inform Contract Administrator of unacceptable conditions immediately upon discovery.

.4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

3.1 INSTALLATION

.1 Complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise in the Contract Drawings.

3.2 NAMPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise in the Contract Drawings.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.6 FIELD QUALITY CONTROL

.1 Refer to Technical Specification 26 05 10 Testing & Commissioning.

3.7 SUBSTANTIAL PERFORMANCE REVIEW

.1 Prior to the Contractor submitting an Application for Substantial Completion, the Contractor will submit written confirmation that:

.1 All wiring devices, cover plates, motor controls, lighting fixtures, and other equipment are operational, plumb, clean, and correctly labelled.

.2 All distribution equipment (cabinets, panels, distribution transformers, etc.) has been cleaned and vacuumed.

.3 All test reports have been submitted.

.4 All auxiliary systems have been tested as required and are in good and proper working order.

.5 All certificates of final acceptance from the authorities having jurisdiction have been received and submitted to the Contract Administrator.

.6 Factory finished equipment has been cleaned, touched up, or refinished as necessary to present a new appearance.

.7 All sealing of conduits, cables, cable trays, wireways, etc. at wall, ceiling, and floor penetrations have been completed.

.8 All lighting fixtures including lenses and reflectors have been properly cleaned as specified in the Contract Drawings.

.9 All loose equipment including spare parts and replacement parts have been turned over to the Owner and receipts obtained for same.

.10 The operations and maintenance manuals have been submitted.

.11 All demonstrations and instructions to the Owner have been completed.

.12 Verification letter from Seismic Engineer has been submitted.

.2 Provision of the above shall not be construed as compliance with all administrative documentation required.

.3 Notwithstanding any other provisions of the Contract, failure if the Contractor fails to complete all of the requirements in this section 3.7 the Contract Administrator may refuse to issue a Certificate of Substantial Completion.

3.8 SYSTEM START-UP

.1 Arrange and pay for services of manufacturer's factory service representative to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.2 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.

3.9 CLEANING

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

.3 Where work is performed in a phased manner, or Owner will take partial occupancy of the area of Work, perform final cleaning at the end of each Phase or prior to Owner taking occupancy of each area.

.4 Waste Management: separate waste materials for reuse and recycling.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 3
1.3 Regulatory Requirements 3
1.4 Shop Drawings and Submittals 3
1.5 Delivery, Storage and Handling 3
Part 2 Products 3
2.0 General 4
2.1 Slack Cable Systems 4
Part 3 Execution 4
3.1 General 4
3.2 Conduits 4
3.3 Floor Mounted Equipment 5

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 It is the responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

.2 Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components and as required by the Specifications.

.3 Provide restraint on all equipment and machinery, which is part of the building electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.

.4 When manufacturer mounting requirements and seismic information are not available to suit the application, the Contractor will ensure that the total electrical seismic restraint design, field review and inspection will be by a B.C. registered professional structural engineer who specializes in the restraint of building elements (the “Seismic Consultant”). Contractor to allow for coordination, provision of seismic restraints, as well as all costs for the services of the Seismic Consultant. The Seismic Consultant will provide normal engineering functions as they pertain to seismic restraint of electrical installations.

.5 The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the Project. Any changes in conditions will not result in an increase to the Contract Price, unless otherwise stated in the Contract Documents.

.6 The Seismic Consultant shall provide detailed seismic restraint installation shop drawings to the Contractor when required. Copies of the shop drawings to be included in the Project Binder.

.7 Provide seismic restraints on all equipment, and/or installations or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure or support slabs per manufacturer instructions or the Seismic Consultants direction as required.

.8 The Seismic Consultant shall provide inspections during and after installation when their services are required. The Contractor shall correct any deficiencies in accordance with the General Conditions of the Contract.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 29 Hangers and Supports for Electrical Systems

1.3 REGULATORY REQUIREMENTS

.1 Restraints shall meet the requirements of the latest edition of the British Columbia Building Code and amendments.

.2 The Contractor's seismic consultant shall submit original signed BC Building Code Letters of Assurance Schedules S-B and S-C to the Contract Administrator together with Shop Drawings submission.

.3 Importance Factor: 1.5.

.4 Use the Electrical Contractors Association of BC details in the absence of any local requirements.

.5 The above requirements shall not restrict or supplant the requirements of any Applicable Laws, including local bylaws, codes, or other certified agencies which may have jurisdiction over all or part of the installation.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Submit shop drawings of all seismic restraint systems including details of attachment to the structure, either tested in an independent testing laboratory or approved by the Seismic Consultant.

.3 Submit all the proposed types and locations of inserts or connection points to the building structure or support slabs. Follow the directions and recommendations of the Seismic Consultant.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 GENERAL

.1 Seismic Restraint Systems (SRS) shall be designed to avoid high impact loads.

.2 SRS shall restrain seismic forces in all directions.

.3 Fasteners and attachment points shall resist same load as seismic restraints.

.4 SRS utilizing cast iron and other brittle materials is not acceptable.

.5 Equipment assemblies required to be vibration/noise isolated shall be provided with seismic rated isolators and restraints which are certified as being rated for the specification application requirements.

.6 Seismic control measures shall not interfere with integrity of fire stopping.

2.1 SLACK CABLE SYSTEMS

.1 Slack shall prevent sway in a horizontal plane, rocking in a vertical plane, sliding and buckling in axial direction.

.2 Hanger rods shall withstand compressive loading and buckling forces.

.3 Slack cable systems to allow normal maintenance of equipment and shall not create additional hazard by their location or configurations. Contractor shall rectify any such installations at no additional cost, all to the satisfaction of the engineer and inspection authority having jurisdiction.

.4 Coordinate requirements of slack cables with suppliers prior to installation.

Part 3 Execution

3.1 GENERAL

.1 All seismic restraints systems shall conform to Governmental Authorities, including local authority having jurisdiction and all Applicable Laws and applicable code requirements.

3.2 CONDUITS

.1 Provide restraint installation information and details on conduit and equipment as indicated in Section 3.2 of this Technical Specification:

.2 Vertical Conduit

.1 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.

.2 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 9.2 m o.c.

.3 Riser joints shall be braced or stabilized between floors.

.3 Horizontal Conduits

.1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.

.4 Do not brace conduit runs against each other. Use separate support and restraint system.

.5 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.

.6 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.

.7 A conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.

.8 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.

.9 The Contractor will ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on Shop Drawings. The Contractor will review the Shop Drawings with Seismic Consultant and submit Shop Drawings to the Contract Administrator for their reference.

3.3 FLOOR MOUNTED EQUIPMENT

.1 Bolt all equipment, (including transformers, kiosks, switchgear, generators, motor control centres, free standing panelboards, control panels, capacitor banks) to the structure. Seismic Consultant shall design anchors and bolts.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 3
2.0 Standards 3
Part 3 Execution 3
3.0 Demolition 3
3.1 Disruption to Operations 3
3.2 Reuse of Existing Components 3
3.3 Disruption of Circuits 3
3.4 Abandoned Conduit, Wire and Existing Circuits 3

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 The Contractor to take note that the demolition and renovation will be done in a public space that is normally occupied during the day and during the evenings, seven days a week, year round. Maintain electrical and communication systems as required to minimize services disruption.

.2 The work of this contract shall be done in a phased manner to allow operations in the renovated area to continue. Refer to the Construction Manager's phasing plan and schedule. To be confirmed prior to the work commencing.

.3 Electrical tender documents do not show all existing luminaires, wiring devices, conduit, boxes or wire. Conduit routing and wire grouping is not known. During demolition, the Electrical trade(s) are to deactivate all existing electrical and communication systems affected in such a manner that complete systems are not deactivated and system circuits affected in party wall partitions to be reactivated immediately on a temporary or permanent basis as site conditions dictate.

.4 Any discrepancies appearing on the Contract Drawings or in this specification are to be brought to the attention of the Contract Administrator who will provide instruction.

.5 Where devices are not shown on the new plans in walls that are not being removed, such devices are to be reinstated and remain.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 BCBC – British Columbia Building Code, Current Edition.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Section 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 STANDARDS

.1 Refer to applicable material standards in other Technical Specification sections and/or as detailed on Contract Drawings.

Part 3 Execution

3.0 DEMOLITION

.1 Demolition to be carried out in strict conformance to provincial, local and municipal authorities and Part 8 of the B.C. Building Code current edition.

.2 All redundant electrical components in the areas of demolition excluding those specifically identified, shall become the property of the Electrical Division and shall be removed from site.

3.1 DISRUPTION TO OPERATIONS

.1 Contractor to issue a scheduled shutdown time and coordinate installation of the new equipment as appropriate. All equipment installed and modified requires testing before start-up.

.2 Contractor to provide temporary connections to all required equipment for temporary power during the installation of any new equipment.

3.2 REUSE OF EXISTING COMPONENTS

.1 Existing components may be reused only where so specifically indicated on the Contract Drawings or in the Technical Specifications, however in all cases all wiring shall be new and no splicing shall be permitted at any location. All lighting switches and all receptacles shall be new.

3.3 DISRUPTION OF CIRCUITS

.1 Circuit: power, voice/data, fire alarm, control etc. which are disrupted during demolition and are essential, to be made good immediately. The Electrical Trade(s) to identify these circuits to the Contract Administrator. Specific tasks involving the demolition of essential circuits will require that the contractor obtain permission from the Owner before proceeding.

3.4 ABANDONED CONDUIT, WIRE AND EXISTING CIRCUITS

.1 Except as specifically noted, all abandoned conduit and wire to be removed and disposed of by the Electrical Divisions.

.2 Remove all accessible (eg. Surface) wiring and cables back to source.

.3 Remove abandoned outlets and raceway, even if in or behind drywall, where they are located behind millwork or in locations unsuitable for reuse i.e. not at standard heights for switches or outlets.

.4 All remaining circuits to be rerouted as required and suitably secured to the building structure to CEC Standards.

.5 Any cabling, including voice/data wiring, presently resting on any suspended ceiling system to be removed as part of the renovation process and shall be neatly bundled, protected and permanently secured to building structure. No cabling is permitted to rest on the ceiling system.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 References 2
1.4 Qualifications 4
1.5 Coordination 4
1.6 Submittals 5
1.7 Operations and Maintenance (O&M) Manuals 5
1.8 Scheduling 5
1.9 Meetings 6
1.10 Safety and Precautions 6
1.11 Test Equipment 6
Part 2 Products 7
2.0 Not Used 7
Part 3 Execution 7
3.0 Requirements 7
3.1 General testing requirements 9
3.2 System Operational Testing requirements and procedures 12
3.3 HVAC and Lighting Systems 21
3.4 Generator Systems 22
3.5 Control Systems 22
3.6 Manufacturer's Field Services: 23
3.7 Standards 24
3.8 Test Apparatus and Inspection Report 24
3.9 Demonstration 25
3.10 Training 25
3.11 System Acceptances 26

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Provide testing and commissioning services and equipment to assure that all electrical equipment is operational within industry manufacturers' tolerances, calibrated per the power system studies, complies with all applicable codes, is installed in accordance with design specifications, and functions in the system in the manner designed by the Consultant.

.2 Inspections, calibrations, and acceptance tests for all equipment systems shall be performed. The inspections and testing activities shall be divided among the following groups, as specified in this Section:

.3 The original equipment manufacturer's authorized service representative shall provide special equipment, labour, and technical supervision, when required, in addition to what is supplied by the Contractor.

.4 Inspections, calibrations, and acceptance tests for equipment and systems not requiring the services of the manufacturer's representative shall be performed by the Contractor.

.5 In cases where equipment and systems require the involvement of two or all of the parties, the parties mentioned above shall coordinate and perform all inspection and testing requirements. The Contractor shall be responsible for coordination of the work and ensuring that the requirements of this Section are met.

.6 All testing and commissioning to be carried out in accordance with the terms of this Contract.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 27 16 Electrical Cabinets and Enclosures

1.3 REFERENCES

.1 Definitions:

.1 Stage 1 – Functional Testing (By the Contractor)

.1 **"Functional Testing"** refers to the stage of testing where the Contractor and sub-contractors provide end to end testing and documentation of all system elements to ensure correct operation and consistency with the design (labels, lamacoids, settings, build quality, correct wiring, etc.).

.2 Stage 2 – VFD and Control System Configuration and Programming (By the Contractor)

.1 **"VFD and Control System Configuration and Programming"** refers to the stage of testing where the Contractor's pump control system supplier configures and programs the VFDs and control system prior to arrival on site.

.3 Stage 3 – Commissioning (By the Contractor)

.1 **"Commissioning"** refers to the stage of testing where the Contractor demonstrates complete system functionality.

.4 Stage 4 – Performance Testing (By the Contractor)

.1 **"Performance Testing"** refers to the stage of testing post Commissioning, where the Contractor will demonstrate complete trouble-free system functionality for a period of two (2) weeks.

.5 All inspections and tests shall be in accordance with, but not limited to, the following applicable codes and standards except as provided otherwise in this Section.

.1 International Electrical Testing Association - NETA

.2 National Electrical Manufacturer's Association – NEMA

.3 Canadian Electrical Manufacturers Association - CEMA

.4 American Society for Testing and Materials - ASTM

.5 Institute of Electrical and Electronic Engineers – IEEE

.1 1584-2015, Guide for Performing Arc-Flash Hazard Calculations

.6 American National Standards Institute – ANSI

.1 ANSI Z535.4-2011, Product Safety Signs and Labels

.7 Canadian Electrical Code - Parts 1 and 2

.8 Canadian Standards Association – CSA

.1 CSA Z462-15, Workplace electrical safety, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment to protect against shock and arc flash hazards.

.9 Insulated Power Cable Engineers Association - IPCEA

.10 National Fire Protection Association - NFPA

.11 ANSI/NFPA 70B: Electrical Equipment Maintenance

.12 WCB Regulations

.13 CANICSA-B72-M87: Lightning Protection Code

.14 Municipal By-Laws

.6 All inspections and tests shall utilize the following references:

.1 Project design drawings and specifications

.2 Shop drawings and submittals

.3 Manufacturer's instruction manuals applicable to each particular apparatus

.4 Applicable NETA acceptance testing work scope sections per NETA ATS (Latest Edition)

1.4 QUALIFICATIONS

.1 The Contractor shall retain the services of an individual that is qualified to test electrical equipment and is approved by the Consultant.

1.5 COORDINATION

.1 The Contractor shall contract the associated sub-contractors and suppliers to provide on-site testing and commissioning support services for the different components of the pump station including, but not limited to, the following:

.1 Pump Supplier

.2 Control Panel Supplier

.3 VFD Supplier

.2 The Contractor, their associated sub-contractors, and suppliers shall be available during the Commissioning activities. This includes, but is not limited to:

.1 Entire Duration:

.1 Instrumentation Technician

.2 Electrician/Wireman

.2 As Required:

.1 VFD Specialist

.2 Other Device Specialists

.3 The Contractor shall provide configuration, functional testing, and system operation testing and verification of all individual components.

.4 Coordinate the factory field-testing and assistance per the requirements of this Section.

1.6 SUBMITTALS

.1 Submit the qualifications of the individual(s) doing testing and commissioning according to this Section for approval.

.2 Submit the coordinated test schedule for approval.

.3 Submit detailed test procedures corresponding to the requirements in this Section for approval. The test procedures shall be detailed test instructions, written with sufficient step-by-step information to allow a test to be repeated under identical conditions. List all setpoint values and acceptable results for each condition tested.

.4 Submit a preliminary copy of the field test results to the Consultant and the Owner within one (1) week after the test is completed.

.5 Prior to energization of equipment, submit a letter certifying that the electrical installation being energized complies with contract documents, applicable codes, and proper system operation.

.6 The test reports shall be compiled and submitted in formal form with a summary.

1.7 OPERATIONS AND MAINTENANCE (O&M) MANUALS

.1 Operations and Maintenance Manuals shall be in accordance with 26 05 00 Common Work Results – Electrical.

1.8 SCHEDULING

.1 Perform all testing after installation and before energizing. All systems shall pass tests prior to being put into service.

.2 The Contractor, in coordination with the equipment manufacturer's representatives, shall confirm the test schedule with the Consultant prior to the test. The Contractor shall coordinate the test schedule so that the Consultant can witness the testing, if required.

.3 Testing and calibration of electrical equipment shall be completed prior to the start of commissioning activities. When required during commissioning, the Contractor shall retest and re-calibrate equipment to support the commissioning activities.

1.9 MEETINGS

.1 Pre-Commissioning conference: The *Contractor* shall request a pre-commissioning conference with the Consultant (conference calls accepted).

1.10 SAFETY AND PRECAUTIONS

.1 Safety practices shall include, but are not limited to, the following requirements:

.1 Workers' Compensation Board Regulations

.2 Municipal By-Laws

.3 Canadian Electrical Code

.4 Electrical Safety Act of BC

.5 Municipal, Provincial and Canadian Building Code

.2 Tests shall be performed with apparatus de-energized unless otherwise specified (e.g., rotation, phasing).

.3 Power circuits shall have conductors shorted to ground by an approved hotline grounded device.

.4 In all cases, work shall not proceed until the Contractor's safety representative has determined that it is safe to do so.

.5 The Contractor shall have sufficient protective barriers and warning signs available, where necessary, to conduct specified tests safely.

.6 The Project safety procedures shall be reviewed and accepted by the Contractor and all sub-trades.

1.11 TEST EQUIPMENT

.1 All test equipment shall be furnished by the Contractor.

.2 Test instrument calibration

.1 The Contractor shall have a calibration program which maintains all applicable test instrumentation within rated accuracy.

.2 The accuracy shall be traceable to the National Bureau of Standards in an unbroken chain.

.3 Up-to-date calibration labels shall be visible on all test equipment.

.3 Use of torque wrenches

.1 Use calibrated torque wrenches for all bolted connections on buses and power cable terminations. Mark the head of the bolt with a coloured marking pen after its being torqued to manufacturer's recommended value.

Part 2 Products

2.0 NOT USED

Part 3 Execution

3.0 REQUIREMENTS

.1 Perform acceptance tests in accordance with manufacturer's recommendations, WCB regulations, and testing specifications NETA ATS (Latest Edition).

.2 Voltage adjustments shall be in accordance with CSA CAN3-C235.83, Preferred Voltage Levels for AC Systems, to 50,000 V.

.3 The test plan, procedures, test results, and reports shall be reviewed, under the supervision of and approved by the Consultant.

.4 Division of responsibility

.1 During Functional Testing the Contractor shall be responsible for the following elements of testing.

.1 End to end testing for all communications and power cabling installed as part of the contract between end devices, any intermediate splice/ terminal junction boxes, and the distributions panels, control panels, and RTU panels.

.2 Individual distribution component testing including, but not limited to, the following:

.1 Transformers,

.2 Kiosk,

.3 Electrical panels,

.4 Motor circuit breakers,

.5 Ventilation controls,

.6 Electrical Controls and Instrumentation; and,

.7 All other electrical components as indicated on the Contract Drawings.

.3 Individual control panel component testing within the factory and in the field following installation including the following:

.1 Push buttons,

.2 Pilot lights,

.3 Control relays,

.4 Control timers,

.5 Control circuit breakers and fuses,

.6 Pump protection modules,

.7 Hydrostatic level transmitters,

.8 All other components contained within the control panel.

.4 Individual field component testing once installed and powered including the following:

.1 Verification of labelling and identification of field components,

.2 Pressure transmitters,

.3 Hydrostatic level sensors,

.4 Float switches,

.5 Door contacts,

.6 Temperature sensors,

.7 Variable frequency drives,

.8 Pump starters,

.9 Security panel,

.10 and all other instrumentation and control components shown on the Contract Drawings.

.5 The Contractor shall confirm that all devices are powered, and signals are being transmitted between the field devices and the control panel prior to control system integration and testing.

.6 Contractor to configure and setup all Instrumentation (Hydrostatic Levels Transmitter).

.7 The Contractor shall coordinate tests to ensure proper functionality of the system.

.2 The VFD and Control System Configuration and Programming stage(s) shall take place both before and concurrently with Functional Testing.

.3 After the Functional Testing and Programming stages are complete, the Contractor shall perform Commissioning activities. This includes the following elements of testing.

.1 Demonstrating complete system functionality by running the system through the Process Narrative.

.2 Confirming system functionality through all programming and instrumentation setpoints.

.4 Once the Contractor has sufficiently demonstrated system functionality to the Owner/Owners Representative, Performance Testing shall commence. This includes the following elements of testing.

.1 The Contractor shall monitor the system for a period of two (2) weeks.

.2 The system must perform trouble-free from the entire two-week period to meet the performance goal and be considered substantially complete.

.3 If there are any deficiencies, operational issues, or system failures during the two (2) week period, at the Owner's discretion the Performance Test period may be restarted after the issue/deficiency has been addressed.

3.1 GENERAL TESTING REQUIREMENTS

.1 Contractor shall coordinate and pay for all testing required by the Contract Documents including any additional testing required by authorities having jurisdiction.

.2 All deficient equipment/devices shall be replaced and retested.

.3 Testing for each system shall be performed after the system installation is complete and prior to the system being put into continuous operation.

.4 Advise the Contract Administrator a minimum of five (5) Business Days in advance of each test and carry out tests in the presence of the Contract Administrator.

.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of Work.

.6 Submit detailed typewritten test reports to the Contract Administrator within five (5) Business Days after the completion of each test. Include all test reports in the Project Binder.

.1 Test reports shall clearly indicate each component that has been individually tested, test results, and whether the results are within acceptable limits.

.2 Each test report shall be accompanied by a cover sheet outlining the test and summarizing any items that have failed the tests.

.3 Cover sheet shall include names, signatures, and contact information of the individuals who conducted the tests.

.7 Protective Device Setting and Testing

.1 All work shall conform to NETA standards.

.2 Ensure circuit protective devices including overcurrent trips, relays, and fuses are installed to required values per protection and coordination study.

.8 The following is a list of general requirements for testing of equipment and cabling to be completed by the Contractor prior to detailed system testing:

.1 The Contractor shall torque down all accessible bolts, perform routine insulation resistance and continuity tests on branch and feeder circuits, and perform rotational tests for all distribution and utilization equipment, prior to, and in addition to tests performed by the Contractor specified in this Section.

.2 The Contractor shall supply a suitable and stable source of test power at each test site.

.3 The Contractor shall clean all the electrical equipment prior to testing.

.4 The Contractor shall be responsible for implementing all final settings and adjustments on protective devices and electrical equipment in accordance with the equipment calibration requirements or Power System Protective Device Studies.

.9 Any questions or concerns identified shall be promptly addressed to the Consultant.

.10 Any system, material, or workmanship which is found defective on the basis of electrical inspections and tests shall be reported directly to the Consultant.

.11 If a test reveals a fault or problem, the materials of equipment under test will be repaired or replaced and the entire test will be repeated. Tests will not be accepted until the problem is corrected. Submit additional written test reports.

.12 Maintain a written record of all tests and, upon completion of the project, assemble and certify a final test report. The field test reports shall be compiled and signed by the individual performing the testing.

.13 Power systems protective device calibration

.1 Adjustments, settings, and modifications

.1 The Contractor shall calibrate necessary field settings, adjustments, and minor modifications to conform to the coordination study without additional cost (examples of minor modifications are trip sizes within the same frame, the time curve characteristics of induction relays, ranges, etc.).

.2 Adjust or replace protective devices to the values provided in the coordination study.

.3 The trip characteristics, when adjusted to setting parameters, shall fall within the manufacturer's published time-current characteristic tolerance.

.2 The Contractor shall verify that the protective devices have been adjusted and set in accordance with the approved Power System Study.

.14 Acceptance criteria

.1 Each function and test shall be performed under conditions which simulate actual operating conditions as closely as possible.

.1 To that end, the Contractor shall provide all necessary materials, equipment, and temporary system voltages and currents to simulate fault conditions on the system being tested in order to prove and verify proper operation (fuses excepted).

.2 At satisfactory completion of all verified tests, the building electrical system being tested shall be returned to the condition required by the contract documents as a complete and operational system.

.2 The Contractor shall perform general inspections at the job site and shall also review the following:

.1 Assembly of the accessory equipment, and the interconnecting wiring for control circuits.

.2 General inspection of the following: appearance, finish, alignment of doors, covers, and similar parts; quality of workmanship; possible shipping and other damage; missing, broken or incorrectly applied devices; loose or missing accessories, bushings, or hardware; loose or broken wires; proper installation of all equipment; verification that shop drawings and instructions have been shipped with all equipment and are available.

.3 Support of electrical equipment: inspect and check all electrical equipment for support and seismic bracing.

.4 Spare equipment: The Contractor shall inspect and verify spare equipment inventory as specified by Division 26.

.3 The Contractor shall provide technical verification of systems installed including the following:

.1 Technical verification: Purpose to ensure that all systems and devices are properly installed and free of defects and damage. Technical verification includes:

.1 Measurements of tension and power.

.2 Connecting joints and equipment fastening.

.3 Measurements of signals (dB, lux, baud rate, etc).

.4 Compliance with manufacturer's specification, product literature and installation instructions.

3.2 SYSTEM OPERATIONAL TESTING REQUIREMENTS AND PROCEDURES

.1 Infra-Red Scanning

.1 Perform infrared scan of all distribution equipment under loaded conditions (new and existing).

.2 Distribution System Testing:

.1 The following equipment and systems shall be inspected and tested by the Contractor per manufacturer's instructions and additional requirements noted.

.2 The following tests require that the Contractor provide materials, tools, and labour (qualified personnel) to prepare equipment and devices for testing and to perform tests and to make adjustments and recalibrations for re-testing as necessary and to reconnect systems after the testing is completed. Include in the Tender, all costs associated with the provision of labour to remove and re-install panel plates, to disconnect/reconnect cables, and perform any labour other than testing, and to provide any materials and tools.

.1 Transformers

.1 Oil and Dry type rated equal to and greater than 600 V.

.2 Tests:

.3 Inspect for physical damage, proper installation, anchorage, and grounding.

.4 Verify transformer is supplied and connected in accordance with the Contract documents.

.5 Insulation-resistance (Megger test) test all windings, high to low and ground, low to high and ground.

.6 Verify phase rotation sequence of transformer secondary windings.

.7 Adjust the transformer taps to the nominal system voltages per CSA CAN3-C235.83.

.8 Inspect and check for operation of all other overcurrent protection devices (switch/fuses, circuit breakers). Verify fuse/circuit breaker sizes in accordance with the Drawings.

.9 Insulation resistance (Megger) test of all incoming bus ducts and feeders and extensions to all relocated outgoing feeders and all new outgoing feeders. Ensure that all electronic and other voltage sensitive equipment is disconnected before the tests are applied and reconnect same at completion of test.

.10 After each switchboard has been energized, manually operate each and every circuit breaker or switch and prove that when operated, the device in fact opens all underground conductors at the load end of the feeder and that the device and load have been labeled correctly.

.2 Cables

.1 Apply grounds for a time period adequate to drain all insulation-stored charge.

.2 Insulation Resistance test per NETA ATS standards (Latest Edition).

.3 Other utilization equipment

.4 Switches

.1 Verify correct wire bending radii at terminations per wire manufacturer's recommendations and CEC.

.5 Protective relays and devices

.1 Conduct tests according to the manufacturer's recommended testing procedures.

.2 Calibrate and set all settings according to the Protective Device Coordination Study.

.3 The following equipment shall be inspected and tested by the Contractor. Coordinate activities with the manufacturer's authorized service representatives.

.1 The Contractor shall coordinate with the suppliers and Subcontractors to perform the following tests:

.1 Test secondary voltage levels of all transformers and adjust taps to within 2% of the rated operating voltage of the connected equipment unless directed otherwise by the Consultant. Test reports shall include phase and neutral currents.

.2 Control and switching - all circuits shall be tested for the correct operation of devices, switches, and controls, including sequenced operation of systems where applicable.

.3 Include in the written reports to the Consultant, the time and date on which each load was measured and the voltage at time of test.

.2 General power system tests

.1 Insulation Resistance test all 120 V and higher circuits, feeders, and equipment.

.2 Check resistance to ground before energizing any equipment.

.3 Phase balance - when load conditions are commensurate with actual operating conditions, measure the load and the voltage on each phase at each switchboard, splitter, motor control centre, motor distribution centre, distribution panelboard, and lighting and power panelboard and report the results, including neutral currents, in writing to the Consultant. Rearrange circuit connections as necessary to balance the load on each phase to within 15% of average load. Measure phase voltages at connected loads under fully load conditions and adjust transformer taps to within 2% of rated voltage of equipment. Provide upon completion of the work specified herein, load balance report, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.4 Motor loading - measure the line current of each phase of each motor with the motor operating under load and report the results along with the motor nameplate current in writing to the Consultant. Upon indication of any unbalance or overload, thoroughly examine the electrical connections and rectify any defective parts or wiring. If electrical connections are correct, overloads due to defects in the driven machines shall be reported in writing to the Consultant.

.5 Phase relationship tests: Check connections to all new and existing equipment, outlets and devices for proper phase relationship. During such check, disconnect all devices which could be damaged by the application of voltage or reversed phase sequence.

.3 Low voltage feeder and branch circuit conductors (600 V and below)

.1 Test for continuity of each lighting and heating circuit originating from branch distribution panels.

.2 Test for grounds in each circuit; test shall consist of the physical examination of the installation to ensure that all required ground jumpers, devices, and appurtenances do exist and are mechanically firm.

.3 Perform a 500V M-Ohm meter test on each circuit between the conductor and ground. The insulation resistance shall not be less than 2 megohms for circuits under 120V, 6 M-Ohms between conductor and ground on those circuits (120 - 600 V) with total single conductor length of 2,500 feet and over, nor less than 8 M-Ohms for those circuits (120 - 600 V) with single conductor length of less than 2500 feet. If conductor fails test, replace wiring or correct defect and retest.

.4 Perform torque test for every conductor tested and terminated in an overcurrent device or bolted type connection; torque all connections per manufacturer's recommendations.

.5 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.6 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.7 Check resistance to ground before energizing.

.4 Panelboards

.1 Inspect for physical damage, proper installation, supports, and grounding.

.2 Verify that neutrals are grounded only at the main service.

.3 Load balance tests: Check all panelboards for proper load balance between phase conductors and make adjustments as necessary to bring unbalanced phases to within 15% of average load.

.4 Electronic and adjustable Breakers: provide adjustments as required to align with connected equipment.

.5 Breakers and Load Break Switches

.1 Adjust and set in accordance with power system study.

.2 Clean and lubricate.

.3 Visual inspection.

.4 Manual function test.

.5 Torque test.

.6 Contact resistant test (100 amp resistance tester).

.7 Electrical function test.

.8 Function trip test of all protective relay device.

.6 Breakers: Molded Case Breakers 150 Amp Frame and Larger:

.1 Visually inspect.

.2 Ductor test.

.3 Megger test.

.4 Mechanical function test.

.5 Set all units with adjustable magnetic trip units.

.6 Where solid state protection is provided with large breakers, test units as follows:

.7 Inspect and test in accordance with manufacturer's most recent installation and maintenance brochure.

.8 Perform tests using manufacturer's relay test unit as applicable, with corresponding test instruction.

.9 If manufacturer's tester is not available, use an approved relay tester unit with proper test data and test accessories.

.10 Proof test each relay in its control circuit by simulated trip tests to ensure total and proper operation of breaker and relay trip circuit by injection of relay circuit to test trip operation.

.11 Check C/T and P/T ratios and compare to coordination data.

.7 Fused or Unfused Disconnect Switches:

.1 Visually inspect and clean.

.2 Ductor test across switch blade contact surfaces.

.3 Megger test.

.4 Mechanical function test.

.8 Transformers

.1 Visual inspection of enclosure and all accessories.

.2 Torque test all bus connections and cable terminations and seal with red lacquer.

.3 Megger test.

.4 Dielectric power factor test.

.5 Core ground test.

.6 Ratio test in all tap positions.

.7 Test operation of temperature and operation of all associated alarm contacts.

.8 Test and calibrate ground fault relays and function test to trip associated breakers.

.9 Make voltage and power factor checks throughout building. If directed by the Contract Administrator, adjust transformer tap settings. Readings taken at this time to be logged, tabulated and any adjustments made to be suitably logged and incorporated in the Project Binders.

.9 Transfer Switch - Low Voltage

.1 Torque test all bus joints and cable terminations and seal with red lacquer.

.2 Ductor test.

.3 Megger test.

.4 Power up control circuits, simulate loss of normal power and function all devices including timers.

.5 Apply device settings as specified.

.6 Wiring Checks as listed:

.7 Check all control, relaying and instrumentation wiring against vendor wiring schematics, three line diagrams and Technical Specifications.

.8 Test each circuit for continuity using a buzzer or similar device.

.9 All current circuits shall be injected, all voltage circuits shall be powered at 120 Volts, all devices functioned and checked against control schematic diagram.

.10 Check polarity and verify phase relationships on all three phase metering circuits.

.11 Where errors are discovered and changes are required, mark up and note required corrective action on vendor prints.

.12 Operation tests in accordance with Section 26 32 13 01 – Power Generation – Diesel.

.10 Microprocessor Type Relays

.1 Mechanical Inspection:

.2 Remove cover from relay case carefully. Trip circuit is live circuit and on some relays it is possible to cause an instantaneous trip while removing relay cover. Inspect cover gasket. Check glass for tightness and cracks.

.3 Eliminate unwanted tripping, short circuit current transformer secondary by careful removal of relay test plug or operation of appropriate current blocks.

.4 Check connections, circuit boards and modules for tightness.

.5 Check output relay coils for signs of overheating and brittle insulation.

.6 Cleaning:

.7 Clean glass inside and out.

.8 Clean relay compartment as required. Clean relay plug in contacts if applicable, using proper tools.

.9 Remove dust and foreign materials from interior of relay using small brush or low pressure nitrogen.

.10 Inspect for any signs of moisture and corrosion.

.11 Clean relay output contacts with burnishing tool or non-residue contact cleaner.

.12 Electrical Testing: Function tests for typical overcurrent relays include:

.13 Energize relay from an appropriate DC power source and check "ON" indication.

.14 Time current function test and trip flag operation.

.15 Instantaneous pickup functional trip and flag operation.

.16 Use tests listed above for most microprocessor overcurrent type relays.

.17 Check C/T and P/T ratios and compare to coordination data.

.11 Solid State Relays

.1 Inspect and test in accordance with manufacturer's most recent installation and maintenance brochure.

.2 Perform tests using manufacturer's relay test unit as applicable, with corresponding test instructions.

.3 If manufacturer's tester is not available, use an approved relay tester unit with proper test data and test accessories.

.4 Proof test each relay in its control circuit by simulated trip tests to ensure total and proper operation of breaker and relay trip circuit by injection of relay circuit to test the trip operation.

.5 Check C/T and P/T ratios and compare to coordination data.

.12 Motor Control Centre/Panels

.1 Megger Test all motor feeders

.2 Check polarity and verify phase relationships on main feeder and all equipment feeders. Bump Test all existing motors fed from the new MCC.

.3 Power up control circuits. Verify operation of all control circuits re-terminated at new MCC.

.4 Test operation of each piece of equipment in ‘Hand’

.5 Test operation of each piece of equipment in ‘Auto’

.6 Where required, verify shutdown of equipment on fire alarm.

.13 Bus Duct - Low Voltage

.1 Visually inspect.

.2 Torque test all bolted connections and seal with red lacquer.

.3 Megger test.

.4 Contact resistance test on total bus duct.

.14 Devices

.1 Test all receptacles for proper polarity, circuitry and grounding.

.15 Grounding systems

.1 Verify that generator neutral is solidly bonded to the building ground by removing the service neutral grounding conductor and insulation resistance test the neutral bus.

.2 Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system-neutral, and/or derived neutral points installed as part of this Contract. Investigate resistance values, which exceed 0.5 ohm. If this resistance cannot be obtained with the ground system, notify the Consultant for further instruction.

.3 The resistance to ground between the equipment enclosures and the grounding grid shall be tested. In soils of low conductivity, additional ground rods, ground plates, and ground wires shall be added, as required. Ground measurements shall not exceed 25 ohms. Measurements shall be undertaken under dry soil conditions, and when frost penetration has not exceeded 150mm. Test results shall be documented by the Contractor and copies given to the Contract Administrator.

.4 Test Method: 3-Point (Fall-of-Potential) Method per IEEE Standard 81.

3.3 HVAC AND LIGHTING SYSTEMS

.1 The following applies to heating, ventilation, and lighting systems:

.1 Heating and Ventilation Systems

.1 Purpose to ensure that existing systems are functional. Verification includes:

.1 Confirmation of thermostat settings for heating and cooling.

.2 Confirmation of operation of heaters and fans.

.3 Confirmation of all control panel elements for ventilation control panels are operational and functioning.

.2 Lighting Systems

.1 Purpose to ensure that systems are functional. Verification includes:

.1 Confirmation that lighting within each system is activated by the associated switches.

.2 Confirmation that emergency lighting is operational in the event of power failure (if applicable).

.3 Confirmation that kiosk and enclosure lighting is operating as intended per Contract Drawings.

3.4 GENERATOR SYSTEMS

.1 In accordance with Section 26 32 13 01 – Power Generation – Diesel.

3.5 CONTROL SYSTEMS

.1 The following applies to control systems and instrumentation:

.1 Loop testing: Purpose is to test all control wiring loops between instrumentation and terminations within the control panel to ensure signal continuity and correct signal polarity. Loop testing to be completed for the following instruments:

.1 Ultrasonic/Hydrostatic level transmitters

.2 Float switches

.3 Door contacts

.4 Heat/ smoke detectors

.5 VFD signals

.6 Current transducers

.7 And any other devices included within the Contract Documents.

.2 Operational verification: Purpose to ensure that devices and systems' performance meet or exceed established functional requirements. Operational verification includes:

.1 Operation of pump starters (VFDs, HOA operation, etc.).

.2 Operation of control system (PLCs, HMIs, relay components, etc.).

.3 Field Quality Control of generator sets per Section 26 32 13 01 Power Generation – Diesel.

.4 Operation of each device individually and within its environment.

.5 Operation of buttons, switches, and pilot lights.

.6 Operation of the external devices, including:

.1 Building controls (heat/ smoke/ security elements)

.2 Float switch

.3 Level sensors

.4 Pressure Transmitters

.7 Provide assistance during Owner testing and commissioning activities.

.2 Labels

.1 Upon completion of the inspection, calibration, and testing, attach a label to all devices tested. These labels shall indicate the date tested, the Contractor company name, and tester's initials.

.3 Re-testing

.1 Any fault in material or in any part of the installation revealed by these tests shall be investigated, replaced, or repaired by the Contractor and the same test repeated by the Contractor at Contractor’s expense until no fault appears.

3.6 MANUFACTURER'S FIELD SERVICES:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit manufacturer's field reports to Contract Administrator for review. Include field reports in Project Binders.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Obtain manufacturer’s field services for commissioning of equipment as required in other Sections of Division 26 Technical Specifications.

.4 Conduct additional testing as required in other Sections in Division 26 Technical Specifications.

3.7 STANDARDS

.1 The following tests shall be conducted in accordance with latest CSA, ASTM, IEEE and IPCEA standards, recommendations for power cable and equipment testing and standards of the authority having jurisdiction. Notwithstanding the test levels listed in these standards, in no case shall the maximum DC test level exceed manufacturer's factory test AC level for that equipment.

.2 Where production tests are required by EEMAC or CSA for manufactured equipment, provide records of these tests. All tests shall be completed in accordance with manufacturer's published instructions. If these instructions do not conform to the test requirements as specified herein inform the Contract Administrator prior to proceeding with the test.

3.8 TEST APPARATUS AND INSPECTION REPORT

.1 The Contractor is responsible for furnishing all apparatus and labour required for the test operations.

.2 Inspection and test results to be recorded on a suitable form which shall be furnished by the Contractor. The inspection and report forms shall be submitted to the Contract Administrator. Each form to be signed by the test technician. Space to be provided for noting approved items and their disposition.

.3 The Contractor will submit full commissioning reports and information for as-built drawings and acceptance documents signed by test technician.

.4 Upon completion of the Work, the Contractor will assemble complete sets of inspection/test results/reports to be placed in the operating and maintenance manuals. Reports shall include the following:

.1 Summary of project

.2 Description of equipment tested

.3 Description of test

.4 Test results including re-testing results

.5 Test dates

.6 Tester’s name

.7 Witnesses (when required)

.8 Corrective work

.9 Acceptance criteria

.10 Conclusions and recommendations

.11 Appendix, including appropriate test forms

3.9 DEMONSTRATION

.1 Demonstrate and instruct the Owner's personnel on operating and maintenance procedures for all electrical systems using the assistance of specialist sub-trades and manufacturer's representatives for instruction. Systems to be demonstrated and trained on shall include the following:

.1 Entire power distribution systems (primary and backup).

.2 Operation of circuit breakers, interlocking schemes, etc.

.3 Motor control equipment and associated components.

.4 Instrumentation and field monitoring/control devices.

.5 Manual and automatic station control operation.

.6 Continuity between switches/pilot lights/field devices and the PLC.

.7 Loss of power controls and backup power operation.

.8 Alarming.

.9 Routing and installation of major feeders, grounding and raceways.

.10 Labeling and identification schemes.

.11 Use of the operations and maintenance manuals.

3.10 TRAINING

.1 Arrange an acceptable time with the Owner and the Contract Administrator and submit a program of instruction and demonstration for the Owner's approval. Assume that the Owner's staff are not familiar with any of the special equipment and/or systems installed.

.2 As a condition of Substantial Completion, submit to the Contract Administrator complete list of systems demonstrated and training completed, and state for each system:

.1 Date that instructions were given to the Owner’s staff.

.2 Duration of instruction.

.3 Names of persons instructed.

.4 Other parties present (manufacturer's representative, Contract Administrator, etc.).

.5 Signature of the Owner's staff stating that they properly understood the system installation, operation, and maintenance requirements and identifying any systems or equipment which were not demonstrated to their satisfaction and which must be re-demonstrated

3.11 SYSTEM ACCEPTANCES

.1 Prior to requesting inspection, submit, for review by the Contract Administrator letters from the manufacturers of equipment and systems indicating their technical service representatives have inspected and tested the equipment and systems and are satisfied with the methods of installation, connections and operation.

.2 Such acceptance letters shall be submitted for the following:

.1 Distribution and Power Panels.

.2 Transformers.

.3 Pump Control Panel.

END OF SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Materials 3
Part 3 Execution 3
3.1 Examination 3
3.2 Installation 3

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for wire and box connectors.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 21 Wires and Cables (0-1000V)

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No. 18.1-13, Metallic Outlet Boxes

.2 CAN/CSA C22.2 No. 18.2-06, Nonmetallic Outlet Boxes

.3 CAN/CSA C22.2 No. 18.3-12, Conduit, Tubing, and Cable Fittings

.4 CAN/CSA C22.2 No. 18.4-04, Hardware for the Support of Conduit, Tubing

.5 CAN/CSA C22.2 No. 65-18, Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y 2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No. 65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y 2 to consist of:

.1 Connector body and stud clamp for copper conductors.

.2 Clamp for stranded copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable and flexible conduit as required to comply with CAN/CSA C22.2 No. 18 (all subsections).

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Consultant or provide photographic evidence of areas of concern.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y 2.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 3
Part 2 Products 3
2.0 Power Wiring 3
2.1 Teck 90 Cable 3
2.2 Control and Instrumentation Cable 4
2.3 Ethernet cables 4
2.4 Ethernet patch cables 5
2.5 Armoured Control and Instrumentation Cable 5
2.6 Twisted Pair Shielded (TPSH) Armoured Cables 6
2.7 Triad Shielded Armoured Cables 6
2.8 Fibre Optic Cables 7
Part 3 Execution 7
3.1 Field Quality Control 7
3.2 General Cable Installation 7
3.3 Wiring Identification 8
3.4 Analog Signals 9
3.5 Digital Signals 9
3.6 Installation of Building Wires 9
3.7 Installation of Teck90 Cable (0-1000V) 9
3.8 Installation of Armoured Cable 9
3.9 Installation of Control and Instrumentation Cable 9
3.10 Installation of Armoured Control and Instrumentation Cable 10

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for wire and cables.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 20 Wire and Box Connectors (0-1000V)

.3 Technical Specification 26 05 43 01 Installation of Cables in Trenches and Ducts

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No. 0.3-09, Test Methods for Electrical Wires and Cables

.2 CAN/CSA C22.2 No. 38-14, Thermoset-insulated wires and cables

.3 CSA C22.2 No. 49, Flexible Cords and Cables

.4 CSA C22.2 No. 51, Armoured Cables

.5 CSA C22.2 No. 52, Underground secondary and service-entrance cables

.6 CSA C22.2 No. 65, Wire Connectors

.7 CAN/CSA C22.2 No. 75, Thermoplastic insulated wires

.8 CAN/CSA C22.2 No. 127-15, Equipment and lead wires

.9 CSA C22.2 No. 131, Type TECK 90 Cable

.10 CAN/CSA C22.2 No. 131-17, Type TECK 90 Cable

.11 1.4.13 CSA C22.2 No. 174, Cables and Cable Glands for Use in Hazardous Locations

.12 CSA C22.2 No. 2556, Wire and Cable Test Methods

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 POWER WIRING

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG, unless noted otherwise.

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

.3 Colour Code:

.1 AC 3-Phase:

.1 Line 1: Red

.2 Line 2: Black

.3 Line 3: Blue

.4 Neutral: White

.2 AC Single Phase:

.1 Hot: Black

.2 Hot (Secondary): Red

.3 Neutral: White

.4 Grounding conductors to be in accordance with requirements in Technical Specification 26 05 28 Grounding - Secondary.

2.1 TECK 90 CABLE

.1 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.2 Insulation:

.1 Cross-linked thermosetting polyethylene rated type RW90 XLPE.

.2 Rating: 1000V

.3 Inner jacket: polyvinyl chloride material.

.4 Armour: interlocking aluminum.

.5 Overall covering: thermoplastic polyvinyl chloride.

.6 Connectors:

.1 Watertight approved for TECK Cable.

.2 Explosion proof in classified areas approved for TECK cable.

2.2 CONTROL AND INSTRUMENTATION CABLE

.1 Internal cabinet control wiring shall be TEW (tinned).

.1 Wire: to CAN/CSA C22.2 No. 127-15.

.2 Minimum Size (unless otherwise noted by Contract Drawings):

.1 120VAC: 14AWG.

.2 24VDC: 18AWG.

.3 Colour Code

.1 AC Hot: Black

.2 AC Neutral: White

.3 DC Positive: Blue

.4 DC Negative: Yellow

.5 Ground: Green

.2 Analog instrumentation wiring:

.1 Cable: to CAN/CSA-C22.2 No. 75.

.2 Conductors:

.1 Circuit conductors: 7 strand tinned copper.

.3 Insulation:

.1 Cross-linked thermosetting polyethylene rated type RW90 XLPE.

.2 Rating: 300V and 600V, as required.

.4 Jacket: polyvinyl chloride material.

.5 Shield:

.1 Individual Foil

.2 Tinned copper drain wiring under and in contact with foil.

2.3 ETHERNET CABLES

.1 CAT6 (250MHz) rated, compatible with 1000BaseT networks.

.2 Outdoor rated, installation in conduit approved, UV resistance.

.3 Conductors:

.1 8 x 23 AWG solid copper conductors, arranged in 4 twisted pairs.

.2 RJ45 Termination: TIA 568A

.3 Straight-through (non-crossover) wiring, unless noted otherwise.

.4 Jacket:

.1 Oil and sunlight resistant PVC.

.2 Colour: Blue

2.4 ETHERNET PATCH CABLES

.1 CAT6 (250MHz) rated, compatible with 1000BaseT networks.

.2 8 x 23 AWG solid copper conductors, arranged in 4 twisted pairs.

.3 Straight-through (non-crossover) wiring, unless noted otherwise.

.4 RJ45 male connectors with molded boots.

.1 Termination: TIA 568A

.5 Colour: Blue

2.5 ARMOURED CONTROL AND INSTRUMENTATION CABLE

.1 Cable: to CAN/CSA-C22.2 No. 239-21.

.2 Conductors:

.1 Circuit conductors: 7 strand tinned copper.

.2 Conductor size per Contract Drawings.

.3 Insulation:

.1 Cross-linked thermosetting polyethylene rated type RW90 XLPE.

.2 Rating: 300V and 600V, as required.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride.

.7 Certification:

.1 FT-4 Flame Rated

.2 Temperature: 105°C dry, 75°C wet, and -40°C

.3 Suitable for installation in Class I, Zone 1 and Zone 2, and Class II, Division 1 and 2 Hazardous Locations.

.8 Connectors:

.1 Watertight approved for armoured control and instrumentation cable.

.2 Explosion proof in classified areas approved for armoured control and instrumentation cable.

2.6 TWISTED PAIR SHIELDED (TPSH) ARMOURED CABLES

.1 TPSH cables are to be constructed as follows:

.1 Compliance: CSA C22.2 - No. 38, No. 174 and No. 239

.2 Two copper conductors, stranded, tinned, minimum #16 AWG, PVC-insulated, twisted in nominal intervals of 50 mm. Conductor identification to be by black and white coloured insulation.

.3 100 percent coverage aluminum foil or tape shield and bare stranded, tinned copper drain wire, minimum #16 AWG for each pair.

.4 Separate bare stranded, tinned copper drain wire, minimum #16 AWG for each pair.

.5 Overall shield and bare stranded tinned copper drain wire for multi-pair cables.

.6 Insulated for 600 V, 90 degrees C.

.7 Interlocking aluminum armour.

.8 Overall flame-retardant PVC jacket rated to minus 40 degrees C and meeting low gas emission and FT4 flame test requirements as specified in CSA-C22.2 – No. 0.3 and IEEE 383, and sunlight (UV) resistant rated.

.9 Overall PVC jacket to be grey in colour.

.10 HL rating for hazardous location Class 1 Div. 1 or 2.

.11 Suitable for cable tray installation, indoor and outdoor, for direct burial, and for installations in conduits.

.12 Each pair of multiconductor TPSH cables to be individually shielded and continuously number coded.

2.7 TRIAD SHIELDED ARMOURED CABLES

.1 Triad shielded armoured cables constructed same as Twisted Pair Shielded cables except for:

.1 Three copper conductors per triad group.

2.8 FIBRE OPTIC CABLES

.1 Optic fibre cables to be aluminum clad armored.

.2 Trunk cable to conform with the following:

.1 ANSI X3.166.

.2 62.5/125 µm core/cladding (OM1).

.3 Dual-mode, 850/1300 nm.

.4 Graded-index glass.

.5 Gel-filled, loose-buffer construction.

.6 Bandwidth: 160/500 MHz-km at 850/1,300 nm.

.7 Attenuation: 3.5/1.5 dB/km @ 850/1,300 nm.

.8 Numerical aperture: 0.275.

.9 Strength member: Kevlar.

.10 Pulling tension: 2,000 N.

.11 Rating: Indoor/Outdoor Use, Tray Rated.

.12 Jacket: orange PVC for multimode optic fibre and yellow PVC for single mode optic fibre.

.3 Break-out cables and jumpers to be similar except tight-buffer construction. Jumper cables are to be supplied as factory assembled units.

.4 Optic fibre connectors are to be oven-cured aluminum/ceramic ST type.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

3.2 GENERAL CABLE INSTALLATION

.1 Install cable in trenches in accordance with Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts.

.2 Terminate cables in accordance with Technical Specification 26 05 20 Wire and Box Connectors - (0-1000 V).

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 All field wiring/communication cabling that maybe field installed directly onto any cabinet door mounted components shall be suitably routed and protected across the door hinge to prevent possible mechanical damage upon door opening and/or door closing.

3.3 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of cable.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

.5 Wire Labeling:

.6 As per contract drawings.

3.4 ANALOG SIGNALS

.1 Use twisted-pair shielded armoured (instrument TECK cable) as applicable, for low-level analog signals such as 4-20 mA, 1-5VDC, 0-10VDC, pulse type circuits 24VDC and under, and other signals of a similar nature.

.2 Use triad shielded armoured cable for connections between RTDs and transmitters or CDAC RTD inputs.

3.5 DIGITAL SIGNALS

.1 Use TPSH armoured cable for input and output signals 24 VDC and under and terminate in the marshalling panels.

.2 Use Control TECK cable or wire and conduit power to instruments, for 120 V signals other than those mentioned above and as otherwise shown in the Contract Drawings.

3.6 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts.

3.7 INSTALLATION OF TECK90 CABLE (0-1000V)

.1 Install cabling as follows:

.1 In conduit systems in accordance with Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts.

.2 Install cable exposed, securely supported by straps or hangers.

.1 Group cables wherever possible on channels, individually strapped.

3.8 INSTALLATION OF ARMOURED CABLE

.1 Install cabling as follows:

.1 In conduit systems in accordance with Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts.

.2 Install cable exposed, securely supported by straps or hangers.

.1 Group cables wherever possible on channels.

3.9 INSTALLATION OF CONTROL AND INSTRUMENTATION CABLE

.1 Ground control cable shield at control cabinet only.

.2 Cut and heatshrink shield at terminations to field devices.

3.10 INSTALLATION OF ARMOURED CONTROL AND INSTRUMENTATION CABLE

.1 Install cabling as follows:

.1 In conduit systems in accordance with Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts.

.2 Install cable exposed, securely supported by straps or hangers.

.1 Group cables wherever possible on channels.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Equipment 2
Part 3 Execution 3
3.1 General Installation 3
3.2 Electrodes 4
3.3 System and Circuit Grounding 4
3.4 Equipment Grounding 4
3.5 Junction Boxes and Vaults 4
3.6 Master Ground bus 4
3.7 Field Quality Control 4

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for secondary grounding.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 24 01 Service Equipment

1.3 REGULATORY REQUIREMENTS

.1 CSA C22.1 - Canadian Electrical Code, Part 1: Section 10 Grounding and Bonding

.2 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837-02, Qualifying Permanent Connections Used in Substation Grounding.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 EQUIPMENT

.1 Rod electrodes: copper clad steel, 19mm dia. by 3 m long.

.2 Plate electrodes: copper surface area minimum 0.2 m^3, 1.5mm thick, In accordance with the CEC.

.3 Grounding conductors: medium hard drawn, 7 strand, bare stranded copper, size as indicated on Contract Drawings.

.4 Insulated grounding conductors: green, size as indicated.

.5 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.

.6 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 Bonding jumpers, straps.

.5 Pressure wire connectors.

Part 3 Execution

3.1 GENERAL INSTALLATION

.1 Install exterior buried grounding loop system as indicated on the Contract Drawings.

.2 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.

.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

.7 Soldered joints not permitted.

.8 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.9 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end.

3.2 ELECTRODES

.1 Install rod electrodes and make grounding connections within inspection wells.

.2 Bond separate, combine multiple electrodes together, if separate.

.3 Size copper conductors for connections to electrodes, sized as indicated on Contract Drawings.

.4 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral secondary 120V system.

3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.5 JUNCTION BOXES AND VAULTS

.1 Bond lids of in-ground junction boxes and vaults.

3.6 MASTER GROUND BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical kiosk.

.2 Ground items of electrical equipment in electrical kiosk to ground bus with individual copper connections, sized as indicated on the Contract Drawings.

.3 Ground items of water system to ground bus with copper connections, sized as indicated on the Contract Drawings.

3.7 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results – Electrical and Technical Specification 26 05 10 Testing and Commissioning.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Contract Administrator and Government Authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Support Channels and Stanchions 2
Part 3 Execution 3
3.1 Installation 3

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with the Contract Documents.

1.1 SCOPE

.1 Materials and installation for hangers and supports for electrical systems.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 02 Seismic Restraint

1.3 REGULATORY REQUIREMENTS

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.1 ANSI/IEEE 837-02, Qualifying Permanent Connections Used in Substation Grounding.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit Shop Drawings in accordance with Section 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 SUPPORT CHANNELS AND STANCHIONS

.1 Select channel as indicated in the Contract Drawings:

.1 U shape, stainless steel, size 41 x 41 mm, 2.5 mm thick, surface mounted and suspended with stainless steel hardware.

.2 All materials to assemble stanchions shall be from same manufacturer.

.2 Wire and cable ties: nylon ‘Ty-rap’ or approved equal for wiring and control cable. Velcro cable wraps for data cables.

Part 3 Execution

3.1 INSTALLATION

.1 Refer to Technical Specification 26 05 02 – Seismic Restraint.

.2 Contractor to note that the intent of this Technical Specification is for the Contractor to provide under the base contract all seismic restraint of electrical equipment.

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

- .1 One-hole stainless steel straps to secure surface conduits and cables 53 mm and smaller.
- .2 Two-hole stainless steel straps for conduits and cables larger than 53 mm.

.4 For surface mounting of two or more conduits use channels at 1500 mm on centre spacing.

.5 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.6 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.7 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.8 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.

.9 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Splitters 2
2.1 Junction and Pull Boxes 3
2.2 Explosion Proof Junction Boxes 3
2.3 Terminal and Pull Boxes 3
2.4 Cabinets 4
Part 3 Execution 4
3.0 Splitters 4
3.1 Junction, Pull Boxes and Cabinets Installation 4
3.2 Identification 5

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for splitters, junction, pull boxes, and cabinets.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings

.3 Technical Specifications 26 27 16 Electrical Cabinets and Enclosures

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

.2 CSA C22.2 No. 76, Splitters.

.3 CSA-C22.2 No. 85, Rigid PVC Boxes and Fittings.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 SPLITTERS

.1 Compliance: CSA C22.2 No. 76, Splitters.

.2 Sheet metal enclosure with welded corners, and formed hinged gasketed cover suitable for locking in closed position.

.3 Main and branch lugs or connection bars to match required size and number of connecting conductors as specified.

.4 At least three spare terminals on each set of lugs in splitters.

2.1 JUNCTION AND PULL BOXES

.1 RPVC construction sized to suit. Screw on flat covers. All mounting hardware to be stainless steel. Except as otherwise specified.

.2 Internal dielectric barrier for separating controls and power terminations only where indicated on Contract Drawings.

2.2 EXPLOSION PROOF JUNCTION BOXES

.1 Aluminum construction sized to suit.

.2 Certification: Class 1, Zone 1 & 2.

.3 Internal back panel for terminal block mounting.

.4 Gasketed, front cover.

.5 Stainless steel hardware.

2.3 TERMINAL AND PULL BOXES

.1 Intended for surface mounting, except as otherwise specified.

.2 Weatherproof, Style WP1

.1 Copper-free cast aluminum, Type 4.

.2 Hinged door if any one dimension exceeds 300 mm.

.3 Manufactured breather, designed to maintain weatherproof classification of enclosure.

.4 When used as terminal box, equipped with mounting pan and terminal strip.

.3 Weatherproof, Style WP2

.1 Same features as for Style WP1, except made of sheet aluminum, minimum 2.3 mm thick.

.2 Dripshield.

.4 Weather- and Corrosion-Proof, Style WP3

.1 Same features as for Style WP1, except Type 4X enclosure, made of 316 stainless steel.

.5 Weather- and Corrosion-Proof, Style WP4

.1 Same features as for Style WP1, except non-metallic, Type 4X fibreglass enclosure.

.2 Quick-release latches.

.6 Indoor Dry Location Non-process Area, Style GP5

.1 Welded steel or aluminum Type 12 enclosure.

.2 Hinged cover with quick-release latch or automotive handle, for enclosures that exceed 300 mm in width or height.

.7 Watertight, Style WT

.1 Same as weatherproof styles WP1 to WP 4, except without breather.

.2 Explosion-proof, Style XP

.3 Same features as for Style WP1, except, in addition to being weatherproof, also suitable for the hazardous location specified.

2.4 CABINETS

.1 Intended for surface mounting, except as otherwise specified.

.2 Enclosure rating is to be the higher rating of the rating shown in the drawings and the rating based upon location of installation.

.3 Single - or double-door construction with 316 stainless steel full-length hinge.

.4 Minimum standard: formed and welded Type 12 construction, of minimum 1.8 mm thick sheet steel, with automotive door handle.

.5 For process and outdoor areas and below-grade valve chambers: formed and welded Type 4X construction of minimum 2 mm thick sheet aluminum, with 316 stainless steel door clamps and hardware.

.6 Full-size equipment mounting pan of formed sheet metal.

Part 3 Execution

3.0 SPLITTERS

.1 Install splitters and mount plumb, true, and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where specified otherwise.

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor, unless otherwise indicated.

.3 Install pole mount enclosures as indicated.

.4 Install equipment and terminal blocks as indicated in cabinets.

.5 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.2 IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Outlet and Conduit Boxes General 2
2.1 Conduit Boxes 3
2.2 Weather-Proof Outlet Boxes 3
2.3 hazardous area outlet boxes 3
2.4 Fittings - General 3
Part 3 Execution 3
3.0 Installation 3
3.1 Identification 4

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for outlet boxes, conduit boxes, and fittings.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 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 240V outlet boxes for 240V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

.7 Provide clear while-in-use gasketed cover for interior outlets, where indicated in Contract Drawings.

2.1 CONDUIT BOXES

.1 FD NEMA 4X RPVC boxes with factory-threaded hubs, mounting feet, and gasketed covers, where indicated in Contract Drawings.

.2 Provide clear while-in-use gasketed cover for interior outlets, where indicated in Contract Drawings.

2.2 WEATHER-PROOF OUTLET BOXES

.1 RPVC boxes for outlets rated for outdoor environments.

.2 Connected to TECK 90 cables as required, minimum size 102 x 54 x 48 mm.

.3 Provide weatherproof clear lockable while-in-use covers for all GFI locations, where indicated.

2.3 HAZARDOUS AREA OUTLET BOXES

.1 Certification: Class I, Divisions 1 and 2.

.2 Material: copper-free cast aluminum body and cover

.3 Finish: Aluminum

.4 Size: as required.

.5 Mounting: elevated mounting feet to allow cable connector termination and removal when surface mounted.

2.4 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

3.0 INSTALLATION

.1 Recess mount lighting and outlet boxes located on building exterior.

.2 Surface mount boxes located in building interior.

.3 Support boxes independently of connecting conduits.

.4 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of the work.

.5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.6 Vacuum clean interior of outlet boxes before installation of wiring devices.

3.1 IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

.2 Install identification labels indicating circuit, voltage, and phase.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 3
Part 2 Products 3
2.0 Conduits 3
2.1 Conduit Fastenings 3
2.2 Conduit Fittings 3
2.3 Expansion Fittings for Rigid Conduit 3
2.4 Hazardous Area Conduit Seals 4
2.5 Pull Cord 4
Part 3 Execution 4
3.0 Manufacturer's Instructions 4
3.1 Installation 4
3.2 Surface Conduits 5
3.3 Underground Conduits 5

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Section of the Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for conduits, conduit fastenings and conduit fittings.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 21 Wires and Cables (0-1000V)

.3 Technical Specification 26 27 16 Electrical Cabinets and Enclosures

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

.2 CAN/CSA C22.2 No.18.3 12, Conduit, Tubing, and Cable Fittings

.3 CAN/CSA C22.2 No.18.4-04, Hardware for the Support of Conduit, Tubing and Cable

.4 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid Tight Flexible Metal Conduit.

.5 CSA C22.2 No. 45.2-08, Electrical Rigid Metal Conduit – Aluminum, Red Brass, and Stainless Steel.

.6 CSA C22.2 No. 83-M1985 – Electrical Metallic Tubing

.7 CSA C22.2 No. 211.2 06, Rigid PVC (Unplasticized) Conduit.

.8 CAN/CSA C22.2 No. 227.2.1-04, Liquid Tight Flexible Nonmetallic Conduit.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 CONDUITS

.1 Rigid aluminum conduit: to CSA C22.2 No. 45.2.

.2 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.3 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

.4 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.2.1.

2.1 CONDUIT FASTENINGS

.1 One hole stainless steel straps to secure surface conduits 53 mm and smaller. Two hole stainless steel straps for conduits larger than 53 mm.

.2 Seismic beam clamps to secure conduits and supports to exposed steel work.

.3 Channel type supports for two or more conduits at 1500 mm oc.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

.5 All conduit fastenings and supports shall be stainless steel.

2.2 CONDUIT FITTINGS

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

.2 Factory "elbows" where 90 degree bends are required for 27 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.

.1 Set-screws are not acceptable.

2.3 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.4 HAZARDOUS AREA CONDUIT SEALS

.1 Hazardous locations are identified on the Contract Drawings. Provide seal fittings for conduit systems in hazardous locations as required by the Canadian Electrical Code.

.2 Provide explosion proof EYS fittings as indicated.

.3 Sealing compound shall be installed after the conductors are installed, tested, and accepted.

2.5 PULL CORD

.1 Polypropylene

.1 Minimum tensile strength of 1.1kN.

.2 Mildew and rot resistant.

Part 3 Execution

3.0 MANUFACTURER’S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.1 INSTALLATION

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

.2 Use rigid PVC conduit underground.

.3 Use liquid tight flexible metal conduit for connection to devices, motors, or vibrating equipment with the exception of connections made using armoured cable.

.4 Install conduit sealing fittings in hazardous areas.

.1 Fill with compound.

.5 Minimum conduit size for lighting and power circuits: 21mm

.6 Bend conduit cold:

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

.7 Mechanically bend steel conduit over 21 mm diameter.

.8 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.9 Install polypropylene fish cord in empty conduits.

.10 Remove and replace blocked conduit sections.

.1 Do not use liquids to clean out conduits.

.11 Dry conduits out before installing wire.

3.2 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.

3.3 UNDERGROUND CONDUITS

.1 Refer to Technical Specification 26 05 43 01 Installation of Cables in Trenches and in Ducts for installation of cable procedures.

.2 The Contractor shall provide and install all necessary bends, couplings, reducers, bell end fittings, plugs, caps and adaptors of the same product material as the conduit to ensure a complete installation.

.3 All conduits shall drain towards junction boxes. Spacing between power and communications conduits for longitudinal runs shall be 300mm (unless concrete encased). The spacing may be reduced to 50mm at crossover points and where the conduits enter and exit junction boxes and pull pits.

.4 The Contractor shall not use any factory bends in the conduit runs except where shown on the Contract Drawings or as approved by the Contract Administrator. Where factory 90 degree bends are approved, the radius shall be greater than 900mm.

.5 All conduits shall be verified and cleaned using the following procedure:

.1 To verify integrity of conduit, pull through each conduit duct a hard rubber mandrel, not less than 300mm long and of a diameter 6mm less than the internal diameter of the duct, preceded by a swab of suitable diameter to remove sand, earth and other foreign materials.

.2 Notify Contract Administrator in the event of conduit failure.

.3 Clean ducts before laying. Cap both ends during Construction and after installation to prevent entry of any foreign materials.

.4 Install pull line.

.5 Terminate conduit ends in the junction box.

.6 Clean and vacuum junction boxes.

.7 Locations shall be laid out by the Contractor and field reviewed by the Contract Administrator prior to installation.

.6 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

.7 Trench Markers:

.1 Concrete type cable markers: Minimum 600 mm x 600 mm x 100 mm, with words: "cable," "conduit," or additional circuit identification if so directed by Engineer, impressed in top surface, with arrows to indicate change in direction of conduit runs.

.8 Warning Tape:

.1 Detectable by a pipe/cable locator or metal detector from above the undisturbed ground.

.2 Minimum 50 mm wide with an aluminum foil core laminated between two layers of 3.5 mil thickness polyester plastic.

.3 Plastic colour coding: red for electrical lines, orange for telephone lines, and orange for optic fibre cables.

.4 Imprint a warning continuously along the length, with message reading similar to: "CAUTION – BURIED ELECTRIC (TELEPHONE) LINE BELOW".

.9 Conduit Spacers:

.1 Preformed, rigid plastic spacers designed for direct burial and concrete encasement.

.2 Base and intermediate spacers to suit conduit trade size.

.3 Snap feature or non-metallic ties to obtain required configuration.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Related Technical Specifications 2
1.2 Regulatory Requirements 2
1.3 Scope 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Not Used 2
Part 3 Execution 3
3.0 Cable Installation in Ducts 3
3.1 Field Quality Control 3

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 28 Grounding – Secondary

1.2 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

1.3 SCOPE

.1 Installation of cables in trenches and in ducts.

.1 Wherever the term “duct” appears, it also applies equally to conduit; similarly, the term “cable” also means wires and conductors.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Quality assurance submittals:

.1 Test reports: submit certified test reports.

.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions: submit manufacturer's installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 NOT USED

Part 3 Execution

3.0 CABLE INSTALLATION IN DUCTS

.1 Install cables in ducts as indicated in Contract Drawings.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 Install instrumentation (4-20ma analog) cables in separate ducts from other cables as specified in the Contract Drawings.

.6 Install digital communication cables in separate ducts from other cables as specified in the Contract Drawings.

.7 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.8 Allow extra length of cable in loop form at splice boxes, pullpits and manholes as per good trade practice.

.9 Leave a pull rope in each conduit after installation of cables to permit installation of additional cables after the completion of the Work.

.10 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.11 After installation of cables, seal duct ends with duct sealing compound.

.12 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre acceptance tests.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Provide Contract Administrator with list of test results showing location at which each test was made, circuit tested and result of each test.

.7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Performance and Design Criteria 2
Part 3 Execution 4
3.0 Installation 4
3.1 Field Quality Control 5

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of fractional horsepower motors.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 100, Motors and Generators.

.2 CSA C22.2 No. 145, Motors and Generators for Use in Hazardous Locations.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC M1-7, Standard for Motors and Generators.

.3 NEMA Std. MG1. Motors and Generators.

.4 IEEE Std 114. IEEE Standard Test Procedure for Single-Phase Induction Motors

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 PERFORMANCE AND DESIGN CRITERIA

.1 General:

.1 Motors are to be approved and bear CSA labels or similar certification marks or labels that are acceptable to Technical Safety BC.

.2 Unless otherwise specified, motors 1/3 hp and smaller to be squirrel cage, single-phase, capacitor start, induction run type.

.3 Construction features listed in this Section may be as normally supplied by the equipment manufacturer.

.4 Service factor of 1.15 at 40 degrees C ambient, Class F insulation and non-hygroscopic windings, Class B temperature rise unless otherwise specified.

.5 Provide copper rotor material and copper windings.

.6 Motor nameplate shall be engraved or stamped 316 stainless steel. Information shall include those items enumerated in NEMA Standard MG1, as applicable. Nameplate shall be permanently fasten to the motor frame and shall be visibly position for inspection.

.7 Provide corrosion resistant hardware.

.8 Motors shall include integral overload and overheating protection per CSA Section 28 or shall include an external motor starter installed as required to provide overload and overheating protection.

.2 Rating:

.1 Unless specified otherwise, motors to be rated for operation at 115VAC / 1PH / 60HZ, and continuous-time rated in conformance with NEMA Standard MG1, paragraph 10.35.

.2 Unless specified otherwise, for valve actuators and for special applications, motors to be rated for operation at 600VAC / 3PH / 60HZ. If 600V is not specified on Drawings, then motors to be rated 208VAC / 3PH / 60HZ.

.3 Motors shall be approved and listed with CSA certification for environments installed. This also includes classification, division, and surface temperature markings for hazardous locations.

.4 Motors are capable of starting and running continually when the terminal voltage is from +10 percent to -10 percent of nameplate voltage.

.3 Enclosures

.1 Unless otherwise specified, provide motors with totally enclosed fan cooled or totally enclosed non-ventilated enclosures.

.2 Provide explosion-proof motors marked or labeled for Class I, Division 1, Group D hazardous locations by CSA or a similar certification agency that is acceptable to Technical Safety BC.

.3 Provide an over-temperature device in the enclosure to detect and automatically de-energize the motor.

.4 Connection Boxes:

.1 Provide explosion proof conduit box for explosion proof motors.

.2 Provide a grounding lug within the box for a cable or raceway ground connection.

.3 Boxes shall be designed to rotate in order to permit installation in any of four position 90 degrees apart.

.4 Provide oversized boxes, a minimum of one size larger than standard.

.5 Connection box shall be copper-free aluminum or approved equal for process areas.

.4 Service and Operating Conditions:

.1 Unless specified otherwise, provide motors suitable for continuous operation at an elevation of 300 m above sea level.

.2 Motors installation location shall be suitable for environmental conditions.

.3 Motors shall be rated for project site condition as specified in Technical Specification 26 05 00 Common Work Results - Electrical

.4 Motor shall de-energize upon the loss of a single phase of a three phase power supply.

.5 Motor shall de-energize within 8 seconds in the event such as a stall or jam equipment.

Part 3 Execution

3.0 INSTALLATION

.1 Install motors and valve actuators per manufacturer’s instructions.

.2 Dry out motor if dampness present in accordance with manufacturer's instructions.

.3 Make wiring connections per manufacturer’s recommendations. Include connections for:

.1 Power

.2 Pump Monitoring Sensors

.3 Exhaust system and muffler model and type.

.4 Check for correct direction of rotation.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

END OF SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specification 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Regulatory Requirements 2
2.1 Design Criteria 3
2.2 Configuration, Components and Features 3
2.3 Submersible Pump Motors 4
2.4 Power Factor Correction Capacitor Sizing 4
Part 3 Execution 4
3.0 Installation 4
3.1 Field Quality Control 5

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of motors from 0.746kW to 149kW.

1.2 RELATED TECHNICAL SPECIFICATION

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 100, Motors and Generators.

.2 CSA C22.2 No. 145, Motors and Generators for Use in Hazardous Locations.

.2 National Electrical Manufacturers' Association (NEMA)

.1 NEMA MG 1-2016, Motors and Generators.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 REGULATORY REQUIREMENTS

.1 Motors are to be approved and bear CSA labels or similar certification marks or labels that are acceptable to Technical Safety BC.

.2 Motor Efficiency

.1 Motors to meet or exceed efficiency specified in the Energy Efficiency Act, Energy Efficiency Standards Regulation, B.C. Reg. 389/93 and Canada's Energy Efficiency Act and Ministry of Natural Resources Canada (NRCan) Energy Efficiency Regulations.

.2 Test motor efficiency as specified in CSA C390.

2.1 DESIGN CRITERIA

.1 Rating:

.1 Motors to be 230VAC, 3-phase, 60Hz unless otherwise specified.

.2 Motors to be inverter duty rated.

.3 Motors are capable of starting and running continually when the terminal voltage is from +10 percent to -10 percent of nameplate voltage.

.4 Motor to be rated no smaller than the hp rating specified on the Contract Drawings unless approved by the Engineer after review of complete documentation submitted by the Contractor.

2.2 CONFIGURATION, COMPONENTS AND FEATURES

.1 Boxes

.1 Provided oversized motor terminal boxes, sized one size larger than standard as a minimum, diagonally split and gasketed complete with threaded hub for conduit or Teck cable entry. Provide NEMA 4 terminal boxes for ODP and TEFC motors. Provide NEMA 7 terminal boxes for explosion-proof motors. Motor conductors in terminal boxes to be connected to R90 compression lug connectors.

.2 Provide a grounding lug located within the box for the cable or raceway ground connection.

.3 Provide separate conduit boxes for temperature devices and space heaters.

.2 Space Heaters

.1 Where specified, furnish motors with space heaters to prevent condensation inside the motor enclosure after motor shutdown and maintain the temperature of the winding at not less than 5-degree C above outside ambient temperature.

.3 Motor Over-Temperature Protection

.1 Provide stator winding over-temperature protection on motors rated 60 hp and larger. Motors rated less than 60 hp to have stator winding over-temperature protection where indicated by the Contract Drawings or if recommended by the driven equipment manufacturer.

.2 When specified as single-phase motor, provide with over temperature device in motor enclosure to detect and automatically de-energize the motor. Device shall self-reset after the motor cools.

2.3 SUBMERSIBLE PUMP MOTORS

.1 Provide stator winding over-temperature protection and seal leak detection in all submersible pump motors.

.2 Provide the power and monitoring cables to the motor with oil resistant chloroprene rubber of sufficient length, when required.

.3 The motor and cable shall be capable of continuous submergence under water without loss of watertight integrity to a depth of 20 metres.

.4 Motor to be sufficiently cooled by the surrounding environment and pumped media.

2.4 POWER FACTOR CORRECTION CAPACITOR SIZING

.1 The motor vendor to confirm the maximum capacitor size that may be connected to motors 50 hp and larger.

.2 Where power factor correction capacitors are specified, size the capacitor for the actual motor supplied. The capacitor sizes shown on the electrical one-line diagrams shall be revised to correct the power factor on the motor feeder to .95 with the actual motor supplied.

Part 3 Execution

3.0 INSTALLATION

.1 Install motors and valve actuators per manufacturer’s instructions.

.2 Dry out motor if dampness present in accordance with manufacturer's instructions.

.3 Make wiring connections per manufacturer’s recommendations. Include connections for:

.1 Power

.2 Pump Monitoring Sensors

.4 Check for correct direction of rotation.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Manual On/Off Switching 2
Part 3 Execution 3
3.0 Manufacturer's Instructions 3
3.1 Installation 3
3.2 Field Quality Control 3

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of low voltage lighting control devices.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 184.1, Solid-State Dimming Controls (Bi-national standard with UL 1472 updates).

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 MANUAL ON/OFF SWITCHING

.1 Individual switches ganged as indicated.

.2 Single or double pole, single or double throw as required to suit switching shown on drawings.

.3 Load rating of device shall be sufficient for size and type of lighting load being switched.

.4 Provide additional control contactors or relays for multi-circuit switching as required.

.5 Key operated where shown on Contract Drawings

.6 Motor rated where shown controlling motor circuit.

.7 Decora style commercial grade. Provide complete with cover plate. Refer to Technical Specification 26 27 26 Wiring Devices for cover plate requirements.

Part 3 Execution

3.0 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet .

3.1 INSTALLATION

.1 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

.2 Where lighting control devices are to be located in close proximity, they shall be ganged with a common device box and cover plate, with voltage barriers as required

3.2 FIELD QUALITY CONTROL

.1 Site Tests:

.1 Perform tests in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical and Technical Specification 26 05 10 Testing and Commissioning.

.2 Demonstrate dimming systems operate as intended and there are no problems in starting lamps, nor in keeping them lit, and free of perceptible flicker at required settings of dimming intensity control.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Potential Transformer 2
2.1 Current Transformers 2
2.2 Mounting Brackets 3
Part 3 Execution 3
3.0 Installation 3
3.1 Protection 3

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of transformers.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 27 15 Electrical and Controls Components

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C13-[M83], Instrument Transformers.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 POTENTIAL TRANSFORMER

.1 Potential transformers: to CSA C13, dry type, indoor use, with the following characteristics:

.1 Sized to suite.

.2 As indicated on the Contract Drawings.

2.1 CURRENT TRANSFORMERS

.1 Current transformers: to CSA C13, dry type for indoor use, with the following characteristics:

.1 Sized to suite.

.2 As indicated on the Contract Drawings.

.2 Positive action automatic short-circuiting device in secondary terminals.

2.2 MOUNTING BRACKETS

.1 Fabricate brackets and channels from electrogalvanized code gauge painted steel.

Part 3 Execution

3.0 INSTALLATION

.1 Install instrument transformers and ensure accessibility.

3.1 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by control and signal transformers installation.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Meter Socket 2
2.1 Meter Enclosure 2
2.2 Metering Antenna 3
2.3 Equipment Identification 3
Part 3 Execution 3
3.0 Installation 3

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of service equipment.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 28 Grounding - Secondary

1.3 REGULATORY REQUIREMENTS

.1 BC Hydro

.1 Refer to BC Hydro Requirements for Secondary Voltage Revenue Metering (https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/distribution/standards/ds-rmr-secondary-voltage-750v-and-less.pdf)

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Section 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 METER SOCKET

.1 Ratings as indicated in Contract Drawings.

.2 Supplied with screw type ring.

2.1 METER ENCLOSURE

.1 Rating: CSA Type 3R

.2 Construction:

.1 Material: stainless steel

.2 Flip-up padlockable cover

.3 Pole bracket designed for bolt or band-on installation

.4 Suitable for overhead or underground service

.3 Viewing Window: As required when indicated on Contract Drawings.

.1 Material: 1/2 inch thick lexan.

.4 Mount: As indicated on Contract Drawings.

2.2 METERING ANTENNA

.1 Include provision for exterior antenna per BC Hydro standards.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical.

.2 Label size: 2.

.3 Nameplate shall include equipment name, voltage, and phase.

.1 Confirm nameplate wording with Contract Administrator prior to manufacture.

Part 3 Execution

3.0 INSTALLATION

.1 Install service equipment as indicated on Contract Drawings.

.2 Connect to incoming service.

.3 Connect to outgoing load circuits.

.4 Make grounding connections in accordance with Technical Specification 26 05 28 Grounding - Secondary

.5 Make provision for BC Hydro's metering.

.6 Allow for BC Hydro coordination, supply and delivery of materials.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Sections 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Service Entrance and Distribution Board 2
2.1 Main Circuit Breaker 3
2.2 Equipment Identification 3
Part 3 Execution 4
3.0 Installation 4

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of the service entrance board.

1.2 RELATED SECTIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 02 Seismic Restraint

.3 Technical Specification 26 24 01 Service Equipment

.4 Technical Specification 26 28 23 Disconnect Switches

.5 Technical Specification 26 28 16 02 Molded Case Circuit Breakers

1.3 REGULATORY REQUIREMENTS

.1 BC Hydro

.1 Refer to BC Hydro Requirements for Secondary Voltage Revenue Metering (https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/distribution/standards/ds-rmr-secondary-voltage-750v-and-less.pdf)

.2 Distribution Standards: Underground Electrical: ES53

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 SERVICE ENTRANCE AND DISTRIBUTION BOARD

.1 Rating: As indicated on Contract Drawings.

.1 L-Box per BC Hydro standards.

.2 Horizontal bus assembly.

.3 Cable clamp assembly.

.4 Grounding assembly.

.5 Identify phases with colour coding.

.2 Cable pull section:

.1 Refer to BC Hydro metering to the Requirements for Secondary Voltage Revenue Metering (http://www.bchydro.com/ext/metering/).

.2 Refer to BC Hydro Distribution Standards: Underground Electrical: ES53.

.3 Each bus to have lugs to accept service conductors.

2.1 MAIN CIRCUIT BREAKER

.1 Solid State Electronic Trip Breaker as indicated on Contract Drawings.

.2 Common-trip breaker: with single handle for multi-pole applications.

.3 Moulded case circuit breaker to operate by means of solid state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long-time/short time/instantaneous tripping for short circuit protection.

.4 Programmable electronic solid state trip unit with separately adjustable long time, short time, and instantaneous settings.

.5 Circuit breaker with interchangeable trips as indicated.

.6 Minimum symmetrical RMS interrupting capacity rating: As indicated on Contract Drawings.

.7 System has been designed to achieve arc flash incident energy levels of less than 1.2 calories/cm^2 for all points downstream of main utility circuit breaker. Provide circuit breakers as required to achieve same.

.8 Provide NEMA 1 enclosures for breakers where indicated.

.9 Short Circuit Capacity: Min 42kA or as indicated on the contract drawings.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical.

.2 Label size: 2.

.3 Nameplate shall include equipment name, voltage, and phase.

.1 Confirm nameplate wording with Contract Administrator prior to manufacture.

Part 3 Execution

3.0 INSTALLATION

.1 Install seismic restraint for all equipment. See Technical Specification 26 05 02 – Seismic Restraint.

.2 BC Hydro metering to be installed as indicated on Contract Drawings per Requirements for Secondary Voltage Revenue Metering.

.3 Connect main service to disconnect switch on service pole and feed to BC Hydro service meter.

.4 Connect load terminals of distribution breakers to feeders.

.5 Check factory made connections for mechanical security and electrical continuity.

.6 Run one grounding conductor bare copper sized per the Contract Drawings from neutral bus to ground bus to main ground.

.7 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specification 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Surge Protection Device 2
2.1 Equipment Identification 3
Part 3 Execution 3
3.0 Installation 3

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of transient voltage surge suppression (i.e. surge protection device).

1.2 RELATED TECHNICAL SPECIFICATION

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 SURGE PROTECTION DEVICE

.1 Provide for transient voltage surge suppression as indicated on Contract Drawings.

.2 Short Circuit Current Ratings: 200kA

.3 Surge Capacity Rating:

.1 Service Entrance (347/600V) – 200kA per Phase (min.)

.2 Service Entrance (120/208V) – 100kA per phase (min.)

.3 Service Entrance (120/240V) – 50kA per phase (min.)

.4 One (1) form C (NO/NC) dry relay alarm output contacts.

.5 Direct bus mounted.

.6 Standard of acceptance: same manufacturer as panelboard.

2.1 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 Common Work Results for Electrical.

.2 Label size: 2.

.3 Nameplate shall include equipment name, voltage, and phase.

.1 Confirm nameplate wording with Contract Administrator prior to manufacture.

Part 3 Execution

3.0 INSTALLATION

.1 Surge protection device integral to panelboard.

.2 Install conductors between suppressor and point of attachment to service equipment sized in accordance with manufacturer's shop drawings and keep conductor lengths as short as possible, not to exceed 600 mm. Provide information from manufacturers who offer an integrated surge protection device in the main service entrance equipment clearly showing lead lengths, including the neutral and ground connections.

.3 Grounding: bond suppressor ground to the equipment grounding conductor and service entrance ground.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Panelboards 2
2.1 Breakers 3
2.2 Equipment Identification 3
Part 3 Execution 4
3.0 Installation 4

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of panelboards and circuit breakers.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 28 16 02 Molded Case Circuit Breakers

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 29-11, Panelboards and enclosed Panelboards.

.2

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 PANELBOARDS

.1 Panelboards based on CSA C22.2 No. 29.

.2 Product of one manufacturer.

.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.

.3 Bus and breakers rated as indicated on the Contract Drawings. Symmetrical interrupting capacity as indicated on Contract Drawings but not less than 42kA.

.4 Sequence phase bussing with odd numbered breakers on the left and even numbered breakers on the right, with each breaker identified by permanent number identification as to circuit number and phase.

.5 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.6 Minimum of 2 flush locks for each panelboard.

.7 Two keys for each panelboard and key panelboards alike.

.8 Copper bus with neutral of same ampere rating as mains.

.9 Mains: suitable for bolt-on breakers.

.10 Trim with concealed front bolts and hinges.

.11 Trim and door finish: baked grey enamel.

.12 Isolated ground bus.

.13 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

.14 Provide minimum additional space for future breakers in panelboards as follows:

.1 Panelboards 120/240V, up to 225A: minimum 10% space and 10% spare 15A breakers or as noted on the Contract Drawings

.2 Distribution boards greater than 240V: minimum 20% or as noted on the Contract Drawings

2.1 BREAKERS

.1 Breakers: in accordance with Technical Specification 26 28 16 02 Molded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker (where applicable): separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 Common Work Results for Electrical.

.2 Label size: 2.

.3 Nameplate shall include equipment name, voltage, and phase.

.1 Confirm nameplate wording with Contract Administrator prior to manufacture.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.0 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Mount panelboards to height specified in Technical Specification 26 05 00 Common Work Results – Electrical or as indicated on Contract Drawings.

.3 Connect loads to circuits.

.4 Connect neutral conductors to common neutral bus.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 3
2.0 Pump Control Panel 3
2.1 Pump Control Panel Components 5
2.2 Electrical Kiosk 6
Part 3 Execution 12
3.0 Installation 12
3.1 Controls 13
3.2 Maintenance Materials 13
3.3 Field Quality Control 13

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for equipment and components housed in cabinets and enclosures.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 10 Testing and Commissioning

.3 Technical Specification 26 05 31 Splitters, Junction, Pull Boxes and Cabinets

.4 Technical Specification 26 28 16 02 Molded Case Circuit Breakers

.5 Technical Specification 26 28 23 Disconnect Switches

.6 Technical Specification 26 29 03 Control Devices

.7 Technical Specification 26 50 00 Lighting

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

.2 C22.2 No. 94.1-15 - Enclosures for electrical equipment, non-environmental considerations

.3 C22.2 No. 94.2-15 - Enclosures for electrical equipment, environmental considerations.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 PUMP CONTROL PANEL

.1 Line Power: 240V, 60Hz, 1-phase, unless otherwise indicated on Contract Drawings.

.2 Modified to suit the components in Technical Specification 26 29 03 Control Devices and Technical Specification 26 29 23 11 Variable Frequency Drive.

.3 Application:

.1 House electrical equipment within electrical kiosks providing a degree of protection from falling dirt, dust, oil, and water.

.2 House electrical equipment at remote monitoring sites providing a degree of protection against ingress of water.

.4 Construction:

.1 Outdoor enclosures shall be fabricated from marine grade aluminum. Steel enclosures are acceptable for indoor areas.

.2 Enclosures shall be rigid, wall or pole mounted. Outdoor enclosures shall be rated NEMA 3R. NEMA 1 is acceptable for indoor enclosures.

.3 Smooth, continuously welded seams without knockouts, cutouts, or holes.

.4 Welded brackets for enclosure mounting.

.5 Formed lip on door and enclosure to prevent ingress of flowing liquids and contaminants.

.6 Continuously hinged door with provision for removal by pulling hinge pin.

.7 Door secured with multi-point latch system including provision for padlocking.

.8 Permanently secured continuous gasket around door.

.9 Removable inner back and side panels, as required.

.10 Bonding studs on door, enclosure, and panels.

.11 Grounding and Bonding lugs, as required. VFD grounding completed as specified by the manufacturer.

.12 Literature pocket located on inside of door.

.13 Heating and ventilation per the Contract Drawings.

.5 Finish:

.1 Door and enclosure shall be finished in recoatable smooth ANSI 61 gray powder coating inside and out.

.2 Inner panels shall be finished with white powder coating.

.6 Power System Design

.1 Provide detailed design for Pump Control Panel power components per the requirements listed in this section:

.2 Pump Control Panel to include the following elements for powering the submersible pumps:

.1 Provide VFD based starters for the pumps

.2 Provide line reactors and DV/DT filters based on pump manufacturer recommendations

.3 Provide individual pump disconnect circuit breakers with through door disconnect handles

.4 Provide terminal blocks for pump power connections in Pump Control Panel

.5 Provide ventilation fans suitable for adequate ventilation within Pump Control Panel

.7 Control System Design:

.1 Provide detailed design for Pump Control Panel per the requirements listed in this section.

.2 Pump Control Panel to include the following elements for control of the submersible pumps:

.1 Provide duty-standby operation of the pumps with interlock to prevent simultaneous operation of the pumps

.2 Provide lead-lag select functionality including pump alternating lead select based on adjustable timer

.3 Provide indication lights on front panel for pump running and pump fault for each pump

.4 Provide hand-off-auto selector switch and associated controls for each pump

.5 Provide adjustable potentiometer dial for speed adjustment for hand operation of the pumps

.6 Provide elapsed time meter for each pump

.7 Provide full speed pump operation in automatic mode

.8 Provide level indication on front panel of pump control panel

.9 Provide high level float indication on front panel of pump control panel

.10 Provide output relays for interconnection to remote alarm panel for the following alarms – High Level, Pump 1 Fault, Pump 2 Fault.

.11 Provide primary and backup pump start up controls

.3 Primary Pump Operation:

.1 Shall be based on submersible level transducer feedback

.2 Shall be based on a smart relay or controller with configurable setpoints for level feedback and start/stop operation

.4 Backup Pump Operation:

.1 Shall be based on high level float feedback

.2 Shall be based on relay and timer control with configurable pump down timer

.8 Enclosure dimensions on Contract Drawings are approximate only. Contractor to determine final enclosure dimensions to layout all of proposed equipment.

.9 Control panel shall include provision for 20 percent future expansion.

.10 All enclosure assemblies shall be from the same manufacturer, shall bear the CSA seal of approval, or other certification mark acceptable in the Province of British Columbia, and be manufactured by an electrical control panel manufacturer regularly engaged in this type of work.

.11 Shop Drawings for the electrical enclosures are to be submitted in accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

2.1 PUMP CONTROL PANEL COMPONENTS

.1 VFD Specific Cabinet Components:

.1 Refer to Technical Specification 26 29 23 11 Variable Frequency Drive.

.2 Selector Switches:

.1 Refer to Technical Specification 26 29 03 Control Devices.

.3 Indicators/Pilot Lights:

.1 Refer to Technical Specification 26 29 03 Control Devices.

.4 Push buttons:

.1 Refer to Technical Specification 26 29 03 Control Devices

.5 Ethernet Bulkhead Receptacle:

.1 Refer to Technical Specification 26 27 26 Wiring Devices.

.6 Network switch:

.1 Refer to Technical Specification 26 29 05 Data Communications Infrastructure.

.7 Interposing Relays:

.1 Refer to Technical Specification 26 29 03 Control Devices.

.8 Intrinsically Safe Relays:

.1 Refer to Technical Specification 26 29 03 Control Devices.

.9 Intrinsically Safe Barriers:

.1 Refer to Technical Specification 26 29 03 Control Devices.

.10 24VDC Power Supply and Diode Module

.1 Refer to Technical Specification 26 29 03 Control Devices.

.11 Circuit Breakers

.1 Refer to Technical Specification 26 27 16 02 Molded Case Circuit Breakers.

.12 Terminals and Interconnect Wiring:

.1 In accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

.2 DIN rail mounted terminals complete with dividers and end stops as required. Provide 10 spare terminals on each section and additional spare terminals as noted on the Contract Drawings.

.3 Utilize plastic finger wiring ducts for organization of all interior and field wiring. Ducts are to be filled to no more than 50% of capacity.

.4 Use ferrules at termination points on stranded wires.

.5 A space of 200 mm must be kept clear for field wiring. All wiring labels must be clearly visible at completion.

2.2 ELECTRICAL KIOSK

.1 Electrical Kiosk shall be rigid, free-standing, vandal resistant kiosk, rated CSA Type 3R and certified to CAN/CSA C22.2 No. 94.1-15 and CAN/CSA C22.2 No. 94.2-15.

.2 Kiosk dimensions on Contract Drawings are approximate only. **Contractor to determine final kiosk dimensions to layout all of proposed equipment.**

.3 All kiosk assemblies shall be from the same manufacturer, shall bear the CSA seal of approval, or other certification mark acceptable in the Province of British Columbia, and be manufactured by an electrical control panel manufacturer regularly engaged in this type of work.

.4 General Material Requirements:

.1 All materials shall be new.

.2 Equipment shall be fabricated from marine grade 5052-H32 sheet aluminum of a least 3.2 mm (1/8 in.) thickness.

.3 Use stainless steel hardware, unless otherwise noted.

.5 Connecting Hardware:

.1 Miscellaneous hardware other than screws, nuts, bolts and washers shall be stainless steel.

.2 Connecting hardware (i.e. screws, nuts, bolts and washers) 3/8” diameter or smaller and shall conform to the following:

.1 All hardware shall have unified national thread form (ANSI) and shall be stainless steel.

.2 All nuts and bolts 1/4-20 and large shall have unified national threads and hexagon heads, and shall bear suitable markings to identify their grade and origin of manufacture.

.3 All machine screws smaller than 1/4-20 (ex. 8-32 UNC, 10-24 UNC) shall be Robertson pan-head. All screw heads shall be sized so only one screwdriver is required when working on the panels.

.4 No sheet metal or self-tapping screws shall be used.

.6 Fabrication Mechanical Requirements

.1 The kiosk shall be fabricated with sufficient bracing to form a structure capable of withstanding transportation, wind, snow and ice loading. The kiosk manufacturer is responsible for obtaining certification from EGBC registered professional engineer.

.2 Recommended anchor locations shall be provided on Shop Drawings.

.3 Anchor requirements shall be provided based on wind, snow and seismic loading criteria for the geographic location of the installation.

.4 Importance factor of one (1) shall be considered for the installation.

.1 All exterior corners shall be rounded to a radius of 3.17mm (1/8 inch) minimum.

.2 All sharp edges shall be de-burred to a radius of 0.4mm (1/64 inch) minimum in order to reduce hazards to service personnel.

.5 Welding:

.1 All welds shall be in accordance with CAN/CSA W59.2 – Welded Aluminum Construction.

.2 All welding to be performed by Canadian Welding Bureau certified welders.

.3 The Supplier shall have suitable credentials to weld aluminum and shall adhere to all applicable ANSI standards. Project references shall be made available upon request.

.4 All exterior seams shall be of continuously welded construction. Exterior seams shall not be visible. All exterior welds shall be ground smooth.

.5 All welds shall be free of slag and spatter.

.6 Roof:

.1 The roof shall have a minimum 75 mm overhang with continuous rain gutters.

.2 Lifting eyes shall be secured to the frame or the kiosk on reinforced material and be removable after installation.

.7 Doors:

.1 Doors shall have internal bracing when required to prevent excessive distortion.

.2 Doors shall be at least 100mm above concrete pad.

.3 All kiosk doors are to be lockable. The latches must contain minimum 13 mm diameter hole to receive padlock. Door handles must contain provision for double padlock capability.

.4 All double doors to be overlapping with no center mullion.

.5 The door handle shall be galvanized steel and powder coated the same colour as the kiosk. Latch handle shall swing towards hinge side of door.

.6 Doors shall have three point latching devices with vertical bars that are riveted to actuator bar.

.7 Handles, latches and padlocks shall be installed recessed in a pocket such that they cannot be struck off or cut with a standard hacksaw.

.8 Handle shall not protrude from recessed pocket during operation.

.9 Door hardware to be mounted with tamper resistant hardware.

.10 Each door shall have a hydraulic dampener to hold the door in the open position at 90 degrees.

.11 Hinges shall be hidden and not accessible from the outside with the door closed. Hinge body to be aluminum with stainless steel hinge pin. Hinges to be of permanently lubricated design

.8 Door Gaskets:

.1 The gasket shall be of one continuous piece per side (ex. four strips per opening) and shall be permanently bonded to the metal.

.2 The gasket shall be of an appropriate length so as not to have gaps at gasket joints or to shrink over time.

.3 The surface of the gasket shall be covered with a silicon lubricant to prevent sticking to the mating surface.

.4 The hinge shall be designed to prevent binding of the gasket.

.9 Plan Pouch and Laptop Shelf

.1 Kiosk shall include a waterproof plan pouch (400mm high x 300mm wide minimum) on inside of door in the controls compartment. The pouch shall be secured using stainless steel fasteners.

.2 Kiosk shall include fold down door-mounted equipment/laptop shelf in the controls compartment. Shelf shall be mounted such that top of shelf is located 1100mm (36”) above the top of finished grade.

.7 Kiosk Finish

.1 General Requirements:

.1 The powder coating process shall be tested on at least one piece from a given batch of aluminum components to ensure a high quality coating for that type of component before the complete batch is powder coated. If there is uncertainty about the quality or appearance of the powder coating, the Contractor shall obtain the Owner’s approval on the powder coating.

.2 Items to be powder coated shall be free of dents, scratches, weld burns, ripples, pits, and abrasion before powder coating.

.3 Removable components which may be damaged by the powder coating process shall be removed before powder coating and reassembled after powder coating.

.4 Mask all threaded hardware and tapped holes, as required.

.2 Pre-Treatment:

.1 The powder coating pre-treatment shall include the following steps in sequential order:

.1 Alkaline cleaning, or equivalent as required, to remove process oil, grease, and dirt.

.2 Rinsing, as required.

.3 Multi-metal iron phosphate coating or dried in place pre-treatment to increase corrosion resistance and improve paint adhesion. Follow chemical supplier's specifications. Chemical concentration, temperature, and timing specifications must be followed precisely.

.4 Rinsing, as required.

.5 Non-chrome, or equivalent, sealing coating to provide additional corrosion protection. Follow chemical supplier's specifications. Chemical concentration, temperature, and timing specifications must be followed precisely.

.3 Drying / Pre-Heating:

.1 All items to be powder coated must be completely dry and pre-heated as required to help prevent out-gassing before powder coat application.

.4 Application:

.1 Powder coat shall be of type Polyester-TGIC.

.2 Powder coat colour: RAL code to be provided by the Owner at the time of shop drawing review.

.3 For porous castings, a powder coat type shall be selected to help prevent out-gassing.

.4 Powder coat must be applied to meet the powder coat manufacturer's specifications.

.5 Powder coat thickness shall be applied to a total 2.5-3.5 mils thickness.

.6 Full-coverage of interior and exterior surfaces is required, with no light spots allowed on exterior surfaces.

.5 Final Appearance:

.1 All powder coatings shall be smooth, substantially free of contamination, flow lines, light spots, powder build-up, powder washout, streaks, sagging, runs, blisters, and other defects that would in any way impair serviceability or detract from the general appearance.

.2 The final product shall be free of thickness variations, poor adhesion, orange peel, blistering, pinholes, craters, powder puffs, drips, colour variations, clouding or grainy/wavy flow, dents, scratches, weld burns and abrasions harmful to its strength and general appearance.

.3 Contractor shall supply and install shrink-wrapped image around all sides of electrical kiosk, if applicable. Owner to provide image during shop drawing review process.

.8 Equipment Mounting Panels:

.1 The kiosk shall be provided with full height inside mounting panels.

.2 Panels shall be minimum 14 gauge galvanized steel painted white.

.3 Panels shall be removable and suitable for drilling and tapping in order to mount internal components.

.9 Kiosk Environmental Requirements

.1 General:

.1 Provide sufficient airflow to keep equipment temperature to below its maximum temperature rating to prevent overheating of the equipment under all prevailing temperature conditions for the area in which it will be installed.

.2 Provide positive pressure ventilation to ensure that dust does not enter the cabinets.

.2 Insulation:

.1 The Supplier shall insulate all sides, doors, and roof of the kiosk.

.2 Insulation shall be 25mm Polyisocyanurate Insulation Sheathing. All edges and seams to be sealed with foil tape.

.3 The insulation shall have a minimum R-rating of 4.5.

.4 On doors, insulation shall be concealed by full height 20 gauge aluminum plates.

.5 On sides and roof, insulation shall be located between outer shell and mounting panels.

.3 Ventilation:

.1 Refer to Technical Specification 26 54 00 Heaters and Ventilation.

.4 Kiosk Heating:

.1 Refer to Technical Specification 26 54 00 Heaters and Ventilation.

.5 Thermostat:

.1 Refer to Technical Specification 26 54 00 Heaters and Ventilation.

.10 Kiosk Lighting:

.1 Kiosk lights shall be LED in accordance with the requirements under Technical Specification 26 50 00 Lighting.

.2 Provide door switch in accordance with Technical Specification 26 27 26 Wiring Devices.

.11 Conduit and Wiring:

.1 Wiring between components within the kiosk shall be in EMT.

.2 Conduit to be in accordance with the requirements under Technical Specification 26 05 34 Conduits, Conduit Fastenings and Conduit Fittings.

.3 Wiring to be in accordance with the requirements under Technical Specification 26 05 21 Wires and Cables (0-1000V)

.12 Electrical Assemblies:

.1 Equipment within the kiosk shall be within enclosures in accordance with the requirements under Technical Specification 26 05 31 Splitters, Junction, Pull Boxes and Cabinets.

.2 Enclosures shall be gray powder coat finish inside and out over pretreated surfaces.

.3 Additional equipment are listed in the Contract Drawings and in the electrical Technical Specifications.

Part 3 Execution

3.0 INSTALLATION

.1 Install cabinets as indicated in the Contract Drawings.

.2 Apply touch up paint as required.

.3 Make field power and control connections as indicated.

.4 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and datasheet.

.5 Supply all necessary equipment and wiring to provide the points connected to the equipment as indicated on the Contract Drawings.

.6 Assemble the control cabinets and VFD cabinets to include the components identified within the Contract Documents and indicated on the Contract Drawings.

.7 Supply, install, and connect external sensors and components as shown on the Contract Drawings.

.8 Contractor to install radio and ancillary equipment including, but limited to, antenna and coax cabling. Contractor to coordinate radio configuration and antenna aiming with Owner where indicated on the Contract Drawings.

3.1 CONTROLS

.1 Refer to process narrative for programming requirements.

3.2 MAINTENANCE MATERIALS

.1 Provide:

.1 Ten (10) spare fuses of each type used in the panel, as required.

.2 One (1) control relay of each type used in the control panel.

.3 Any other components which the Contractor recommends to be kept as spares.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Ensure moving and working parts are lubricated where required.

.3 Operate system to prove satisfactory performance of complete system during 24 hour period.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Switches 2
2.1 Receptacles 3
2.2 Cover Plates 3
2.3 Equipment Identification 4
Part 3 Execution 4
3.0 Installation 4
3.1 Protection 4

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No. 42-10, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA C22.2 No. 42.1-13, Cover Plates for Flush Mounted Wiring Devices (Bi national standard, with UL 514D).

.3 CSA C22.2 No. 55-15, Special Use Switches.

.4 CSA C22.2 No. 111-10, General Use Snap Switches (Bi national standard, with UL 20).

.5 CSA-C22.2 No. 177-13, Clock-operated Switches

.6 CSA-C22.2 No. 184-15, Solid-State Lighting Controls

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 SWITCHES

.1 15A, 120 V, single pole, specification grade switches to: CSA-C22.2 No. 55 and CSA-C22.2 No. 111.

.2 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 White toggle.

.3 Toggle operated fully rated for tungsten filament, fluorescent, and LED lamps, and up to 80% of rated capacity of motor loads.

.4 Provide switches with occupancy sensors for control of interior lighting.

.5 Switches will be of one manufacturer throughout the Project.

2.1 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R/20R as indicated, 125 V, 15/20 A as indicated, U ground, to: CSA-C22.2 No.42 with following features:

.1 White urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and riveted grounding contacts.

.2 Other receptacles with ampacity and voltage as indicated in Contract Drawings.

.3 Receptacles will be of one manufacturer throughout the Project.

.4 Ground fault interrupting capabilities as indicated in Contract Drawings.

.5 Ethernet Bulkhead Receptacle:

.1 Application: Feed-thru coupler

.2 Mounting: Jam nut panel mount

.3 Connector: Female RJ45

.4 Rating: IP67-weatherproof with attached cap.

2.2 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No. 42.

.2 Cover plates will be of one manufacturer throughout the Project.

.3 Stainless steel.

.4 Weatherproof RPVC cover plates for surface-mounted FS or FD Type boxes.

.5 Weatherproof clear, lockable, while-in-use cover plates for all GFI locations, as indicated in Contract Drawings.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Install identification labels indicating circuit, voltage, and phase.

Part 3 Execution

3.0 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 switch is required in one location.

.3 Mount toggle switches at height in accordance with Technical Specification 26 05 00 Common Work Results – Electrical or as indicated on the Contract Drawings.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Technical Specification 26 05 00 Common Work Results – Electrical or as indicated on the Contract Drawings.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Install GFI type receptacles as indicated on Contract Drawings.

.3 Cover plates:

.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.

3.1 PROTECTION

.1 Protect installed products and components from damage during Construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Breakers General 2
2.1 Thermal Magnetic Breakers 3
2.2 Solid State Electronic Trip Breakers 3
2.3 Main Circuit Breaker 3
2.4 Enclosure 3
Part 3 Execution 4
3.0 Installation 4

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials for molded-case circuit breakers.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 – Common Work Results for Electrical.

.2 Technical Specification 26 24 02 – Service Entrance Board

.3 Technical Specification 26 27 16 – Electrical Cabinets and Enclosures

.4 Technical Specification 26 24 16 01 – Panelboard Breaker Type

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489 and NMX-J-266-ANCE).

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit documents to the Contract Administrator in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Submit trip unit datasheets and time-current characteristic curves for breakers to the Contract Administrator.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 BREAKERS GENERAL

.1 Molded case circuit breakers based on CSA C22.2 No. 5-16.

.2 Bolt-on molded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.5 Circuit breakers in Panelboards to have minimum interrupting capacity ratings of 42kA or as indicated on the Contract Drawings.

2.1 THERMAL MAGNETIC BREAKERS

.1 Molded 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.

2.2 SOLID STATE ELECTRONIC TRIP BREAKERS

.1 Solid state electronic trip breakers as indicated on Contract Drawings.

.2 Common trip breakers: with single handle for multi pole applications.

.3 Molded case circuit breaker to operate by means of solid state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long-time/short time/instantaneous tripping for short circuit protection.

.4 Programmable electronic solid state trip unit with separately adjustable long time, short time, and instantaneous.

.5 Circuit Breakers to have auxiliary contact for PLC notification of breaker status (contact changes state when breaker is open), where indicated on Contract Drawings.

.6 Circuit breakers with interchangeable trips as indicated on Contract Drawings.

.7 Circuit breakers to have minimum interrupting capacity ratings as indicated on Contract Drawings.

.8 Refer to single line diagrams within Contract Drawings. System has been designed to achieve arc flash incident energy levels of less than 1.2 calories/cm2 for all points downstream of main utility circuit breaker. Provide circuit breakers as required to achieve same.

.9 Standard of Acceptance: Eaton with DigiTrip 310+ (LSI) trip device.

2.3 MAIN CIRCUIT BREAKER

.1 Main Circuit Breaker in accordance with Technical Specification 26 24 02 – Service Entrance Board.

2.4 ENCLOSURE

.1 Provide enclosures for breakers as specified in Technical Specification 26 05 31 Splitters, Junction, Pull Boxes and Cabinets.

Part 3 Execution

3.0 INSTALLATION

.1 Manufacturer's instructions to be followed for circuit breaker installation.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Pump Control Panel Disconnect Switches 2
2.1 Equipment Identification 3
Part 3 Execution 3
3.0 Installation 3

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of disconnect switches.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 24 02 Service Entrance Board

.3 Technical Specification 26 27 16 Electrical Cabinets and Enclosures

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No. 4, Enclosed and Dead-Front Switches (Tri-National Standard, with ANCE NMX-J-162 and UL 98).

.2 CAN/CSA-C22.2 No. 14, Industrial Control Equipment

.3 CSA C22.2 No. 39, Fuseholder Assemblies.

1.4 SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 PUMP CONTROL PANEL DISCONNECT SWITCHES

.1 To: CSA C22.2 No. 14

.2 Circuit breaker based, size as indicated in Contract Drawings.

.3 Operation: rotary on/off with position indication on panel door.

.4 Type: open with external operator, shaft length for handle to be determined by panel builder.

.5 Provision for padlocking in on-off switch position.

.6 Short-circuit rating, as indicated in Contract Drawings.

.7 Auxiliary contacts, as indicated in Contract Drawings

.8 Standard of acceptance as indicated in Contract Drawings.

2.1 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

.2 Label size: 2.

.3 Nameplate shall include equipment name, voltage, and phase.

.1 Confirm nameplate wording with Contract Administrator prior to manufacture.

Part 3 Execution

3.0 INSTALLATION

.1 Install disconnect switches as indicated in Contract Drawings.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Contactors 2
2.1 Equipment Identification 3
Part 3 Execution 3
3.0 Installation 3
3.1 Protection 3

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Contactor materials, installation.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 – Common Work Results for Electrical.

1.3 REGULATORY REQUIREMENTS

.1 CSA International

.1 CSA C22.2 No.14, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 2, Controllers, Contactors and Overload Relays Rated 600 V.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit documents to the Contract Administrator in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

Part 2 Products

2.0 CONTACTORS

.1 Contactors: to CSA C22.2 No.14.

.2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled.

.3 Breaker combination contactor as indicated.

.4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.5 Mount in NEMA Enclosure 3R unless otherwise indicated.

.6 Include following options in cover:

.1 [Red] [Green] indicating lamp.

.2 [Stop-Start] pushbutton.

.3 [Hand-Off-Auto] selector switch.

.4 [On-Off] selector switch.

.7 Control transformer: in accordance with Technical Specification [26 29 03 - Control Devices], factory wired and installed in contactor enclosure.

2.1 EQUIPMENT IDENTIFICATION

.1 Identify equipment in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical.

.2 Size 4 nameplate indicating name of load controlled, source panel and circuit, voltage, and phase.

Part 3 Execution

3.0 INSTALLATION

.1 Install contactors and connect power wires and auxiliary control devices.

.2 Identify contactors with nameplates or labels indicating panel and circuit number.

.3 Test contactors in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical and Technical Specification 26 05 10 – Testing and Commissioning.

3.1 PROTECTION

.1 Protect installed products and components from damage during construction.

Repair damage to adjacent materials caused by contactor installation.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical SpecificationS 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Control Relays 2
2.1 Timing Relays 3
2.2 Relay Accessories 3
2.3 Door Switches 3
2.4 Limit Switches 3
2.5 Pushbuttons 4
2.6 Selector Switches 4
2.7 Indicating Lights 4
2.8 Control Circuit Transformers 4
2.9 24VDC Power Supply 4
2.10 Control Fuse Holders and Fuses 4
2.11 Intrinsically Safe Relays 5
2.12 Intrinsically Safe Barriers 5
Part 3 Execution 5
3.0 Installation 5
3.1 Field Quality Control 5

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for electrical control devices.

.2 Some equipment and devices listed under the Products section of the may not be utilized for this project. The Contractor shall refer to the Contract Drawings to identify which equipment is required.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results - Electrical.

.2 Technical Specification 26 27 16 Electrical Cabinets and Enclosures.

1.3 REGULATORY REQUIREMENTS

.1 CSA International

.1 CSA C22.2 No. 14, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit documents to the Contract Administrator in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

Part 2 Products

2.0 CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No. 14.

.2 Unless otherwise noted, use flat-pin encapsulated type plug-in relays.

.3 120 VAC relays: General purpose, 2PDT, plug-in, complete with test button, operation indicator, and surge suppressor.

.4 24 VDC relays: General purpose type, 2PDT, plug-in, complete with test button, operation indicator (red), and surge suppression RC Circuit. RC circuit may be external to relay using manufacturer's approved components, soldered and insulated using heat-shrink sleeves.

.5 Relay contacts: Form C rated 110 VAC, 10A resistive, and 7.5 A inductive.

.6 Provide retainer to hold/secure relay in seated position.

2.1 TIMING RELAYS

.1 Unless otherwise noted, use plug-in timer relays.

.2 Time delay relays for behind panel-mounting: 2PDT, plug-in, and programmable for 16 time ranges and 6 operation modes.

.3 Time delay relays for flush panel mounting and accessible timing range modifications: SPDT, screw terminals, programmable for five timing ranges and nine operation modes, complete with digital display, module for time settings, and flexible protective cover.

.4 Output contact: Form C rated at 250 VAC, 5 amp with p.f. = 1.

.5 Provide relay plug-in sockets for DIN mounting, complete with stacked screw clamp terminals.

.6 Provide retainer to hold/secure relay in seated position.

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

2.3 DOOR SWITCHES

.1 Provide a door switch mounted to the kiosk such that actuation occurs when the outer door with handle is opened, the switch is triggered.

.2 Door switch shall have a lever type actuation with 1 normally open and 1 normally closed set of contacts.

.3 Door switch shall be suitably rated for hazardous application locations where indicated on the Contract Drawings.

2.4 LIMIT SWITCHES

.1 Minimum standard is heavy duty, oiltight, or as specified for field-located devices.

.2 Adjustable wand-type operating levers.

2.5 PUSHBUTTONS

.1 Panel mountable, 120VAC/24VAC/DC rated, as required, momentary contacts, normally open, 30mm.

.2 Bezel Material: Chromium Plated Metal.

.3 Colour: Black unless otherwise indicated on Contract Drawings.

2.6 SELECTOR SWITCHES

.1 Panel mountable, two, three or four position, as indicated on the Contract Drawings, 30mm.

.2 Contact arrangement as indicated and to suit control requirements.

.3 120VAC/24VAC/DC rated, as required.

.4 Bezel Material: Chromium Plated Metal

.5 Colour: Black unless indicated otherwise on Contract Drawings.

2.7 INDICATING LIGHTS

.1 Panel mountable, round, LED-based, push-to-test, 30mm, 120VAC/24VAC/DC rated, as required.

.2 Bezel Material: Chromium Plated Metal

.3 Colour as indicated on Contract Drawings.

2.8 CONTROL CIRCUIT TRANSFORMERS

.1 Refer to Technical Specification 26 12 16 01 – Dry Type Transformers up to 600V Primary.

2.9 24VDC POWER SUPPLY

.1 Basis of design: Phoenix Contact QUINT4-PS/1AC/24DC/20.

2.10 CONTROL FUSE HOLDERS AND FUSES

.1 Applicable to fuses protecting control circuits, primary and secondary windings of instrument transformers, voltage sensing circuits, and other similar circuits.

.2 Type and size as shown or as selected by panel builder for optimum protection of equipment being served.

.3 Door-mounted fuse holders for small-dimension fuses 6.4 x 31.8 mm (¼" x 1¼ "). Where possible, use different models for different voltages:

.1 120 VAC circuits, Type HKL with clear octagon knob.

.2 12 V dc circuits, Type HKT with amber octagon knob.

.3 24 V dc circuits, Type HKX with amber flat sided knob.

.4 Fuse holders mounted on back pan to be finger safe dead-front type for use with HRC fuses.

2.11 INTRINSICALLY SAFE RELAYS

.1 Suitable for Class 1 Division 2 usage.

.2 DIN rail mounting.

.3 1 and 2 channel devices as specified in Contract Drawings.

.4 120VAC/24VAC/DC rated, as required.

2.12 INTRINSICALLY SAFE BARRIERS

.1 Transmits supplied or active 0/4-20mA signals from the hazardous area to a load (active or passive) in the safe area.

.2 Suitable for Class 1 Division 2 usage.

.3 DIN rail mounting.

.4 120VAC/24VAC/DC rated, as required.

Part 3 Execution

3.0 INSTALLATION

.1 Install control devices as indicated in Contract Drawings. Make readily accessible for servicing maintenance and adjustments.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical and Technical Specification 26 05 10 Testing and Commissioning.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 General 2
2.1 Mounting Hardware 3
2.2 Interconnecting Cable 4
2.3 Programming Device 4
2.4 Control Components 4
Part 3 Execution 5
3.0 Installation 5
3.1 Field Quality Control 5

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation for Transmitting and Indicating devices.

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 – Common Work Results for Electrical.

1.3 REGULATORY REQUIREMENTS

.1 CSA International

.1 CSA C22.2 No.14, Industrial Control Equipment.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1, Industrial Control and Systems: General Requirements.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit documents to the Contract Administrator in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

Part 2 Products

2.0 GENERAL

.1 Provide each device as a pre-assembled, packaged unit. Upon delivery to the Work Site, each system shall be ready for installation with only final piping and electrical connections required by the Contractor.

.2 Provide power supply to the transmitters and as indicated on the Contract Drawings. Derive any required power for the primary elements from the transmitter.

.3 Install the transmitters to measure the specified process at the ranges and conditions indicated on the Contract Drawings.

.4 Factory-calibrate transmitter to the calibration ranges specified on the Contract Drawings. Calibrate transmitters using NIST-approved bench calibration procedures. Store calibration data digitally in the transmitter. Program transmitter with the instrument tag designation indicated on the Contract Drawings. Submit factory calibration data as described elsewhere in this Technical Specification.

.5 Unless otherwise specified, provide transmitters with integral isolated 4-20 mA output “two wire type” transmitters with operating power derived from the signal loop. Transmitters are to support an external load of up to 600 ohms or greater with a loop power supply of 24 VDC.

.6 Provide transmitters with adequate power output to drive devices associated with that signal loop. Provide signal boosters as required to achieve adequate signal strength.

.7 Transmitter’s 4-20 mA output is to be galvanically isolated from the process and the transmitter case.

.8 Provide microprocessor-based transmitters. For the pressure transmitter sensing cells an isolating diaphragm in combination with a sensing diaphragm using silicone oil as a pressure transmission medium.

.9 Transmitters shall not be damaged by reverse polarity.

.10 Transmitters are to have local indication scaled in Engineering Units and are to include a lamacoid label indicating the Engineering Units. Mount the transmitter such that this indication is correctly oriented and visible from the normal operating floor position.

.11 Transmitters are to have a 3½ digit LCD display, calibrated in engineering units.

.12 Transmitter and/or primary element enclosures (or housings) are to be, as a minimum, rated NEMA 4; where located outdoors or in areas specified as corrosive, enclosures to meet NEMA 4X requirements.

.13 Transmitter flanges, adaptors, and associated bolts, nuts, etc. are to be fabricated from 316 stainless steel.

.14 Two spare fuses of each type required.

2.1 MOUNTING HARDWARE

.1 Provide all mounting brackets, cables, connectors, and hardware necessary to install primary elements.

.2 Provide brackets and mounting hardware to allow standard 50mm pipe-stand or wall mounting, unless otherwise noted.

.3 Fabricate brackets from aluminum or stainless steel and all sundry hardware from stainless steel.

.4 Primary elements and transmitters are to be complete with necessary liquid filling, identification, configuration, etc. as necessary to make the unit ready for use.

2.2 INTERCONNECTING CABLE

.1 Provide an interconnecting cable from the element to the transmitter for systems where the primary element and transmitter are physically separated.

.2 The cable shall be the type approved by the instrument manufacturer for the intended purpose of interfacing the element to the transmitter.

.3 Length of cable shall be as indicated in the Instrument Specification Sheet, or if not specifically indicated, shall provide a continuous unbroken length sufficient to route via approved supports from the element to the transmitter plus additional length to permit the element to be easily removed and reinstalled.

2.3 PROGRAMMING DEVICE

.1 For systems that require a dedicated programming device for calibration, maintenance, or troubleshooting, provide two such programming devices for each class or type of instrument. Include appropriate operation manuals and the programming device in the training requirements.

.2 For systems that allow the programming device functions to be implemented in software, running on a laptop computer, provide two full licensed copies of the software instead of the programming device.

2.4 CONTROL COMPONENTS

.1 Wet Well Float Switches:

.1 Provide float switches with contacts that will activate in the presence of liquid.

.2 Specific Gravity: 0.95 – 1.10

.3 Materials:

.1 Body: Polypropylene (Grey)

.2 Length: 162mm

.3 Strain Relief: EPDM Rubber

.4 Weight: Zinc

.4 Cable:

.1 Conductors: 3C No. 18

.2 Length: to suit installation. 20m minimum

.3 Coil excess cable on hanger cable support

.5 Approvals: Class I, Div. 1 & 2, Groups A-D

.6 Standard of Acceptance: Flygt ENM10 or approved alternate

.2 Hydrostatic Level Sensor Equipment:

.1 Housing: Stainless Steel

.2 Application: Wastewater

.3 Sensor Outer Diameter: 42mm

.4 Cable: PUR

.5 Approvals: Class I, Div. 1 & 2, Groups A-D

.6 Standard of Acceptance: Wika LS-10, Flygt LTU 403 or approved alternate

.3 Door Position Switches:

.1 Voltage: As indicated on contract drawings.

.2 Enclosure Material: 304 stainless steel with corrosion resistant coating (polyurethane)

.3 Approvals: Class I, Div. 1 & 2, Groups A-D

.4 Contact Form: SPDT (Form C)

.5 Lead Wires: 1829mm (72”) minimum

.6 Sensing: End Sensing

Part 3 Execution

3.0 INSTALLATION

.1 Supply a multi-pole receptacle with all instruments.

.2 Mount transmitters so that interference to the function is not caused by surrounding structures.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 Common Work Results - Electrical and Technical Specification 26 05 10 Testing and Commissioning.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specification 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Materials 2
2.1 Manual Motor Starters 3
2.2 Full Voltage Magnetic Starters 3
2.3 Full Voltage Reversing Magnetic Starters 3
2.4 Multi-Speed Starters 3
2.5 Magnetic Starter, Reduced Voltage, Auto-Transformer 3
2.6 Variable Frequency Drives (VFDs) 3
2.7 Accessories 4
2.8 Finishes 4
2.9 Equipment Identification 4
Part 3 Execution 5
3.0 Installation 5
3.1 Field Quality Control 5

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of motors.

1.2 RELATED TECHNICAL SPECIFICATION

.1 Technical Specification 26 05 00 - Common Work Results – Electrical

1.3 REGULATORY REQUIREMENTS

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Current Edition.

.2 International Electrotechnical Commission (IEC)

.1 IEC 947-4-1, Part 4: Electromechanical contactors and motor-starters.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

Part 2 Products

2.0 MATERIALS

.1 Starters: to IEC 947-4 with AC4 utilization category.

.2 Extra Materials:

.1 Provide listed spare parts for each different size and type of starter.

.1 3 contacts, stationary.

.2 3 contacts, movable.

.3 1 contacts, auxiliary.

.4 1 control transformer[s].

.5 1 operating coil.

.6 3 fuses. (if applicable)

2.1 MANUAL MOTOR STARTERS

.1 Not required.

2.2 FULL VOLTAGE MAGNETIC STARTERS

.1 Not required.

2.3 FULL VOLTAGE REVERSING MAGNETIC STARTERS

.1 Not required.

2.4 MULTI-SPEED STARTERS

.1 Not required.

2.5 MAGNETIC STARTER, REDUCED VOLTAGE, AUTO-TRANSFORMER

.1 Not required.

2.6 VARIABLE FREQUENCY DRIVES (VFDS)

.1 Pump Motors

.1 The VFDs shall be selected in accordance with Technical Specification 26 29 23 11 - Variable Frequency Drive

.2 Line Reactor Equipment:

.1 Provide open frame line reactor as indicated on the Contract Drawings on the line side of the VFD.

.2 Mount within VFD Cabinet.

.3 Standard of Acceptance: as indicated on the Contract Drawings.

.3 Disconnect Switch

.1 Provide disconnect switch within VFD Cabinet in accordance with Technical Specification 26 28 23 Disconnect Switches.

.2 Size as indicated on Contract Drawings.

.4 Transformer

.1 Provide transformer within VFD Cabinet in accordance with Technical Specification 26 12 16 01 Dry Type Transformers up to 600V Primary.

.2 Size as indicated on Contract Drawings.

.5 Circuit Breakers

.1 Standard of Acceptance: Phoenix Contact UT 6-TMC series with Phoenix Contact FBS Series plug-in bridges.

.6 Terminals and Interconnect Wiring:

.1 In accordance with Technical Specification 26 05 00 Common Work Results - Electrical.

.2 DIN rail mounted terminals complete with dividers and end stops as required. Provide 10 spare terminals on each section and additional spare terminals as noted on the Contract Drawings.

.3 Utilize plastic finger wiring ducts for organization of all interior and field wiring. Ducts are to be filled to no more than 50% of capacity.

.4 Use ferrules at termination points on stranded wires.

.5 A space of 200 mm must be kept clear for field wiring. All wiring labels must be clearly visible at completion.

2.7 ACCESSORIES

.1 Pushbuttons: heavy duty, oil tight.

.1 as indicated on the Contract Drawings.

.2 Selector switches: heavy duty, oil tight.

.1 as indicated on the Contract Drawings.

.3 Indicating lights: LED, heavy duty.

.1 as indicated on the Contract Drawings.

.4 Provide Size 1 nameplate for all accessories mounted on front of starter.

.5 Auxiliary control devices as indicated.

2.8 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.9 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Magnetic starter designation label, white plate, black letters, size 1 engraved as indicated.

.3 Where starters are installed outside of an MCC, starter designation label shall include equipment ID and description, phase, voltage, upstream distribution source panel and circuit.

.4 Obtain approval from Consultant for wording of identification labels prior to manufacture.

Part 3 Execution

3.0 INSTALLATION

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses installed.

.4 Confirm motor nameplate and adjust overload device to suit.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 - Common Work Results - Electrical.

.2 Operate switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Scope 2
1.2 Related Technical Specifications 2
1.3 Regulatory Requirements 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Harmonic Mitigation 3
2.1 Variable Frequency Drives (VFD) 3
2.2 Disconnect Switch 4
2.3 Control Circuit Transformers 4
2.4 Thermostat (Line Voltage) 4
Part 3 Execution 4
3.0 Installation 4
3.1 Factory Testing 4
3.2 Field Testing and Commissioning 4
3.3 Functional Demonstration Testing 5
3.4 Field Quality Control 5

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 SCOPE

.1 Materials and installation of Variable Frequency Drives (VFDs).

1.2 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 05 31 Splitters, Junction, Pull Boxes and Cabinets

.3 Technical Specification 26 05 10 Testing and Commissioning

1.3 REGULATORY REQUIREMENTS

.1 The Variable Frequency Drives (VFD) and all components shall be designed, manufactured and tested in accordance with the latest applicable standards.

.1 IEEE 519-1992: Guide for harmonic content and control

.2 UL508C: Power Conversion Equipment

.3 cUL

.4 NEMA ICS 7.0: Industrial Controls & Systems for AFD

.5 IEC 61800-2 and -3

.6 EN 50082-1 and -2

.7 Fulfill all EMC immunity requirements

.2 In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit documents to the Contract Administrator in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 - Common Work Results – Electrical.

Part 2 Products

2.0 HARMONIC MITIGATION

.1 Line Filter Equipment:

.1 Provide an integrated 5% DC link choke or open frame line reactor. External choke is not acceptable.

.2 DC choke:

.1 The choke shall be a two coil design. DC choke shall include input surge protection.

.3 Line reactor:

.1 Provide open frame line reactor as indicated on the Contract Drawings on the line side of the VFD.

.2 Mount within VFD Cabinet.

.3 Standard of Acceptance: as indicated on the Contract Drawings.

.2 Load Filter Equipment:

.1 Provide dv/dt filter located at the VFD and shall reduce the dv/dt clamp any voltage overshoots of the VFD output. It will return the energy in the voltage overshoots to the VFD DC bus. A power dissipative resistance device is not acceptable.

.2 Standard of Acceptance: as indicated on the Contract Drawings.

2.1 VARIABLE FREQUENCY DRIVES (VFD)

.1 Pump Motors

.1 The VFDs shall be selected in accordance with the pump motor ratings, Refer to Contract Drawings for motor sizing.

.2 Constant Torque

.3 Overload rating:

.1 150% for one minute of motor FLA

.2 110% continuous of motor FLA.

.4 Provide Terminal blocks for field wiring.

.5 Include inputs for VFD start/stop.

.6 Include relay outputs for VFD running and fault status.

.7 Include analog inputs/outputs for VFD speed setpoint and feedback.

.8 Provide adequate ventilation for stated site conditions.

.9 Mount within enclosure.

.10 Provide remote mounted control panel installed on front door of VFD cabinet.

.1 Include panel platform for docking of control panel.

.11 Standard of Acceptance: ABB or approved alternate.

2.2 DISCONNECT SWITCH

.1 Refer to Technical Specification 26 28 23 – Disconnect Switches – Fused and Non-Fused.

2.3 CONTROL CIRCUIT TRANSFORMERS

.1 Refer to Technical Specification 26 12 16 01 - Dry Type Transformers up to 600V Primary.

2.4 THERMOSTAT (LINE VOLTAGE)

.1 Refer to Technical Specification 26 54 00 – Heaters and Ventilation.

Part 3 Execution

3.0 INSTALLATION

.1 Install control devices and interconnect as indicated on the Contract Drawings and per manufacturers recommendations.

3.1 FACTORY TESTING

.1 Tests shall be performed to verify the proper operation of control devices, input and output signals, local control functions, and indication and alarm points.

.2 The Consultant reserves the right to witness the factory tests. Notify the Consultant 14 working days in advance that the assembly is ready for testing.

3.2 FIELD TESTING AND COMMISSIONING

.1 Operational Readiness Testing

.1 The Contractor shall inspect and test furnished equipment and associated systems for conformance to the contract documents, including equipment manufacture's recommendations, and readiness for operation. The test shall include the following as a minimum:

.2 Visually inspect for physical damage and proper installation

.3 Perform tests in accordance with manufacturer's instructions

.4 Perform tests in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical and Technical Specification 26 05 10 Testing and Commissioning.

.5 Perform tests that equipment is ready for operation

.6 Touch-up paint all chips and scratches with manufacturer-supplied paint and transfer remaining paint to Owner

.2 Contractor shall submit an operational readiness test report documenting all test results, including all assumptions, conditions, allowances and corrections made during the test. The report shall provide a listing of all modifications and adjustments made onsite to include any settings / parameters not identified as factory defaults within the equipment's O&M documentation. The test report shall include a signed statement from the Contractor, installer(s) and the factory-trained manufacturer's representative(s) certifying that the furnished equipment and associated system have been installed, configured, and tested in accordance with the manufacturer's recommendations, completely conforms to the requirements of the Contract Documents and is ready for operation.

3.3 FUNCTIONAL DEMONSTRATION TESTING

.1 Prior to scheduling functional demonstration testing the Contractor shall submit a signed statement from the Contractor, installer(s) and the factory-trained manufacturer's representative(s) certifying that the furnished equipment and associated system have been installed, configured, and tested in accordance with the manufacturer's recommendations, completely conforms to the requirements of the Contract Documents and is ready for operation.

.2 The Contractor shall completely demonstrate the functionality and performance of the equipment and associated systems in the presence of Owner and Engineer, observing and documenting complete compliance with the Contract Documents.

.3 The Contractor shall submit a written report documenting successful completion of functional demonstrating testing including all assumptions, conditions, allowances and corrections made during the test.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 00 - Common Work Results for Electrical and Technical Specification 26 05 10 Testing and Commissioning.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Related Technical Specifications 2
1.2 Regulatory Requirements 2
1.3 Scope 3
1.4 Shop Drawings and Submittals 3
1.5 Delivery, Storage and Handling 3
Part 2 Products 3
2.0 Kiosk Light Fixture 3
Part 3 Execution 3
3.0 Installation 4
3.1 Wiring 4
3.2 Luminaire Alignment 4

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 Common Work Results – Electrical

.2 Technical Specification 26 27 16 Electrical Cabinets and Enclosures

.3 Technical Specification 26 32 13 01 Power Generation – Diesel

1.2 REGULATORY REQUIREMENTS

.1 American National Standards Institute (ANSI)

.1 ANSI C78.374-2015 Light-Emitting Diode Package Specification Sheet for General Illumination Applications

.2 ANSI C78.377-2015 American National Standard for Electric Lamps—Specifications for the Chromaticity of Solid State Lighting (SSL) Products

.2 Illuminating Engineering Society (IES)

.1 IES LM-79-08: Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

.2 IES LM-80-15: Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules

.3 IES LM-82-12: LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature

.4 IES LM-84-14: Approved Method for Measuring Luminous Flux and Color Maintenance of LED Lamps, Light Engines, and Luminaires

.5 IES LM-85-14: Approved Method for Electrical & Photometric Measurements of High Power LEDs

.6 IES TM-21-11: Projecting Long Term Lumen Maintenance of LED Light Sources

.7 IES TM-28-14: Projecting Long-Term Luminous Flux Maintenance of LED Lamps and Luminaires

.8 IES TM-30-15: IES Method for Evaluating Light Source Color Rendition

.3 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41.1-2002 (R2008), IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits

.2 ANSI/IEEE C62.41.2-2002, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits

.4 Canadian Standards Association (CSA International)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

.5 ICES-005-2016, Lighting Equipment

.6 National Electrical Manufacturers Association (NEMA)

.1 NEMA SSL 1-2010 Electronic Drivers for LED Devices, Arrays, or Systems

.7 Underwriters' Laboratories of Canada (ULC)

.1 UL 1449 (2014), Standard for Surge Protective Devices

1.3 SCOPE

.1 Materials and installation of lighting.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 KIOSK LIGHT FIXTURE

.1 LED, 120V

.2 Mounted to ceiling panel of kiosk.

.1 Include all necessary connectors.

.3 Standard of Acceptance: Stego – Ecoline Light LED 025 or approved equal.

Part 3 Execution

3.0 INSTALLATION

.1 Locate and install luminaires as indicated in Contract Drawings.

3.1 WIRING

.1 Connect luminaires to lighting circuits:

.1 Install flexible or rigid conduit for luminaires as indicated in Contract Drawings.

3.2 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END SECTION

TABLE OF CONTENTS

Part 1 General 2
1.0 Documents 2
1.1 Related Technical Specifications 2
1.2 Regulatory Requirements 2
1.3 Scope 2
1.4 Shop Drawings and Submittals 2
1.5 Delivery, Storage and Handling 2
Part 2 Products 2
2.0 Controls 2
2.1 Heaters 3
2.2 Ventilation 3
2.3 Thermostat 4
Part 3 Execution 4
3.0 Installation 4
3.1 Field Quality Control 4

Revision History

Rev. No.	Date	Description of Revisions	Prep. By	Rev. By
-	Mar 03, 2023	Issued for Tender	NI	BW

Part 1 General

1.0 DOCUMENTS

.1 This Technical Specification forms a part of the Contract Documents and is to be read, coordinated and implemented in conjunction with all other parts.

1.1 RELATED TECHNICAL SPECIFICATIONS

.1 Technical Specification 26 05 00 - Common Work Results – Electrical

.2 Technical Specification 26 05 10 – Testing and Commissioning

.3 Technical Specification 26 05 31 – Splitters, Junction, Pull Boxes and Cabinets

.4 Technical Specification 26 27 16 – Electrical Cabinets and Enclosures

.5 Technical Specification 26 32 13 01 – Power Generation Diesel

1.2 REGULATORY REQUIREMENTS

.1 Not Used

1.3 SCOPE

.1 Materials and installation for heating and ventilation systems.

1.4 SHOP DRAWINGS AND SUBMITTALS

.1 Submit in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Technical Specification 26 05 00 Common Work Results – Electrical.

Part 2 Products

2.0 CONTROLS

.1 Refer to electrical Contract Drawings for details on heating and ventilation control.

.2 Provide control equipment as shown on electrical Contract Drawings. Devices to be industrial quality, line voltage (120/240 volts), single-pole, white unless otherwise indicated on the Contract Drawings.

.3 Provide clear plastic thermostat guard for all heating/cooling wiring devices: thermostats, astronomical time switch.

2.1 HEATERS

.1 Element: Durable tubular heating element with fins.

.2 Finish: Epoxy-polyester powdercoat

.3 Installation: Wall mounted with surface mounting box (included)

.4 Wattage & Voltage: As indicated on Contract Drawings

.5 Control: Built-in thermostat with control knob.

.6 Heaters shall be serviceable and replaceable without removing any component in the kiosk or area. Heaters shall be located to prevent burning of adjacent components.

.7 Heaters shall be suitably shielded to prevent accidental burning.

.8 There shall be no exposed electrical parts.

.9 Standard of Acceptance: Ouellet OVS Series or approved equal.

2.2 VENTILATION

.1 Kiosk Ventilation

.1 Ventilating louvers shall be vermin, insect and rainproof with easily replaceable fiberglass, non-circular automotive type filters.

.2 Ventilation louvres shall be adequately sized and die punched.

.3 The controls compartment of the kiosk shall be equipped with one or more 120VAC exhaust fans. The number of fans and louvers will vary according to the kiosk size, prevailing temperature conditions and kiosk equipment heat load.

.4 Electrical connections shall be by two insulated spade connectors.

.5 There shall be no exposed electrical parts.

.6 Fans shall be covered with a protective guard.

.7 Fans shall be serviceable and replaceable without having to remove any other component in the kiosk.

.2 VFD Ventilation

.1 To ensure adequate heat dissipation, the VFD unit may include fan-assisted cooling such that it would not degrade the enclosure rating.

.2 Forced-air ventilation shall have front intake and exhaust channels.

.3 Cooling fans shall be automatically controlled to operate based on the cooling air demands of the drive controller.

.3 Wet Well Ventilation Fan

.1 Power: 120V, 1 Phase

.2 Rating: As indicated on Contract Drawings.

.3 Hazardous location classification: Class 1 Div. 1

.4 Motor: Explosion proof construction

.5 Fan guard

.6 Mounted on top of the wet well

.7 Supplier/Contractor to provide package for review.

2.3 THERMOSTAT

.1 Kiosks or enclosures shall be equipped with one or more 120/240VAC thermostats as indicated in the Contract Drawings.

.2 Thermostats shall be serviceable and replaceable without removing any component in the kiosk.

.3 There shall be no exposed electrical parts.

.4 Control of heater shall be from a thermostat integral to heater enclosure.

.5 Control of fan shall be from a wall-mount thermostat.

Part 3 Execution

3.0 INSTALLATION

.1 Mount heaters on kiosk wall as indicated on Contract Drawings.

.2 Electrically connect ventilation as shown in manufacturer's installation instructions.

.3 Install control equipment in locations indicated on Contract Drawings.

.4 Install heat trace equipment in water compartment of electrical kiosk.

.5 Make power and control connections.

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Technical Specification 26 05 10 – Testing and Commissioning.

.2 Ensure that heaters, ventilation and controls operate correctly.

END SECTION