DIVISION 17

INSTRUMENTATION AND CONTROL

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INSTRUMENTATION AND CONTROL

INSTRUMENTATION AND CONTROLS GENERAL REQUIREMENTS

1. GENERAL

1.1 Requirements of Work

.1 Supply, install, commission and provide warranty for a complete and fully documented instrumentation and control system as shown on the drawings and as specified herein. The instrumentation and control system contains vendor component subsystems specified in this and other sections of the specification.

.2 Component subsystems of the instrumentation and control system will include, but are not limited to, the following:

.1 Primary elements and transmitters

.2 Final control elements

.3 Instrumentation and control field devices

.4 Instrumentation and control junction boxes

.5 Instrumentation cabling

.6 Conduit and cable trays

.7 Instrumentation power supplies

.8 Programmable Logic Control (PLC).

.3 The Contractor's responsibility also includes receiving, uncrating, examining for shortages or damage, assembling, field fitting, installing, mounting, wiring and testing of vendor supplied component subsystems.

.4 Where packaged, stand-alone control systems are supplied under other divisions of this specification, provide cabling to connect to the required remote monitoring and/or control functions. Provide end-to-end commissioning of all required remote monitoring and/or control functions. Ensure the correct functionality of any equipment supplied under other divisions of this specification.

.5 Documentation for the equipment and systems referred to in 1.1.2.1 to include as a minimum:

.1 Equipment descriptive data.

.2 Equipment installation, service manuals, operation/maintenance manuals and recommended spare parts lists.

.3 Schematics and interconnecting wiring diagrams.

.4 Records of conductor identification, field terminals, changes, etc.

.5 Instrumentation and control panel shop drawings, face layouts, schematics and point-to-point wiring diagrams.

.6 Loop diagrams – show the complete wiring requirements for each of the control device loops connected to the PLC I/O terminals. All cabling identification numbers are to be recorded as As-Built on these drawings. (Where a drawing is provided as typical make the required # of copies and provide one As-Built for each loop.) Formatted Templates for loop drawings will be provided to the Contractor in AutoCAD upon request.

.7 Records of as-built information for the complete instrumentation system.

.6 Documentation provided to the contractor in this package is formatted as follows:

.1 P&IDs – depict the general intent of the control systems and are to be used as the governing document for the scope of work.

.2 Instrument Index - a sorted index of the detailed information for the devices shown on the P&IDs. The index lists the appropriate support documentation for the devices' supply and installation. The instrument index is the controlling document for the supply of materials.

.3 Input/Output Index - a sorted index of the PLC and Datalogger I/O points shown on the P&IDs, giving the supporting documentation as per the instrument index.

.4 Instrument Specification Sheets - detail the relevant data for the supply of devices.

.5 Location Drawings - indicate in plan and/or elevation views where the instrument elements are physically located. These drawings are provided to assist the Contractor in estimating the amount of cable and ducting required.

.6 PLC wiring schematics – show the complete wiring requirements for each of the PLC Input or output module cabling identification numbers are to be recorded as As-Built on these drawings

.7 Detailed Specification - lists qualifications, quality of materials and workmanship, and supplementary information.

.7 References

.1 This specification contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section prevail.

INSTRUMENTATION AND CONTROLS
GENERAL REQUIREMENTS

Reference Title

CSA – C22.01-02	Canadian Electrical Code (CEC)
NBC-	National Building Code
API RP550-86	Manual on Installation of Refinery Instruments and Control Systems, Part I - Process Instrumentation and Control Sections 1 Through 13
ASTM B68-86	Seamless Copper Tube
ASTM D883-89	Terms Relating to Plastics
IEEE 100-88	Dictionary of Electrical and Electronic Terms
ISA RP7.1-56	Pneumatic Control Circuit Pressure Test
ISA S5.4-76	Instrument Loop Diagrams
ISA S18.1-79	Annunciator Sequences and Specifications
ISA S51.1-79	Process Instrumentation Terminology
NEMA 250-85	Enclosures for Industrial Controls and System
NEMA ICS 1-88	General Standards for Industrial Control and Systems
NEMA ICS 2-88	Industrial Control Devices, Controllers, and Assemblies
SAMA PMC 17-10-63	Bushings and Wells for Temperature Sensing Elements
UL 1012-89	Power Supplies
UL 94-80	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
Weik, Martin H.	Communications Standard Dictionary, Van Nostrand Reinhold Co., 1983

.8 Related Work

.1 Process: Division 13

.2 Mechanical: Division 15

.3 Electrical: Division 16

.9 Qualifications

.1 The instrumentation subcontractor to be a firm normally engaged and fully competent in the type of work described in this section of the specification. The firm shall have been continuously and successfully engaged in this business for at least 5 years.

.2 The instrumentation subcontractor to be experienced in the process and instrument requirements of this contract.

.3 The instrumentation subcontractor to show that it maintains a fully equipped and qualified organization, capable of performing the present work and of providing warranty service to the system after installation.

.4 Perform all instrument hook-ups, calibrations and checkouts with qualified journeyman instrument mechanics who are familiar with the devices being installed. Perform all control wiring installation and connections with qualified journeyman electricians.

INSTRUMENTATION AND CONTROLS
GENERAL REQUIREMENTS

.10 Codes, Rules, Permits & Fees

.1 Comply with all laws, ordinances, rules, regulations, codes and orders of all authorities having jurisdiction relating to this work.

.2 Comply with all rules of the Electrical Safety Act of the Territory, the CEC, CSA Standards, Canadian Underwriters Laboratories and the applicable building codes, whether specifically shown on drawings or not.

.3 Give all required notices, submit drawings, obtain all permits, licenses and certificates and pay all fees required for this work.

.4 Furnish a certificate of final inspection and approvals from an inspection authority to the Engineer.

.11 Standards of Workmanship

.1 Execute all work in a manner which will result in the completed installation presenting an acceptable appearance, to a level of quality defined in the general conditions of this specification.

.2 Employ a competent supervisor and all necessary licensed tradesmen to complete the work in the required time.

.3 Arrange and install products to fit properly into designated building spaces.

.4 Unless otherwise specified or shown, install products in accordance with the recommendations and ratings of the product manufacturers.

.5 Supply and execute installation of all instrumentation control tubing in accordance with Division 17.

.12 Contract Drawings and Specifications

.1 Refer to Division 1.

.2 Supply and install all items and accessories specified by the drawings or the specification in the quality and quantity required. Perform all operations as designated by the specification according to the methods prescribed, complete with all necessary labour and incidentals.

.3 Treat any item or subject omitted from this division's specifications or drawings, but which is mentioned or reasonably specified in other divisions' specifications or drawings and pertains to the instrumentation and control system, as being integral to the overall system. Provide such specified items or subjects.

.4 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the work.

.5 If discrepancies or omissions in the drawings or specifications are found, or if intent or meaning is not clear, consult the Engineer for clarification before submitting tender.

.6 The responsibility to determine which division provides various products and work rests with the Contractor. Additional compensation will not be considered because of differences in interpretation of specifications.

1.2 Equipment

.1 Receiving, Storing, and Protection of Components During Construction

.1 Examine each component upon delivery to site. Report all damage noted to the Engineer prior to accepting or rejecting delivery. All instrumentation primary elements, control components, panels, etc. shall be placed in a secure, dry, heated storage building. Maintain the space temperature above 10°C and the space relative humidity below 50%.

.2 Perform a preliminary examination upon delivery to ensure that:

1 All instrumentation and control components supplied for this project under this section of the specification comply with the requirements stated in the instrument specification sheets

.2 Ensure that all instrumentation and control components supplied under other sections of this specification, to be connected to instrumentation and control components supplied under this section of the specification, comply with the requirements stated in the contract documents.

.3 Itemize all non-conformities noted above and forward them to the Engineer. Any delays in construction resulting from the delivery to site of non-conforming instrumentation and control components to be bourne by the Contractor.

.4 Do not install primary elements or other sensitive equipment until construction is sufficiently completed to provide an "operating condition" environment. Notify the Engineer prior to installing any equipment of this type.

.5 Ensure that covers where required are properly installed on all equipment. Provide all covers, padding, guards, etc. as required to guard any equipment against damage.

.6 Return all damaged equipment to the factory for total corrective repairs. If deemed necessary by the Engineer, the damaged equipment shall be replaced with new product. The Contractor shall bear any costs due to construction delays resulting from the delay in delivery of acceptable equipment.

1.3 Documentation

.1 Project Submittals

.1 Submit shop drawings for all products supplied by this Division. Submit shop drawings for review prior to delivery of any products or equipment to job site and sufficiently in advance to allow ample time for checking, submit shop drawings for review.

.2 Contractor to review, modify, and approve the shop drawings prior to submitting shop drawings to the Engineer for review. Contractor approval of a drawing indicates the following:

.1 The drawing has been checked by the person making the approval

.2 The equipment or material complies in all respects with the requirements of the specifications and drawings

.3 The quantities, if indicated on the drawing, are correct

.4 The physical dimensions of the components are such that they can be installed without interference with the building structure or other equipment, and that, after installation, there are sufficient clearances on all sides for maintenance, servicing and operation of the equipment

.5 The points of attachment are clearly indicated, i.e., TOP, BOTTOM, SIDE, etc.

.6 The arrangement and location are properly oriented

.7 The product is suitable for its intended use.

.3 Stamp and sign the shop drawing to show approval, indicating the above has been complied with. If contractor revisions are too extensive, return the submission to the supplier for revision, then repeat the shop drawing approval process before submitting them to the Engineer.

.4 Manufacture of products shall conform to shop drawings marked as reviewed by the Engineer and returned to the Contractor. No subsequent changes will be permitted.

.5 Keep one complete, maintained set of shop drawings at the job site during the construction period, record site modifications.

.6 Refer to Division 1 for further information on shop drawing submittals.

.2 Operations and Maintenance Manuals

.1 Refer to Division 1 for general O&M manual submittal information.

.2 In addition to the requirements specified in Division 1, provide the following information:

.1 Table of Contents – Arrange contents sequentially by systems under section numbers. Label tabs of dividers between each to match section numbers in the Table of Contents.

.2 Systems Descriptions – A brief synopsis of each system typed and inserted at the beginning of each section. Include sketches and diagrams where appropriate.

.3 Maintenance and operating instructions for all equipment and controls - These operating instructions need not be manufacturer's data but may be typewritten instructions in simple language to guide the Owner in the proper operation and maintenance of his installation.)

.4 A copy of all wiring diagrams complete with wire coding.

.5 Set of final reviewed shop drawings.

.3 Record Drawings

.1 Maintain on-site a complete set of as-built drawings as listed in Division 1 of this specification.

.2 In addition to the requirements as stated in Division 1, record on the drawings the following information:

1 Mark all change orders, alterations or additions

2 Show all instrumentation cable and control tubing complete with all corresponding identification tagging and numbering

3 Show all changes to the numbers and location of outlets, motors, panels and end devices that may occur during the course of the work.

.3 Before requesting the final completion certificate make any necessary final corrections to the drawings, sign each print as a certification of accuracy. Submit Record drawings in accordance with Division 1 of this specification.

2. PRODUCTS

2.1 General

.1 Refer to the requirements of Division 1

.2 Selected Products and Equivalents

.1 Provide products and materials that are new and free from all defects.

.2 Products and materials called for on the drawings or in the specifications by trade names, manufacturer's name and catalogue reference are those which are to be used as the basis for the Tender.

.3 The design has been based on the use of the first named product, where applicable equivalent products are listed.

.4 Provide the products specified unless a proposal for an alternative or substitute product has been accepted by the Engineer.

.3 Alternate Products

.1 Refer to Division 1 for the terms and conditions for submitting alternate products for consideration.

.2 Alternate products and materials to those specified will only be considered by the Engineer if they are shown in the Tender as a material variation, and if they are submitted with an appropriate price adjustment. The Engineer will reserve the right to accept or reject any alternative without explanation.

.3 The alternate submission shall provide sufficient information to enable the Engineer to determine whether the alternate is acceptable or unacceptable.

.4 Provide complete information on required revisions to other work and products to accommodate each alternate product.

.5 The Contractor assumes full responsibility when providing alternative products or materials that all space, weight, connections, power and wiring requirements etc. are considered and compensated for. Any costs incurred for additional components, changes to other services, structural or space requirements, layouts and plans, etc. that may arise from the use of the alternate to be borne by the Contractor.

.6 Materials or equipment rejected by the Engineer to be immediately removed from the project.

.4 Substitution of Products After Contract Award

.1 All proposed substitutions are to be declared to the Engineer prior to submission of shop drawings for that product.

.2 To receive acceptance, proposed substitute products are to equal or exceed the quality, finish and performance of those specified and/or shown, and not to exceed the physical space requirements allotted, as shown on the drawings.

.3 Provide to the Engineer documentary proof of equality, and delivery dates, in the form of certified quotations from suppliers of both specified items and proposed substitutions.

.4 The Contractor shall be responsible for all costs related to the product substitution and for any required revisions to other structures and products to accommodate such substitutions.

.5 Refer to Division 1 for additional information on substitutions.

.5 Quality of Products

.1 All products provided to be CSA Approved, and Canadian Underwriters' Laboratory approved where applicable.

.2 If products specified are not CSA approved, obtain approval of the relevant provincial or territorial regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.6 Uniformity of Manufacture

.1 Unless otherwise specifically called for in the specification, uniformity of manufacture to be maintained for similar products throughout the work.

.7 Use of Products During Construction

.1 Any equipment used for temporary or construction purposes to be approved by the Engineer and in accordance with Division 1 of this specification. Clean and restore to "as new" condition all equipment prior to the time of substantial completion.

.2 The warranty period does not begin until the date of substantial completion of the work.

2.2 Instrumentation

.1 General

.1 Instruments to be suitable for the environmental conditions in which they are to be installed.

.2 Determine where injurious conditions may be expected to occur and make proper provision to protect the instruments to ensure their proper and reliable operation.

.3 Provide power surge protectors, heating cables and devices to protect instruments, equipment and sensing lines from being functionally impaired or damaged by power surges or environmental conditions such as moisture or freezing.

2.3 Identification

.1 Refer to Division 16 for general identification requirements. Provide lamicoid nameplates with 5mm white lettering on black background. Identify the loop tag number (where applicable) and the device name, function, and instrument range or setpoint value on the nameplate.

.2 Where it is not possible to attach a lamicoid nameplate to a field instrument component, provide the component with a stainless steel metal tag firmly wired to the device and identified with the loop tag number.

.3 Identify all wires where they terminate at the marshalling panels, junction boxes and field devices with a heat shrink sleeve with machine printed labeling.

.4 Clearly mark all panels, pull boxes, junction boxes, etc. to indicate the nature of service.

.5 Provide neatly typed circuit directories for panel power distribution systems to indicate loops or devices powered by the circuit and the fuse size.

.6 Identify all exposed control conduits at all pull box locations, where the conduits enter or leave a room, and 13 meters on center throughout the room. This shall apply to conduits above removable ceilings. Use Thomas & Betts TY-RAP 5532-M labels as conduit identification.

.7 For direct current wiring use black for positive and white for negative.

.8 For thermistor wiring to motors, use red and blue coloured, insulated wire.

3. EXECUTION

3.1 Site Examination

.1 Refer to the requirements of Division 1.

.2 No additional compensation will be given for extra work due to existing conditions which a site examination prior to tender should have disclosed.

3.2 Coordination With Other Divisions

.1 Examine the drawings and specifications of all divisions and become fully familiar the work. Before commencing work, obtain a ruling from the Engineer on any conflicting issues between divisions. No compensation will be made for any costs arising from conflict not identified before work has commenced.

.2 Coordinate the work to be performed under this section of the specification with all divisions installing equipment to ensure that there are no conflicts.

.3 Install anchors, bolts, pipe sleeves, hanger inserts, etc. required in ample time to prevent delays to other division's installation work.

.4 Lay out the work and equipment with due regard to architectural, structural and mechanical features. Architectural and structural drawings take precedence over electrical drawings regarding locations of walls, doors and equipment.

.5 Structural members shall not be cut without prior approval of the Engineer.

.6 Examine previously constructed work and notify the Engineer of any conditions which prejudice the proper completion of this work.

3.3 Product Handling

.1 Use all means necessary to protect the products included in this division before, during and after installation, and to protect products and installed work of all other trades.

.2 Any damage to the products and/or installed work shall be repaired or replaced by the Contractor at no additional cost to the Owner, and to the approval of the Engineer.

.3 Remove advertising labels from all products installed that have such labels attached. Identification or CSA labels are not to be removed.

.4 Remove dirt, rubbish, grease, etc. resulting from work performed under this section of the contract from all surfaces.

3.4 Separation of Services

.1 Maintain separation between the electrical wiring system, building piping, ductwork, and the instrumentation cables so that each system is isolated (except at approved connections to such systems) to prevent galvanic corrosion. In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is unacceptable.

.2 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings may be used for the support of wiring only when approval is obtained from the Engineer and the ceiling installer, and only if approved clips or hangers are used.

3.5 Wire And Cable

.1 Refer to Section 17124.

3.6 Equipment Connections

.1 Prior to the connection of signal wiring to process control and instrumentation devices, check the device voltage rating and polarity for compatibility with the corresponding loop and/or schematic diagram. Where device and circuit characteristics are found to be incompatible, the connections are not to be made. Report the condition immediately to the Engineer.

.2 All control wiring diagrams illustrate typical control circuits applicable to the type of equipment specified. Control circuits may vary with different manufacturer's equipment. Verify all control circuits with the suppliers of the equipment and make any corrections to the control wiring diagrams that may be required.

.3 Provide power disconnect terminals in the marshalling panels for all devices or CDACS input/outputs sourced from the panel. Provide local power disconnect switches for all 120VAC power instruments. Mount adjacent the instrument.

.4 Provide a disconnecting means in the cable connecting each ultrasonic transponder to the transmitter. This disconnect shall consist of a terminal strip in a local WP junction box with approximately 3 meters of cable from the transponder.

.5 Provide a disconnecting means in the cable connecting each analytical field device to the transmitter. This disconnect shall consist of a terminal strip in a local WP junction box with approximately 3 meters of cable from the analytical element or cable quick connect at the element.

3.7 Wiring To Equipment Supplied By Others

.1 Equipment supplied by the Owner or by other Divisions, that have external or field mount control devices, are to be installed, wired and commissioned by this Division.

3.8 Instrument Mounting Stands

.1 Supply and install instrumentation mounting stands as required. Stands are to be either floor or wall mounted. The mounting stands are to be fabricated from aluminum or galvinized steel.

.2 Supply and install protective drip shield for any exterior stand-mounted instrumentation equipment. The drip shield is to extend 50 mm at the top and sides from the front face of the equipment. The drip shield is to be fabricated from aluminum.

3.9 Sealing Of Wall And Floor Openings

.1 Seal all conduit and cable entries passing through outside walls of buildings, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade.

.2 Seal openings after all wiring entries have been completed.

.3 Sealing material shall be fire resistant and not contain any compounds, which will chemically affect the wiring jacket or insulating material. Cable penetrations through fire separations, if required, are to be sealed. Acceptable methods are Canstrut "Fire Stop", Electrovert "Multi-Cable Transit" or Dow Corning RTV Silicone Foam.

3.10 Connections to Mechanical, Electrical and Existing Systems

.1 Refer to Division 16 for the required tie-in procedures.

3.11 Testing of Instrumentation Loops

.1 After all devices within a loop have been connected, check the loop for correct functioning and interaction with other loops, where applicable. Provide written notice to the Engineer when the loops are going to be tested so that the tests may be witnessed at the Engineer's discretion.

.2 Check the operation of final control elements such as solenoid valves, actuators, etc. by manual control before checking with automatic control.

.3 Perform tests and record results on test data forms, which are included in this section. Develop additional and/or more detailed test forms as necessary to suit more complex instrumentation.

.4 Sign and date all test reports. Submit the test reports to the Engineer within 5 working days of testing.

3.12 Calibration

.1 Instruments to be factory pre-calibrated and the calibration verified in-place after installation. Provide a printed record of the factory calibration parameters for "smart" devices.

.2 Prior to calibration completely program all "smart" transmitters including entries of the appropriate range and tag number. Provide a printed record of smart device serial numbers against their assigned tag number.

.3 Instruments to be set up and calibrated by an accredited instrument technician working under the approval of the instrument manufacturer.

.4 Calibrate all instruments to an accuracy of 1/2 of one percent of full range, or to the manufacturer's stated accuracy of the instrument whenever an accuracy of 1/2 of one percent is not achievable.

.5 Prior to instrument installation perform the following applicable calibration for each instrument and its associated signal conditioning equipment:

.1 Calibrate all inline flow meters by a draw-down test

.2 Calibrate all vacuum and pressure instruments by manometer or accurate test instrument and hand test pump

.3 Calibrate temperature instruments against a standard lab thermometer.

3.13 Commissioning

.1 Refer to the requirements of Division 1 for additional commissioning requirements.

.2 Inspections

.1 Provide 2 weeks' written notice to the Engineer prior to energizing any system to allow for inspection by the Engineer of the following:

.1 Proper mounting.

.2 Proper connections.

.2 During commissioning demonstrate to the Engineer proper calibration and correct operation of instruments and gauges.

.3 Commissioning of the instrumentation and control system to include but not be limited to the following:

.1 Supervise installation of components, wiring connections and piping connections.

.2 Supervise wiring continuity and pipe leak tests.

.3 Verify instrument calibration and provide written report.

.4 Function check and adjust under operational conditions the instruments and control equipment.

.5 Coordinate instruments and control equipment supplier's service personnel as required for complete system testing.

.6 Instruct plant personnel in correct method of operation of instruments and control equipment.

.7 Direct plant personnel at hand-over as to final adjustment of the system for correct operation of plant.

.8 Ensure that the instrumentation and control equipment suppliers cooperate to complete the work of this section.

.9 Verify signal levels and wiring connections to all instrumentation and control equipment.

3.14 Training

.1 Provide training, described in detail in Division 1, as required by the plant's personnel to become fully competent in the proper operation and maintenance of all control devices, control valves, and ancillary instrumentation described under this section of the specification.

3.15 Test Forms

Form Number	Title
ITR	Instrument Test Report
LCR	Loop Check Report

END OF SECTION

INSTRUMENTATION AND CONTROLS
GENERAL REQUIREMENTS

LOOP CHECK REPORT

☐ CHECKED OUT OK
☐ NOT APPLICABLE
☐ FURTHER ACTION REQUIRED

	INSTRUMENT TAG NO.								
LOOP NO. _____ SHEET NO. _____ P & I DWG. NO. _____									
INSTALLATION COMPLETE									
Primary Element									
Impulse Lines									
Block and Drain Valves									
Air Supply/Filter/Reg.									
Wiring									
Tracing/Insulation/Housing									
Mounting and Location									
CDACS I/O & Status									
CALIBRATED									
Impulse LInes Press. Tested									
LOOP CHECKED									
Element To Receiver									
X Mtr. to Receiver									
X Mtr./Trans. to Receiver									
X Mtr./Trans. to Switches									
Switches to Annunciator									
Interlocking Circuit									
Controller to Valve									
Controller Action D or R									

INSTRUMENTATION AND CONTROLS
GENERAL REQUIREMENTS

REMARKS

READY FOR START-UP

DATE: _____

Installed by: _____

Checked by _____

SYSTEM: _____ _____

SERVICE: _____ TAG NO. _____

LOCATION: _____ _____

MAKE: _____ MODEL: _____

SERIAL NO.: _____ CSA: _____

ELEMENT: _____ RANGE: _____

DESIGN SETTING/RANGE: _____ CONTACT TO: _____ ON: _____

SIGNAL IN: _____ OUT: _____ ASSOCIATED INSTRUMENT: _____

INSTRUMENT CONDITION _____ CONFORM TO SPEC: _____

PROJECT NO.: _____ DATA SHEET: _____

	TEST 1				TEST 2			
TEST METHOD								
	INPUT		**OUTPUT**		**INPUT**		**OUTPUT**	
PROCESS	**INC.**	**DEC.**	**INC.**	**DEC.**	**INC.**	**DEC.**	**INC.**	**DEC.**
TEST POINT 1								
TEST POINT 2								
TEST POINT 3								
TEST POINT 4								
TEST POINT 5								
COMMENTS								

INSTRUMENTATION AND CONTROLS
GENERAL REQUIREMENTS

GRAPHS		

TESTED BY: _____ CHECKED BY: _____

DATE: _____ DATE: _____

SCOPE OF WORK

1. GENERAL

1.1 General

.1 This section is intended to generally describe and outline the scope of work required to be carried out in conjunction with this contract. Execution of this work shall be read in combination with the specifications and drawings.

1.2 Measurement and Control Devices

.1 Provide, install, calibrate, loop check and commission all measurement and control devices as indicated on drawings and specified herein.

.2 Devices associated with the Lower Base Recirculation and Fire Pump are for future construction and are not part of this contract

.3 Provide the related devices, wiring, and control signals for all motor control applications as indicated on drawings and specified herein. Co-ordinate submittals for and performance of this work with Division 16. Loop check and commission all motor control devices in co-operation with Division 16.

.4 Provide and install all water quality analytical devices. Calibrate, loop check and commission the same. Ensure this equipment is provided with all required spares and consumables for a minimum period of one year.

1.3 Automation Equipment and Programming

.1 Provide and install a complete PLC based automation system as indicated on drawings and specified herein. The contractor to provide all hardware, software and application programming required to meet the functional requirements as detailed in the project control philosophy.

2. WORK INCLUDED

2.1 Related Work

.1 The Administrative Sections under Divisions 00 (Bidding and Contract Requirements) and 01 (General Requirements) shall be considered to be part of these Specifications.

2.2 General Requirements

.1 General Clean-up.

.2 All inspection and other permits, licenses required by various Inspection Agencies and local regulations.

.3 Special testing or inspection, additional to the above as specified or covered by a Cash Allowance.

.4 Scaffolding.

.5 Shop Drawings.

.6 Label all instruments with their specific tag numbers as listed on P&ID drawings and the instrument index.

.7 Identify all cabling from the field devices and instruments to respective marshalling panels.

.8 Project Record Documents (As-Built Drawings) where specified.

.9 Operating and Maintenance Data, where specified.

.10 Testing and commissioning of the complete installation.

2.3 Materials

.1 Provide one PLC, alarm dialer and Ethernet switch. The contractor shall review and confirm the I/O from the PLC I/O Index list and procure peripheral equipment (i.e., racks, battery backup, I/O cards) as indicated in Sections 17110, 17500, PLC Instrument Specification Sheets and as shown on the tender drawings.

.2 Contractor to provide the marshalling panels as indicated in the tender drawings. The contractor shall generally adhere to the marshalling panel layout drawing, making minor deviations only to ensure reasonable fit for the installed equipment. Consideration shall be given for the need for future maintenance work (i.e., adequate working area around components and for the future additions).

.3 Software tools and related programming for the PLC, operator interface devices and the communications equipment.

.4 Control panels associated with any electrical equipment covered under this section of Work.

.5 Conduit systems, including underground, floor, riser, etc. which are intended to contain cables, buses or any device associated with or connected to the power system.

.6 Grounding systems, as required by the Electrical Code, or as otherwise specified in the bid documents.

.7 Control and instrumentation systems - electrical or electronic including infrared, solar, high frequency, ultra high frequency and microwave control and instrumentation systems, with auxiliary equipment and components, unless specified otherwise.

3. WORK EXCLUDED FROM DIVISION 17

3.1 General Requirements

.1 Temporary power

.2 Temporary light.

.3 Hoisting.

.4 Barriers.

.5 Special testing or inspection not specified or covered by Cash Allowance.

3.2 Other Work Excluded

.1 Painting (on site), except touch-up of electrical equipment (Division 9).

.2 Control transformers supplied with Mechanical Equipment (Division 15).

4. UNITS OF MEASUREMENT

4.1 General

.1 The Contract Documents have been prepared using the modified International System (SI) units of metric measurement. Whenever appropriate, available metric products shall be used unless otherwise specified herein.

.2 Only metres (m) and millimetres (mm) are used. Generally, metres are used for measurements of 10 metres or more, and millimetres for measurements below 10 m.

.3 All measurements on drawings are in millimetres unless otherwise indicated.

4.2 Conversions

.1 The following three conversion methods were used in product and location dimensions:

.1 Hard Conversion: Industry available products which are manufactured in metric measurements.

.2 Soft Conversion: Products which are still manufactured in Imperial units and are converted in specifications using arithmetic conversion factors.

.3 Rationalized Conversion: Dimensions which are soft converted and rounded off for ease of measurements.

.2 In cases where measurements may be open for interpretation, dual dimensions have been incorporated until hard conversions can be used exclusively.

5. DEFINITIONS

5.1 General

.1 All terminologies, abbreviations and acronyms used in this document are as listed in the various Standards, Codes, Rules and Bulletins used herein.

6. FORMAT

6.1 Practice

.1 This Scope of Work has been written to conform to the British Columbia Construction Association (BCCA) Bid Depository Rules and Procedures and Scope of Work.

6.2 Sections

.1 The Sections are written in a three part format: General, Products and Execution.

6.3 Reference

.1 Imperative tense has been used throughout this Document for work intended for the successful Contractor. There shall be no work exclusions unless they have been clearly identified as such herein.

.2 Any reference to "Design Authority" shall mean Earth Tech Canada Inc.

.3 The word "provide" shall mean "supply and install" unless otherwise indicated.

7. CODES

7.1 General

.1 All Codes, Standards, Rules, Regulations, Bulletins, By-laws etc., shall be those that are currently enforced in the locality of job site, unless otherwise specified herein.

END OF SECTION