Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections of Division 40. This section supplements requirements of Division 1.

1.2 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1-2009 except where specified otherwise.

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

1.3 DRAWINGS AND SPECIFICATIONS

.1 The intent of the Drawings and Specifications is to include all labour, products, and services necessary for complete Work, tested and ready for operation.

.2 These Specifications and the Drawings and Specifications of all other divisions shall be considered as an integral part of the accompanying Drawings. Any item or subject omitted from either the Specifications or the Drawings but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.

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

.4 If discrepancies or omissions in the Drawings or Specifications are found, or if the intent or meaning is not clear, advise the Contract Administrator for clarification before submitting Bid, in accordance with B4.

1.4 CARE, OPERATION AND START-UP

.1 Instruct City maintenance 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.

1.5 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Contract Administrator.

1.6 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.3 Minimum enclosure type to be used is NEMA 12 unless otherwise specified.

1.7 FINISHES

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

.1 Paint indoor switchgear and distribution enclosures light grey to ANSI 61 grey enamel, unless otherwise specified.

.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.

1.8 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:

.1 Lamicoid 3 mm thick plastic lamicoid nameplates, white face, black lettering, mechanically attached with self tapping screws.

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
Size 8	35 x 100 mm	3 lines	5 mm high letters

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

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

.5 Identification to be English.

1.9 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders and branch circuit wiring.

.1 Wire tags to be heat shrink type with black letters on white background.

1.10 SUBMITTALS

.1 Prior to delivery of any Products to job Site and sufficiently in advance of requirements to allow ample time for checking, submit Shop Drawings for review as specified in Division

.2 Submit Shop Drawings (including Product Data) for all equipment as required in each Section of this Specification.

.3 Prior to submitting the Shop Drawings to the Contract Administrator, the Contractor shall review the Shop Drawings to determine that the equipment complies with the requirements of the Specifications and Drawings.

.4 The term “Shop Drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data, which are to be provided by the Contractor to illustrate details of a portion of the Work. Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the adjacent items will be supplied and installed. Indicate cross-references to Design Drawings and Specifications. Adjustments made on Shop Drawings by the Contract Administrator are not intended to change the contract price. If adjustments affect the value of the Work state such in writing to the Contract Administrator prior to proceeding with the Work.

.5 Manufacture of Products shall conform to revised Shop Drawings.

1.11 RECORD DRAWINGS

.1 The Contractor shall keep one (1) complete set of white prints at the Site during work, including all addenda, change orders, Site instructions, clarifications, and revisions for the purpose of Record Drawings. As the Work on-site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions, which deviate from the original Contract Documents. Record Drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment.

1.12 O&M MANUAL

.1 Operations and Maintenance Manuals

.1 Refer to Section 01 78 00 for general O&M Manual requirements.

.2 In addition to the general requirements, 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 Manuals containing all pertinent information, drawings and documents of the Contractor's supply and/or documentation included with the instruments supplied by others, such as:

.1 Mechanical drawings of the equipment.

.2 Installation drawings and procedures.

.3 Instrument model numbers.

.4 Equipment specifications.

.5 Detailed utility requirements.

.6 Replacement parts list with model numbers.

.7 Recommended preventative maintenance frequency.

.8 Troubleshooting procedures.

.9 Procedures for dismantling.

.10 Procedure to operate the equipment/instruments.

.11 Recommended cleaning procedure.

.12 Recommended list of supplies to be used in conjunction with the operation and maintenance of the equipment.

.13 Recommended spare parts list

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

.5 Include type and accuracy of instruments used.

.6 Set of final reviewed Shop Drawings.

.7 Testing documentation including:

.1 Loop Check Report

.2 PLC Software Operation and Maintenance Manual:

.1 Provide a manual that contains, at minimum, all pertinent information, drawings and documents associated with the PLC program and associated integration, including:

.1 Printout of the entire PLC program. Printout to be sealed by a professional engineer.

.2 Repair instructions for common issues

.3 Printout of any related design documents, such as interface lists, etc.

.4 CD in a sleeve containing the latest PLC program including configuration software.

.3 HMI Operation and Maintenance Manual:

.1 Provide a manual that contains, at minimum, all pertinent information, drawings and documents associated with the PLC program and associated integration, including:

.1 Complete step-by-step procedures for operation of system including required actions via the HMI.

.2 Operation of computer peripherals, and associated input and output formats.

.3 Emergency, alarm and failure recovery procedures.

.4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

.5 Repair instructions for common issues.

.6 CD in a sleeve containing the latest HMI programs and configuration software.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 FAT Factory Acceptance Test

1.2 DESIGN REQUIREMENTS

.1 Develop a demonstration and test procedure, along with test forms, for the FAT.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit the following for review at least 15 Working Days prior to FAT.

.1 Detailed test procedure and test forms for review.

.1 Incorporate all changes to the procedure and test forms requested by the Contract Administrator.

.3 Submit the following, to be received on the date of the FAT:

.1 Detailed listings of all control logic and software utilized to implement the control sequences, for the scenarios demonstrated as part of the FAT. Listings are to be neatly organized, and commented as required. All supporting documents, including variable listings are to be included.

1.4 CLOSEOUT SUBMITTALS

.1 Include all FAT documentation and test forms in the O&M manuals.

1.5 DEMONSTRATION AND TESTING

.1 The location of the FAT will be in a Contractor supplied facility, within Winnipeg, Manitoba, Canada.

.2 Correct deficiencies, and re-test until satisfactory performance is obtained.

.3 Acceptance of tests during the FAT will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

1.6 COMPLETION OF FAT

.1 The FAT is considered to be complete only when full approval of the Contract Administrator has been received by the Contractor.

.2 Schedule additional re-tests until approval is obtained.

Part 2 Products

2.1 NONE USED.

.1 None Used.

Part 3 Execution

3.1 PROCEDURES

.1 All tests shall be documented.

.2 Produce test forms to allow for recording the results of the simulations and tests.

.3 Advise Contract Administrator of the date of testing. Contract Administrator may, at their discretion, observe factory acceptance testing based on the completeness of the submittal or other factors.

.1 Demonstration tests to include:

.1 Complete demonstration of meeting the requirements of the applicable Functional Requirements Specification.

.2 Response times to operator actions.

.3 Controller processor spare capacity.

.4 HMI graphics templates and overall system screen layout.

.5 HMI trends.

.6 Alarm system capabilities.

.7 System programming and configuration capability.

.4 The Contract Administrator may request additional tests and simulations at the FAT.

.5 The Contract Administrator will review the system, simulations, and test results. Incorporate comments and feedback from the Contract Administrator into the system design.

3.2 Evaluation

.1 All evaluations will be pass/fail.

.2 The Contractor is expected to ensure that all required demonstrations are fully operable and meet required specifications, prior to the FAT. Upon failure of a required demonstration in the FAT, the Contractor shall provide subsequent re-tests to the satisfaction of the Contract Administrator.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit commissioning plans and procedured, in writing, at least 10 Working days prior to commissioning.

1.2 CLOSEOUT SUBMITTALS

.1 Final Report:

.1 Include measurements, final settings and certified test results.

.2 Include completed commissioning forms

.3 Bear signature of commissioning technician and supervisor

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications as set during commissioning and submit to the Contract Administrator in accordance with Section 01 78 00 - Closeout Submittals.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.3 COMMISSIONING FORMS

.1 The Contract Administrator will provide the required commissioning forms.

.2 Supplement the provided forms as required to make a complete commissioning report package.

1.4 COMMISSIONING

.1 Carry out commissioning under direction of the Contract Administrator and in the presence of representatives of the Contract Administrator and the City.

.2 Inform, and obtain approval from the Contract Administrator in writing at least 14 days prior to commissioning or each test. Indicate:

.1 Location and part of system to be tested or commissioned.

.2 Testing/commissioning procedures, anticipated results.

.3 Names of testing/commissioning personnel.

.3 Correct deficiencies and re-test until satisfactory performance is obtained.

.4 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.5 Perform tests as required.

1.5 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by the Contract Administrator.

Part 2 Products

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Test instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 6 months prior to tests.

Part 3 Execution

3.1 STATUS PRIOR TO COMMISIONING

.1 Prior to commissioning, ensure that the following is completed:

.1 Installation of all panels and completion of all wiring connections.

.2 Testing wiring for continuity from the field device to the control panel.

3.2 PROCEDURES

.1 Provide a minimum of one qualified technician to test and commission the control system.

.2 Test each I/O point from the instrument to the HMI.

.1 Test both states of discrete points.

.2 Test, at minimum, two values for analog points.

.3 Test each piece of equipment individually for complete functionality.

.4 Completely test the E-Stop functionality of each piece of equipment, as provided.

.5 All modifications to the software program, to bypass interlocks or sensors, shall be recorded and documented clearly in a separate document, and the software.

.1 Any software bypasses that remain, prior to leaving site, must be authorized by the Contract Administrator or designated representative.

.6 All deficiencies must be corrected by the Contractor.

.7 Commission each system using procedures prescribed by the Contract Administrator.

.8 Optimize operation and performance of systems by fine-tuning control loops and PID values.

3.3 SYSTEM SOFTWARE

.1 Load PLC system with appropriate program, fully tested and approved as part of the software FAT.

.1 Any changes made to the software after the FAT must be submitted for review and approval of the Contract Administrator.

.2 Any issues identified on site must be communicated to the Contract Administrator. Approval is required prior to making any modifications.

.3 The Contractor is reminded that this facility is critical to operation of the City's wastewater pumping station.

3.4 CHECKLISTS, FORMS, AND REPORTS

.1 Complete checklists, forms, and reports for each instrument, loop, and control device.

.1 Instrument Loop Checklist.

.2 Discrete Device Checklist

3.5 DEMONSTRATION

.1 Demonstrate to the Contract Administrator operation of systems including sequence of operations under all potential conditions, start-up, shut-down interlocks and lock-outs.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Process and HVAC instrumentation.

1.2 REFERENCES

.1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA-C22.1-2009, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.3 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Include manufacturer's installation instructions for specified equipment and devices in O&M Manuals.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant.

.3 Operating conditions: 0 – 35 degrees C with 5 - 95% RH (non-condensing) unless otherwise specified.

.4 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

2.2 STATION FLOOD SWITCH

.1 Requirements:

.1 Suspended mechanical float switch
.2 Fluid: Wastewater
.3 Temperature Range: 0 to 50°C
.4 Output: Form C dry contact
.5 Protection: IP68
.6 Approvals: CSA

2.3 DUCT TEMPERATURE SENSORS WITH INTEGRAL TRANSMITTERS

.1 Requirements:

.1 RTD's: 100 ohm platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.

.2 Sensing element: hermetically sealed.

.3 Stem and tip construction: copper or type 304 stainless steel.

.4 Time constant response: less than 3 seconds to temperature change of 10 degrees C.

.5 Suitable for insertion into ducts at various orientations, insertion length 150 mm or as indicated

.6 Transmitter:

.1 Power Supply: loop powered

.2 Output Signal: 4-20 mA, 2-wire

.3 Accuracy: 0.2 degrees C over range of 0 to 70 degrees C.

.4 Stability: 0.02 degrees C drift per year.

.5 Transmitter range: -40 °C to 60 °C

.7 Acceptable Products:

.1 Rosemount

.2 Endress & Hauser

2.4 ROOM TEMPERATURE SENSORS WITH INTEGRAL TRANSMITTERS

.1 Requirements:

.1 RTD's: 100 ohm platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm degrees C.

.2 Mounting: Wall

.3 Protection: NEMA 4 or IP67

.4 Power Supply: loop powered

.5 Output Signal: 4-20 mA, 2-wire

.6 Accuracy: 0.2 degrees C over range of 0 to 70 degrees C.

.7 Stability: 0.02 degrees C drift per year.

.8 Acceptable Products:

.1 Rosemount

.2 Endress & Hauser TST434

2.5 FLOW SWITCH (DIFFERENTIAL PRESSURE SWITCH)

.1 Service:

.1 Ventilation airflow, fan failure sensing.

.2 Requirements:

.1 Industrial - grade

.2 Adjustment for setpoint pressure

.3 Temperature range:

.1 -20°C to 60°C

.4 Pressure limits:

.1 68.95 kPa (10 psig) continuous

.2 172.4 kPa (25 psig) surge

.5 Repeatability: +/- 2%

.6 Form C (SPDT) switch, rated 5A at 120 VAC

.7 Electrical connections: Inside enclosure

.8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

.9 CSA approved.

.3 Sizing:

.1 Size as required to provide clear indication of fan failure.

2.6 MAGNETIC FLOW METER

.1 Service:

.1	Fluid:	Wastewater
.2	Fluid Temperature:	-10°C to 50°C
.3	Ambient Temperature:	0°C to 40°C
.4	Pressure:	0 – 100 kPa

.2 Accuracy: 0.5% of span.

.3 Flowtube Requirements:

.1	Area Classification:	unclassified
.2	Size:	see drawings
.3	Flange Material:	Carbon Steel
.4	Electrodes:	316L Stainless Steel or Tantalum
.5	Electrode Housing:	Sealed, welded housing.
.6	Lining:	Neoprene or Teflon
.7	Grounding:	Straps or rings.
.8	Enclosure:	NEMA 4X rated.
.9	Approvals:	CSA or equivalent.

.4 Transmitter Requirements:

.1	Mounting:	Wall (near flowtube)
.2	Local Display:	LCD
.3	Units of Operation:	L/s
.4	Power Supply:	120 VAC
.5	Output:	4-20 mA with HART.
.6	Approvals:	CSA or equivalent.
.7	Enclosure:	NEMA 4X rated.

.5 Acceptable Products:

.1 Rosemount 8705 flowtube with 8712D transmitter
.2 ABB Magmaster MF series
.3 E&H Promag 33
.4 or approved equal in accordance with B6

2.7 SUBMERSIBLE LEVEL TRANSMITTER

.1 Service:

.1 Fluid: Wastewater
.2 Fluid Temperature: -10°C to 50°C
.3 Sensing range: 0 – 10m H_2O

.2 Requirements:

.1 CSA Class I, Zone 1 Groups IIA or Class I, Div 1, Group D certified
.2 F.M. approved.
.3 Sensor Body: Titanium or Stainless Steel
.4 Pressure Connection: Elastomeric diaphragm
.5 Ingress Protection: IP68
.6 Electrical Connection: Leads in submersible cable assembly.
.7 Electrical Signal: 2 wire, 4-20 mA,
.8 Cable Length: As per drawings
.9 Accuracy: <±0.25% full scale
.10 Pressure compensation through vented cable.

.3 Acceptable Products:

.1 GE Druck PTX 1290
.2 or approved equal in accordance with B6

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.4 Electrical:

.1 Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.
.2 Install communication wiring in conduit or utilizing ACIC cabling if shown on the drawings.

.1 Provide complete conduit /cable system to link instrumentation and the control panel(s).

.2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.3 Maximum conduit fill not to exceed 40%.

.4 Design drawings do not show conduit layout.

3.2 TEMPERATURE SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.

.3 Duct installations:

.1 Do not mount in dead air space.

.2 Locate within sensor vibration and velocity limits.

.3 Securely mount extended surface sensor used to sense average temperature.

.4 Thermally isolate elements from brackets and supports to respond to air temperature only.

.5 Support sensor element separately from coils, filter racks.

.4 Averaging duct type temperature sensors.

.1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.

3.3 SUBMERSIBLE LEVEL TRANSMITTERS

.1 Install in a manner to allow easy removal of the transducer and cable assembly for maintenance purposes.

3.4 IDENTIFICATION

.1 Identify field devices with lamacoids. Install in a conspicuous location.

3.5 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 40 80 11 - Automation Commissioning.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Process Control Devices including damper actuators.

1.2 REFERENCES

.1 Association (NEMA).

.1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).

.2 Canadian Standards Association (CSA International).

.1 CSA-C22.1-2009, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.3 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Include manufacturer's installation instructions for specified equipment and devices in O&M Manuals.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight assembly.

.3 Operating conditions: 0 – 32 degrees C with 5 - 95% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

2.2 ELECTRONIC MODULATING DAMPER ACTUATORS

.1 Requirements:

.1 Direct mount proportional type.

.2 Spring return type for "fail-safe" in Normally Open or Normally Closed position as indicated.

.3 Torque: 4 Nm (35 lb-in) minimum.

.4 Damper actuator to drive damper from full open to full closed in less than 150 seconds.

.5 Spring return to drive damper from full open to full closed in less than 25 seconds at normal room temperature.

.6 Angle of Rotation: 90° minimum, adjustable with mechanical stops.

.7 Direction of Rotation: Configurable via switch mounted on the actuator.

.8 Shaft Diameter: 8.0mm to 16.0mm (3/8” to 5/8”).

.9 Electrical Connection: 0.9 meter (3 ft), 18 AWG, plenum rated cable.

.10 Overload protection: Required.

.11 Auxiliary Switches: Not required.

.12 Position Feedback: Required, 0-10V output.

.13 Power requirements: 5 VA maximum at 24 VAC, 60Hz.

.14 Operating range: 0-10 or 2-10 VDC.

.15 Operating Temperature: -30 °C to 50 °C.

.16 Housing: NEMA 2 or IP54 or better.

.17 CSA listing or equivalent.

.18 Acceptable Products: Belimo LF24-SR or approved equal in accordance with B6

2.3 ELECTRONIC ON-OFF DAMPER ACTUATORS

.1 Requirements:

.1 Direct mount on-off type.

.2 Spring return type for "fail-safe" in Normally Open or Normally Closed position as indicated.

.3 Torque: 4 Nm (35 lb-in) minimum.

.4 Damper actuator to drive damper from full open to full closed in less than 90 seconds.

.5 Spring return to drive damper from full open to full closed in less than 60 seconds at normal room temperature.

.6 Angle of Rotation: 90° minimum, adjustable with mechanical stops.

.7 Direction of Rotation: Configurable via switch mounted on the actuator.

.8 Shaft Diameter: 8.0mm to 16.0mm (3/8” to 1/2”).

.9 Electrical Connection: 0.9 meter (3 ft), 18 AWG, plenum rated cable.

.10 Overload protection: Required.

.11 Auxiliary Switches: One SPDT, adjustable operation between 0 and 95°.

.12 Power requirements: 7.5 VA maximum at 120 VAC, 60Hz.

.13 Operating Temperature: -30 °C to 50 °C.

.14 Housing: NEMA 2 or IP54 or better.

.15 CSA listing or equivalent.

.16 Acceptable Products: Belimo LF120-S or approved equal in accordance with B6

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.4 Electrical:

.1 Complete installation in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install communication wiring in conduit or utilizing ACIC cabling.

.1 Provide complete conduit /cable system to link instrumentation and the control panel(s).

.2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.

.3 Maximum conduit fill not to exceed 40%.

.4 Design drawings do not show conduit layout.

.5 Terminate devices with leads in junction boxes with terminals.

.1 Wire nuts are not permitted.

.2 Protect leads in flexible conduit.

3.2 IDENTIFICATION

.1 Identify devices with lamacoids. Mount in a conspicuous location.

3.3 TESTING AND COMMISSIONING

.1 Calibrate and test control devices for accuracy and performance in accordance with Section 40 80 11 – Automation Commissioning.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 C22.2 No.205-M1983(R2004), Signal Equipment.

.2 International Electrotechnical Commission (IEC)

.1 IEC 61131, Programmable Controllers

1.2 DEFINITIONS

.1 PLC Programmable Logic Controller

1.3 PLC SYSTEM DESCRIPTION

.1 The PLC consists of a controller rack, mounted in control panel CP-L1.

.2 The City utilizes a remote SCADA system that interfaces with the pumping station control system via a Control Microsystems SCADAPack RTU.

.1 Currently only SCADA monitoring and alarming is implemented.

.2 Future remote SCADA control is desired, and to be implemented into the design.

.3 The Contractor's responsibility on the SCADA system is limited to:

.1 Installation of CP-L3 containing the RTU.

.2 Installation of conduit and wiring to CP-L3.

.3 Provision of an interface in the PLC for the SCADA system.

1.4 SYSTEM ARCHITECTURE

.1 Single PLC

.1 No remote I/O.

.2 Connected to the following:

.1 Touchscreen HMI via Modbus TCP over Ethernet

.2 VFD-P-L1 via Modbus TCP over Ethernet (future)

.3 VFD-P-L1 via Modbus TCP over Ethernet (future)

.4 SCADA RTU via Modbus TCP over Ethernet

1.5 SOFTWARE OWNERSHIP

.1 The City will fully own all PLC programming logic supplied, and may utilize the software provided for any purpose including:

.1 Modification and revision.

.2 Use at other City facilities.

.2 The City may turn the software over to a 3rd party, for use at any City owned facility.

.3 Provide source code for all custom software and function blocks, or any other software logic utilized in the application.

.1 Source code for base function blocks provided by the PLC manufacturer are not required.

1.6 DESIGN REQUIREMENTS

.1 Design and implement a complete operating PLC system.

.2 The design is to be based upon the supplied Functional Requirements Specification.

.1 Utilize a tag naming convention that extends, and does not conflict with the tag scheme utilized in the Functional Requirements Specification.

.3 The PLC is utilized to control wastewater pumping for a municipal application. The consequences of system failure could be significant, and thus a high level of care, attention to detail, and testing is expected.

.4 The PLC software design is to be supervised and approved (sealed) by a Professional Engineer licensed to practice in Manitoba.

.5 Do not assume that the Contractor's internal standards or standard programming methodology will be acceptable for this project. No additional payment will be made for assumptions made regarding standard methods utilized by the Contractor.

.6 The Contract Administrator will review the overall design. Make changes as requested by the Contract Administrator.

1.7 SUBMITTALS

.1 All submittals to be in accordance with Section 01 33 00 – Submittal Procedures.

.2 Stage 1:

.1 Submit product datasheets

.3 Stage 2:

.1 Submit a PLC design criteria prior to initiating programming which includes:

.1 The general PLC program structure.

.2 The programming languages (ie ladder, function block) to be utilized

.3 A sample section of code.

.4 HMI interface

.5 SCADA interface map.

.6 Variable naming methodology.

.4 Stage 3:

.1 Submit a 25% complete submittal, including:

.1 Software logic printout.

.2 The primary purpose of this submittal is to ensure that the methodology being utilized is as per requirements prior to the bulk portion of the work being

completed. At this point, copies of code for similar pieces of equipment should not be completed.

.5 Stage 4:

.1 Submit a 99% complete submittal a minimum of 20 Working days prior to the FAT, including:

.1 Complete software logic printout.

.2 HMI interface

.3 SCADA interface map.

1.8 O&M MANUALS

.1 Include the following in the O&M Manuals:

.1 Product datasheets.

.2 Hardware and software user manuals.

.3 Letter stating that the PLC application has been reviewed and approved. The letter is to be signed and sealed by a Professional Engineer licensed to practice in Manitoba.

.4 HMI and SCADA interface map.

.5 PLC database listing and logic printout.

.6 CD sleeve with CD containing PLC application program.

Part 2 Products

2.1 PROGRAMMABLE LOGIC CONTROLLER

.1 Suitable product will be a PLC system produced by a major, international industrial automation vendor.

.2 Modularity

.1 The construction of the PLC is to be modular, utilizing separated modules, that are located within or on a common substructure such as a rack or a DIN rail.

.2 Utilize separate modules for power supplies, fans, processor, and I/O.

.3 Each module to visibly indicate relevant module status information.

.4 Common components within the controller system, such as racks or rails, which cannot be removed and replaced on-line to have a minimum of active components.

.5 Keying systems to be utilised to prevent improper module insertion.

.6 Module set-up is to be universal and not rely on the use of removable components such as jumpers or shorting bars, or require permanent changes to module components.

.7 The organisation of the modules to follow consistent design practices.

.3 Self-Tests, Diagnostics and Failure Modes

.1 Integrity of controller hardware and software to be constantly monitored by an intrinsic series of continuously running self-tests and diagnostics.

.2 Immediately report abnormal results as system alarms.

.3 Have predictable failure mode upon an error. At a minimum, faults are to generate a system alarm.

.4 Equipment may have the ability to diagnose degradations to performance that may not yet adversely affect operator functions or be a permanent failure. When such conditions are automatically noted, the system is to journal the event in the Historian and have the capability to report such information selectively, as either a system alarm or a message on the programming workstation.

.4 Physical Size Requirements

.1 The PLC must fit with the control panel dimensions, as shown in the drawings.

.5 Processor:

.1 Physical Size: To fit in rack as per drawings.

.2 I/O Processing Requirements (minimum)

.1 Discrete I/O: 1024 (in rack)

.2 Analog I/O: 256 (in rack)

.3 Integrated Ethernet port, 10/100 Mb

.1 Capable of native Modbus TCP communication

.1 Use of a Modbus TCP communication module with configurable mapping to internal variables is not acceptable.

.4 Internal RAM: 4096 kB

.5 Flash memory card to contain application program

.1 8 MB minimum or as required to contain application program with 25% spare space.

.1 Application program on memory card to contain all program documentation, provided there is space.

.6 Processing power (minimum)

.1 8100 instructions per ms

.7 Display on front including

.1 Running status

.2 Processor error status

.3 I/O fault status

.4 Serial communication activity

.5 Memory card missing or faulty

.6 Activity on the Ethernet Modbus/TCP network

.7 Ethernet Modbus/TCP network status

.8 Ethernet Modbus/TCP data rate (10 or 100 Mbps)

.8 Real-time clock.

.6 Power Supply

.1 Redundancy: not required.

.2 Requirements:

.1 Supply Voltage: 24 VDC

.2 Supply Protecting: Integral fuse or breaker.

.3 Size: As indicated on the drawings.

.4 Output Voltage: As required.

.5 Output Current: As required, with a minimum of 20% spare capacity above rated current draw of all loads. Calculate power supply loads with all points energised and all installed input and output points used or spare carrying a maximum connected load.

.6 Integrated protection against overloads, short circuits, and overvoltages.

.7 Backplane / Rack

.1 Number of slots: as indicated on drawings

.2 Provide protective covers for all unused slots

.8 Input / Output Modules

.1 General

.1 Functionality

.1 Provide physical interface between field signals and the control equipment.

.2 Provide electrical isolation of circuits between the field and the controller.

.3 Perform validity checks of all input values.

.4 Perform input and output conditioning, including square root extraction.

.5 Perform self-diagnostics.

.6 Perform reporting and responding to the controller.

.7 Display an appropriate alarm on the HMI upon an I/O module failure.

.2 I/O Module Installation:

.1 Capable of being removed from or inserted into their rack slot while under power and without disturbing external wiring.

.2 On-line removal and replacement of a failed module will not require personnel to reconfigure system software, alter system wiring or cabling, de-energize the system module, or re-initialize the controller.

.3 Field Wiring

.1 Terminals at the module, or

.2 Multi-pin connector on the module.

.1 Provide corresponding pre-manufactured cable, minimum 1 meter long, with multi-pin connector at one end and loose wires at the other end.

.2 Discrete Input (DI) Modules

.1 Requirements:

.1 Voltage: 24 VDC.

.2 Current sinking.

.3 Minimum channels per module: 16

.4 Meet IEEE C37.90.1 surge withstand capability.

.5 Isolation: Isolated from logic or processor circuitry via optical coupling or other equivalent means.

.6 Indicating LEDs:

.1 Channel status (on/off) for each I/O channel.

.2 Module Error/Fault.

.3 Discrete Output (DO) Modules – 16 Channel

.1 Requirements:

.1 Voltage: 24 VDC.

.2 Current sourcing.

.3 Current capacity: 0 – 0.5A.

.4 Meet IEEE C37.90.1 surge withstand capability.

.5 Protection against current overloads.

.6 Minimum channels per module: 16

.7 Isolation: Isolated from logic or processor circuitry via optical coupling or other equivalent means.

.8 Configurable fail state: Freeze in the present state (fail-last) or turn off (fail-off), upon a controller or Remote I/O communication failure.

.9 Indicating LEDs:

.1 Channel status (on/off) for each I/O channel.

.2 Module Error/Fault.

.4 Analog Input (AI) Modules

.1 Requirements:

.1 Minimum channels per module: 8 channels

.2 Convert analog signals to digital format with a minimum 15 bit analog-to-digital resolution.

.3 Channels individually configurable for 0-20mA current input, 4-20mA current input, 0-10V voltage input, 2-10V voltage input

.4 Acquisition time: 9 ms maximum for all channels.

.5 Voltage input impedance: 10 MΩ minimum.

.6 Current impedance: 250 Ω

.7 Maximum error: 0.15% at 25 °C.

.8 Have common mode signal rejection greater than 60 dB to 60 Hz.

.9 Isolation

.1 Between channels: +/- 300V

.2 Between channels and bus: 1400 VDC

.3 Between channels and ground: 1400 VDC

.5 Analog Output (AO) Modules

.1 Requirements:

.1 Convert digital data from controller processor to acceptable analog output signals using a minimum 15 bit digital-to-analog resolution.

.2 Minimum 4 channels per module.

.3 Channels individually configurable for either current or voltage output.

.4 Current output: 4 - 20 mA, capable of driving up to 500 ohms.

.5 Voltage Output: 0 - 10 VDC, capable of driving a load as low as

.6 Configurable fail state: Freeze in the present state (fail-last) or turn off (fail-off), upon a controller

.7 Output refresh time: 1 ms

.8 Maximum error: 0.1% at 25 °C.

.9 Isolation

.1	Between channels:	750 VDC
.2	Between channels and bus:	1400 VDC
.3	Between channels and ground:	1400 VDC

.9 Required Accessories:

.1 Include all accessories including cables, terminators, backplanes, memory, batteries, and other components required to make the system operable.

.2 Include a second memory card (in addition to the one installed in the processor) that is of the same memory capacity.

.10 Acceptable Products:

.1 Schneider Electric M340 series or approved equal in accordance with B6.

2.2 PLC PROGRAMMING SOFTWARE

.1 Supply PLC programming software enabling the City to develop, debug, and monitor application programs.

.2 Requirements:

.1 Operate on Microsoft Windows XP®.

.2 Menu driven.

.3 Integrated help functions to assist the user.

.4 Programming software to be fully compliant with the IEC 61131-3 control languages and include:

.1 Ladder Logic (LD)

.2 Function Block Diagram (FBD)

.3 Sequential Function Chart (SFC)

.4 Structured Text (ST)

.5 Instruction List (IL)

.5 System diagnostics/fault status.

.6 Program documentation/cross-reference printout.

.7 Hardware Configuration.

.8 On-line data changes.

.9 Input/output forcing.

.10 Support both on-line and off-line programming.

.3 Program Instruction Set

.1 Minimum requirements:

.1 Math Instructions: add, subtract, multiply, divide, square root; ladder logic programming to provide integer and floating point math.

.2 Comparison Elements: Less Than, Greater Than, Equal to, Less than or Equal to, Greater than or Equal to, Not Equal, Relational Contacts.

.3 Timer and Counter Elements: Counterup, Countdown, Time up, Time down (with accumulator, preset and time-base sub-elements); time base from .01 sec to hours) counter scale factors from X1 to X1000.

.4 Relay Contact Elements: N.O., N.C., Transition on, Transition off, (positive/negative).

.5 Relay Coil Elements: Standard, Latch, Unlatch.

.6 Control Algorithms: PID

.4 PLC Simulator

.1 Provide software to simulate a PLC on a PC.

.5 Licence:

.1 Requirements

.1 One user.

.2 Fully capable of programming all features for PLC supplied.

.3 Licence does not expire.

.6 Acceptable Products:

.1 Schneider Electric Unity Pro Small (Latest version available.)

2.3 ACCESSORIES

.1 Include the following accessories:

.1 One Flash card, installed in the PLC processor, for running the application program.

.2 One spare Flash card, of the same size and configuration as that utilized in the processor.

.3 Serial or USB Transfer cable for downloading program.

2.4 USB MEMORY STICK

.1 Provide a USB memory stick as part of the Commissioning process, with the following:

.1 Latest application program, with documentation.

.2 PLC hardware user manuals

.3 PLC software user manuals.

.4 HMI hardware user manuals.

.5 HMI software user manuals.

.2 Locate the memory stick in a pocket in the control panel.

2.5 SPARE PARTS

.1 Supply the following spare parts:

.1 One power supply module.
.2 One backplane.
.3 One processor module.
.4 One DI 24 VDC I/O module.
.5 One DO 24 VDC I/O module.
.6 One AI module.
.7 One AO module.

.2 Complete set of spare parts to be supplied prior to commissioning.

Part 3 Execution

3.1 HARDWARE INSTALLATION

.1 Install the PLC in control Panel CP-L1 as per manufacturer instructions and recommendations.

.2 Update the processor and all updatable modules with the latest firmware.

3.2 PLC PROGRAMMING SERVICES

.1 General Requirements:

.1 Program in a manner to make the program easy to follow and maintain.
.2 Insert comments into the program to clarify all items not readily apparent.
.3 Utilize commonly accepted good programming practices.
.4 Utilize function blocks to encapsulate common systems and sections of code.
.5 All field inputs to be checked against range limits. If a field input is outside of its range limits or the data cannot be otherwise propagated because of an equipment fault, the data is to be declared “bad” within the Control System.
.6 All tagnames are to be named and identified using positive logic. Where required, provide comments to clarify the states.
.7 Program PID Control loops to provide bumpless transfer when switching between automatic and manual control modes.
.8 Configure alarms generated in the PLC into two types:
.1 Automatic reset alarms clear upon the alarm condition being removed. Provide logic as required to ensure that fast cycling of the alarm does not occur.
.2 Manual reset alarms require reset from the HMI. Utilize manual reset alarms where the initiating condition would be removed by the action resulting from the alarm. Ensure that manual reset alarms are configured such a a reset signal from the HMI will not clear the alarm, unless the initiating condition is cleared.
.9 For any piece of equipment that has control from the PLC, provide a Manual and Auto control mode selector buttons on the equipment faceplate, and allow for

manual control of the equipment from the HMI. Provision of a hardwired local, hand, or manual control mode in the field does not eliminate this requirement.

.2 Provide all required PLC programming as per the Functional Requirements Specification.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 All Control Panels shall be built by a CSA/cUL-approved manufacturer and shall bear the CSA/cUL seal with the manufacturer's file number.

.2 All Control Panels shall be factory assembled and pre-wired. The Control Panel wiring shall be verified at the manufacturer's factory and completely tested before being shipped to the site.

.3 Supply, install, wire and test all components inside the Control Panels according to the specifications herein and the drawings.

1.2 SUBMITTALS

.1 Prior to construction:

.1 Submit product datasheets, and wait for approval, prior to construction of the Control Panels.

.2 Submit stamped red-line mark-ups of the proposed modifications to the control panels. If significant modifications are proposed/required, AutoCAD drawings will be supplied to the Contractor for revision.

.2 Prior to shipment:

.1 Submit electronic pictures of enclosure exterior and interior, including door interior.

.1 Pictures to be of sufficient resolution to read component labels.

.2 As-built drawings:

.1 Submit as-built drawings. Minor changes may be made via red-line mark-ups.

.2 Draft significant changes on AutoCAD drawings.

.3 Do not ship control panel until approval from Contract Administrator is received.

1.3 INSPECTION

.1 A factory inspection of the control panels will be performed at the discretion of the Contract Administrator based upon the pre-shipment submittals.

.2 If requested, demonstrate and test the control panel in presence of the Contract Administrator designated representative.

Part 2 Products

2.1 GENERAL

.1 Construction of the control panels is required, in accordance with the supplied drawings.

.2 Control devices of each category shall be of same type and manufacturer.

2.2 ENCLOSURES

.1 Install lamacoids as per the control panel layout drawings.

.2 All indoor control panels shall be NEMA 12 or as shown on drawings.

.3 All enclosure angles and cut-outs shall be free of dents, gouges or weld marks, and shall present a clean, smooth appearance.

.4 No screws, fittings or other fastenings shall be used on external panel faces, which must be free of any marks, scratches or defaults.

.5 The door is to be a minimum fourteen (14) gauge steel plate, full height and flush with adjacent surfaces.

.6 The interior of the control panel shall be painted gloss white.

.7 Component mounting plates shall be three (3) mm thick steel and shall be painted with one (1) coat of primer and one (1) coat of white baked enamel.

.8 All Control Panel doors shall open through 180 degrees without restriction.

.9 All control panels of a depth greater than or equal to twelve (12) inches shall be equipped with a fluorescent lighting device located in the cabinet's upper portion with a door switch. Whenever the door is opened, the lighting system shall automatically be activated.

.10 Enclosure brand shall be Hoffman or an approved equivalent.

2.3 POWER SOURCE

.1 Each power source must be protected by a CSA approved circuit breaker or fuse.

.2 The location of each power source must be clearly shown.

.3 Panels powered by more than 1 electrical source shall display on their door; "Caution: This panel is electrically powered by more than one source".

2.4 COMPONENTS

.1 Rails (DIN Rails)

.1 Rails used must be DIN Rail style TS 35mm, slotted.

.2 When used to mount terminals, rails shall be mounted on straight raisers (Rail support / Mounting feet) so as to raise them to the same height as the highest adjacent wiring duct.

.3 Raisers (Rail support / Mounting feet) shall not be used when rail hosts heavy components.

.2 Terminals

.1 Requirements:

.1 TS-35 DIN Rail mounting.

.2 Voltage rating:

.1 600V for general control circuits.

.2 600V for power circuits.

.3 Manufacturer: Phoenix Contact or approved equal in accordance with B6.

.2 Terminal blocks shall be designed for the size of the wires to be connected to them. Terminal blocks used for analog, digital, and power cables shall be identified and physically separated from each other.

.3 Each terminal shall bear an identification number on both sides.

.4 Drawings and templates supplied may not detail all hardware components such as labels, stoppers, rail lifters, end plates, separators, etc. The supplier must supply and install such components when required.

.3 Ground Bus Bar

.1 Supply a ground bus bar in each control panel.

.2 Requirements:

.1 Tapped holes with screws.

.2 Bar to have sufficient connection points for all cables entering the control panel, plus 25% spare.

.3 Maximum one wire termination per screw.

.4 Pushbutton, Switch and Indicator Light

.1 When required, all control panel pushbuttons, switches and indicator lights shall be at least NEMA 12 (or better)-type devices.

.2 Manufacturer to be Allen-Bradley or approved equivalent.

.5 Programmable Logic Controllers

.1 As per section 40 94 43.

.6 Touch-screen HMI

.1 As per section 40 95 20.

.7 General Purpose Relays

.1	Type:	DPDT or as shown on drawings
.2	Indication:	LED
.3	Coil Voltage:	As per drawings
.4	Contact Rating:	5A (120 VAC), 5A (24 VDC)
.5	Approvals:	CSA
.6	Manufacturer:	Omron or approved equal in accordance with B6

.8 10 VDC, 24 VDC Power Supplies

.1	Size:	As shown on the drawings
.2	Supply Voltage:	120 VAC, 1ph
.3	Approvals:	CSA
.4	Manufacturer:	Sola or approved equal in accordance with B6

.9 Uninterruptible Power Supply

.1	Size:	850 VA, 500 W
.2	Type:	Offline
.3	Input Voltage:	120 VAC, 1ph
.4	Output Voltage:	120 VAC, 1ph
.5	Manufacturer:	Sola or approved equal in accordance with B6

.10 Ethernet Switch

.1	Ports:	8
.2	Speed:	100BASE-T
.3	MDI/MDI-X:	Automatic
.4	Supply Voltage:	24 VDC
.5	Approvals:	CSA
.6	Manufacturer:	Moxa or approved equal in accordance with B6

.11 Grounding

.1 All control panel components shall be adequately grounded in accordance with the component manufacturer, especially control system components.

.2 Firmly bond all panel mounted devices on or within the panels to ground. Provide supplementary bonding conductors for back panels and doors. Attach a separate bonding conductor to all devices that are not firmly fastened to the panels with screws for such devices as case mounted instruments, meters, etc.

.12 Wiring

.1 All conductors shall be securely fastened to terminals at both ends; no splices are allowed inside the panel.

.2 No more than two (2) conductors may be terminated under each terminal screw. All internal panel conductors shall be connected to the same side of a terminal block, and external conductors to the other side. The only exception is for fused terminals which require connection to the field side for internal wiring.

.3 All wires and cables inside the control panels shall be identified on both ends with non-erasable markers from.

.4 Identification shall follow the supplied documents, such as wiring diagrams.

.1 Label both ends of each wire.

.2 Utilize machine printed non-slip labels.

.3 Wherever possible wire labels shall be positioned to be read from the panel opening without removal of wire duct covers or other wiring.

.5 Individual conductors or wires exiting a cable shall be identified using non-erasable markers.

.6 The routing of all analog, digital, and power cable wiring inside control panels shall be segregated as much as possible, in distinct wiring ducts, by the type of signal they are carrying. All wires shall be physically protected by wiring ducts with covers. The wiring ducts shall be of sufficient size to be filled to a maximum of 50% when all wires are inside.

.7 All analog signal wiring shall be 18 AWG shielded twisted pairs such as Belden No. 8760, or an approved equivalent. Shield wires exiting the jacket must be covered with a black heat shrink, and the overall cable at the jacket end must also be covered with a heat shrink.

.8 All 24 VDC or 120 VAC discrete signal panel wiring shall be 16 AWG TEW stranded conductor.

.1 Increase the size of power wiring, 12 AWG minimum.

.9 The sizes and colours of wires shall be in accordance with the CSA and the Canadian Electrical Code.

.10 The panel builder shall group and form wiring into a loop when going from a fixed part of the panel to a door. Each end of the loop shall be properly supported.

.11 Ethernet Patch Cords

.1 Requirements:

.1 Cat-5e.

.2 Jacket colour: Blue.

.12 Wiring Duct

.1 All wires shall be run in narrow slot wiring duct such as such as Panduit or an approved equivalent.

.2 Wiring Duct shall be installed on both sides of the panel and between the DIN rails.

.3 Wire or cable, connected to internal device or arriving from external device, shall be uncovered by Wiring Duct for a maximum of 10 cm.

.4 120 VAC wires cannot share wiring duct with 10 VDC, 24 VDC or 4-20 mA wires, but can cross their path.

Part 3 Execution

3.1 COMPONENT INSTALLATION

.1 Components on the front of the panel shall be identified with an individual permanent nameplate installed in an organized manner. The nameplate must identify the component's function.

.2 Each component inside the control panel shall be identified with a nameplate corresponding to the drawings.

.3 All non-DIN rail mountable devices in the control panel shall be mechanically affixed to the back panel with either tapped or self-tapping screws.

.4 All control devices shall be mounted so that any component can be replaced without removing the sub-panel.

.5 Components and/or auxiliary instruments mounted at the rear of the panel shall be readily accessible and their installation shall not be affected by, or interfere with the removal of any panel instrument.

.6 Nameplates shall be made of lamacoid material with a white background and engraved black letters for internal and external components. Nameplates must resist harsh industrial conditions.

.7 Supply and install all required fuses.

.8 Control devices must be spaced adequately to allow for cooling, replacement, servicing, and wiring access.

.9 Control devices shall be grouped according to voltage and function to reduce electrical noise.

3.2 IDENTIFICATION

.1 Perform terminal identification using a computerized device. Handwriting is not acceptable.

.2 Label terminals as shown on drawings.

.3 Install label above each terminal block with terminal block name.

3.3 TESTING

.1 Testing of the control panels shall be fully completed prior to the FAT, and shall include at minimum:

- .1 Provide a signed and dated inspection sheet with all tests performed listed on it.
- .2 The list of the various test procedures described hereunder is not restrictive, and does not relieve the control panel manufacturer of his responsibility to perform any other work that is not mentioned but requested to verify the good operation of the control panels.
- .3 Isolate all instruments and components of the control panels as required to protect them from any damage during tests.
- .4 Provide the services of qualified personnel as well as tools and equipment required to perform all tests and inspection of the control panels.
- .5 Tests to include:
  - .1 Power supply functionality
  - .2 PLC component functionality
  - .3 Point to point tests of all inputs and outputs
  - .4 Power terminal voltage verification
  - .5 Relays and switches functionality
  - .6 E-stop system component functionality
  - .7 Receptacle and lighting functionality
  - .8 Ethernet switch and fibre transceiver functionality

3.4 SPARE COMPONENTS

.1 Supply two spares of each fuse type and rating. Place in a clear plastic bag and attach to the panel door interior

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 HMI Human Machine Interface

1.2 HMI SYSTEM DESCRIPTION

.1 The HMI consists of a single touch-screen panel, mounted in control panel CP-L1.

.2 The City utilizes a remote SCADA system that interfaces with the pumping station control system via a Control Microsystems SCADAPack RTU.

.1 Currently only SCADA monitoring and alarming is implemented.

.2 Future remote SCADA control is desired, and to be implemented into the design.

.3 The Contractor's responsibility on the SCADA system is limited to:

.1 Installation of CP-L3 containing the RTU.

.2 Installation of conduit and wiring to CP-L3.

.3 Provision of an interface in the PLC for the SCADA system.

1.3 SOFTWARE OWNERSHIP

.1 The City will fully own all HMI programming logic supplied, and may utilize the software provided for any purpose including:

.1 Modification and revision.

.2 Use at other City facilities.

.2 The City may turn the software over to a 3rd party, for use at any City owned facility.

.3 Provide source code for all custom software and function blocks, or any other software logic utilized in the application.

.1 Source code for base function blocks provided by the HMI manufacturer are not required.

1.4 DESIGN REQUIREMENTS

.1 Design and implement a complete operating HMI system.

.2 The design is to be based upon the supplied Functional Requirements Specification.

.1 Utilize a tag naming convention that extends, and does not conflict with the tag scheme utilized in the Functional Requirements Specification.

.3 The HMI is utilized to control wastewater pumping for a municipal application. The consequences of system failure could be significant, and thus a high level of care, attention to detail, and testing is expected.

.4 The HMI design is to be supervised and approved (sealed) by a Professional Engineer licensed to practice in Manitoba.

.5 Do not assume that the Contractor's internal standards or standard programming methodology will be acceptable for this project. No additional payment will be made for assumptions made regarding standard methods utilized by the Contractor.

.6 The Contract Administrator will review the overall design. Make changes as requested by the Contract Administrator.

1.5 SUBMITTALS

.1 All submittals to be in accordance with Section 01 33 00 – Submittal Procedures.

.2 Stage 1:

.1 Submit product datasheets

.3 Stage 2:

.1 Submit an HMI design criteria prior to initiating programming which includes:

.1 The general HMI structure.

.2 A sample screen / window layout.

.3 A sample faceplate.

.4 Variable naming methodology.

.4 Stage 3:

.1 Submit screenshots of all screens, and printouts of scripts and the tag database upon 25% completion.

.2 The primary purpose of this submittal is to ensure that the methodology being utilized is as per requirements prior to the bulk portion of the work being completed. At this point, copies of code and graphics for similar pieces of equipment should not be completed.

.5 Stage 4:

.1 Submit a 99% complete submittal a minimum of 20 Working days prior to the FAT, including:

.1 Submit screenshots of all screens.

.2 All scripts

.3 Tag database.

1.6 O&M MANUALS

.1 Include the following in the O&M Manuals:

.1 Product datasheets.

.2 Hardware and software user manuals.

.3 Letter stating that the HMI Application has been reviewed and approved. The letter is to be signed and sealed by a Professional Engineer licensed to practice in Manitoba.

.4 CD sleeve with CD containing HMI application program.

Part 2 Products

2.1 TOUCHSCREEN HMI

.1 Hardware Requirements:

- .1 Display:
  - .1 Type: Backlit colour TFT LCD
  - .2 Size: 307mm (12.1”)
  - .3 Resolution: 800 x 600 minimum
- .2 Data Entry: Touch-screen
- .3 Memory Capacity:
  - .1 Application: 32 MB Flash EPROM
  - .2 Expansion: By means of CompactFlash card, up to 4 GB capacity
- .4 Real Time Clock.
- .5 Processor: 133 Mhz RISC CPU or better

.2 Software Requirements

- .1 Maximum Number of screens: Limited only by available memory
- .2 Variables per screen / page: Max 8000
- .3 Representation of variables: Alphanumeric, bitmap, bargraph, gauge, tank, tank level indicator, curves, polygon, button, LED
- .4 Trending: Required
- .5 Alarm Log: Required

.3 Communication Requirements:

- .1 Ethernet port, 10/100 Mbit
- .2 Supported protocols: Modbus, Modbus TCP
- .3 USB port

.4 Operating System:

- .1 Non-Windows operating system

.5 Acceptable Products:

- .1 Schneider Electric XBT GT6330
- .2 or approved equal in accordance with B6.

2.2 DEVELOPMENT SOFTWARE REQUIREMENTS

.1 Software Requirements:

- .1 Fully functioning and licensed development software environment for the HMI supplied. Will allow full development capability and use of all HMI features.
- .2 Licence:
  - .1 One user.
  - .2 Licence does not expire.
- .3 Simulation:
  - .1 Includes simulation of the HMI in software on the development PC.

.4 Supply installation CDs / DVDs.

.5 Operates on Windows XP and Windows Vista.

.6 Variable / Tag Database:

.1 8000 variables minimum

.7 Graphics Editor:

.1 Capable of creating:

.1 Points, lines, rectangles, ellipses, arcs, bar graphs, gauges, tanks, fillers, pie charts, curves, polylines, polygons, regular polygons, Bézier curves, scales, texts, images or alarm summary, etc.

.2 Contain preconfigured advanced objects: switches, radio buttons, indicators, buttons, tanks, bar graphs, potentiometers, selectors, text or number fields, enumerated lists, etc.

.3 Capable of hiding of screens and application structure types

.8 Graphic Object Animation:

.1 Allow the following animations:

.1 Pressing the touch panel

.2 Change of colour

.3 Filling

.4 Movement

.5 Rotation

.6 Size

.7 Visibility

.8 Display of associated value

.9 Graphics Library:

.1 Provide a graphics library with over 4000 preconfigured animated objects.

.10 Scripting:

.1 Provide a scripting language based upon a standard accepted industry programming language such as JavaScript or BASIC

.2 Scripts to be up to 50 lines of code each

.3 Allow association and initiation of the scripts on:

.1 Variables

.2 Operator actions

.3 Screens

.4 The application itself

.11 Advanced Features:

.1 Image display (jpeg, bmp, emf and png files)

.2 Text display and processing (txt files)

.3 Sound message processing (wav files)

.4 Alarm or curve logs recorded

.5 Zoom in/out on trending curves for a detailed analysis

.6 Alarm management

.7 Multimode application transfer: via serial link, via USB, via Ethernet network, and by using Compact Flash memory card on multifunction terminals

.8 User-friendly data exchange between PC and terminal using the Data Manager tool

.9 Use of a USB memory stick (up to 4 GB) for application downloads/uploads, data

.10 E-mail on action and event (the e-mail text can contain up to 1000 characters)

.2 Acceptable Products:

.1 Schneider Electric Vijeo Designer (Latest version available.)

2.3 ACCESSORIES

.1 Include the following accessories:

.1 One 4GB CompactFlash card, installed in HMI, for running the application program.

.2 One spare 4GB CompactFlash card.

.3 Serial or USB Transfer cable for downloading program.

Part 3 Execution

3.1 HARDWARE INSTALLATION

.1 Install HMI in control Panel CP-L1

3.2 HMI PROGRAMMING REQUIREMENTS

.1 Provide all required HMI programming as per the Functional Requirements Specification.

.2 Provide complete HMI programming services, including:

.1 Provide operator displays for all systems, not just templates for standard systems.

.2 Provide a complete database of all points and link to graphics.

.3 Provide complete alarm system configuration, including and alarm display screen.

.4 Provide all other programming, scripting, configuration, and testing as required to produce a fully complete HMI system.

.5 Provide 3 line summary of the latest alarms at the top of each graphic display screen.

.6 Provide PLC and HMI diagnostic screen(s).

END OF SECTION

Part 1 GENERAL

1.1 Submittals

.1 Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to the Contract Administrator, 30 working days prior to anticipated date of beginning of training.

.1 List name of trainers, and type of visual and audio aids to be used.

1.2 Quality Assurance

.1 Provide competent instructors thoroughly familiar with all aspects of the instrumentation system installed in the facility.

.2 Contract Administrator reserves right to approve instructors.

1.3 Instruction

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of the system installed.

1.4 Training Materials

.1 Provide equipment, visual and audio aids, and materials for classroom training at City's site.

.2 Supply manual for each trainee, describing in detail data included in each training program.

.1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.5 Training Program

.1 Operations Training

.1 Location: At a facility provided by the City.
.2 Duration: Four hours.
.3 Number of trainees: Coordinate with Contract Administrator prior to training.
.4 Audience: Operations and maintenance personnel.
.5 Content:
.1 General system overview.
.2 Description of system components.
.3 Presentation of the HMI and system operation.
.1 Use of the system.
.2 Navigation.
.3 Alarm system use.

1.6 Monitoring Of Training

.1 Contract Administrator to monitor training program and may modify schedule and content.

Part 2 PRODUCTS

2.1 General

.1 Not Applicable.

Part 3 EXECUTION

3.1 Training

.1 Provide on-site training to City personnel, as indicated above.

END OF SECTION

Part 1 General

1.1 MAINTENANCE SERVICES

.1 Not required.

1.2 SUPPORT SERVICES

.1 Duration:

.1 The duration of support services is to extend during the Warranty period (one year past Total Performance)

.2 Requirements:

.1 Provide telephone support for all products supplied (during regular business hours)..

.2 Respond to emergency service calls (during regular business hours).

.3 Telephone Support:

.1 Telephone support to utilize service personnel knowledgeable in the products and have the required troubleshooting skills.

.2 No payment will be made for telephone support during the warranty period.

.4 Emergency Service Calls:

.1 Respond to service calls from the City when the system is not functioning correctly.

.2 Qualified control personnel to be available to provide on-site service upon a critical failure, whenever required.

.1 A critical failure is the inability to operate of any critical system supplied by the Vendor.

.2 Critical systems include, but are not limited to:

.1 Communication networks.

.2 PLC system.

.3 HMI systems.

.3 Perform work continuously until system is restored to a reliable operating condition.

.4 Response Time:

.1 The response time to emergency service calls is to be less then four hours.

.5 Record each service call request, when received separately on approved form and include:

.1 Serial number identifying component involved.

.2 Location, date and time call received.

.3 Nature of trouble.

.4 Names of personnel assigned.

.5 Instructions of work to be done.

.6 Amount and nature of materials used.

.7 Time and date work started.

.8 Time and date of completion.

.6 Costs:

.1 If the issue is determined to be due to poor workmanship or defect of the Contractor, no payment will be made to the Contractor.

.2 If the issue is determined to be due to failure of a physical component supplied, and covered under manufacturer's warranty, the Contractor will be paid for the service call.

.3 If the issue is determined to be due to an issue outside of the Contractor's responsibility, the Contractor will be paid for the service call.

.4 Payment will be based upon the rates specified in Form B.

.5 If the service call is subsequent to Total Performance, submit an invoice, based upon the established rates to the City.

Part 2 Products

2.1 NOT APPLICABLE.

.1 Not applicable.

Part 3 Execution

3.1 NOT APPLICABLE.

.1 Not applicable.

END OF SECTION