Part 1 General

1.1 RELATED SECTIONS

.1 Section 44 00 50 - General Instructions Specific for Process Engineering

.2 Section 44 01 00 – Pipes, joints and couplings

.3 Section 44 05 00 – Valves and accessories

1.2 GENERAL

.1 The present specifications cannot necessarily specify in detail the design and construction of all the diverse elements and components as well as their installation. If missing information, the Contractor must observe generally accepted techniques and the manufacturer's recommendations.

1.3 SUBMITTALS

.1 Submit documents and samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings and Technical Sheets:

.1 Submit shop drawings and technical sheets in electronic (pdf) format.

.2 Submit shop drawings and technical sheets for all fire protection equipment and apparatus in the project.

.3 The expression "Shop drawings" refers to drawings, schematics, illustrations, tables, performance graphs, and other documentation that must be supplied by the Contractor to describe in detail the element of Work referred to.

.4 Shop drawings must include the following information:

.1 Preparation and revision dates;

.2 Project name and number;

.3 The relevant section of the specifications pertaining to the equipment in question;

.4 The name and address of:

.1 The Contractor;

.2 The sub-contractor;

.3 The supplier;

.4 The manufacturer.

.5 The shop drawings and technical sheets must show the following:

.1 Materials and fabrication details;

.2 Disposition or configuration, with dimensions, including those taken in the field;

.3 Operating and maintenance clearances, such as necessary spaces for access doors;

.4 Details pertaining to the installation and adjustment;

.5 Characteristics, such as force, flow rate, or capacity;

.6 Details pertaining to mechanical connections;

.7 Tables and performance curves indicating operating points;

.8 Reference norms;

.9 Operating weight;

.10 Technical details to allow for the performance of the submitted equipment to be evaluated.

.11 Material Safety Data Sheets (MSDS).

.6 Submit the following documents with the shop drawings and technical sheets:

.1 Detailed drawings of bases, supports, and anchor bolts;

.2 Manufacturer to certify current model production;

.3 Certification of compliance to applicable Codes.

.7 Submit the data sheets as required by the Health Canada/Workplace Hazardous Materials Information System (WHMIS). The sheets must be in conformity with the aforementioned system.

.8 Keep a copy of the shop drawings and technical sheets at the work site to be used for reference.

.9 The Contractor, in planning his work, must allow for a minimum of ten working days for the verification of the shop drawings by the Departmental Representative.

.3 Erection Drawings:

.1 General:

.1 Erection drawings consist of drawings drawn to scale, showing the position of equipment, conduits, piping, faucets, and others, with sections and details required, including dimensions of equipment, conduits and pipes, locations of ducts, openings, anchorages and supports, relative positions with structural, architectural, and other mechanical and electrical works, position of access doors, and clearances required for operation and maintenance.

.2 Prepare and submit erection drawings in order to coordinate the work of the various trades of construction. Erection drawings are required for at least the following works:

.1 Automatic sprinklers and fire protection work;

.2 Fire protection work located in mechanical and electrical rooms, tunnels, wells, parking lots, etc.;

.3 Fire protection work located in places where space is congested with equipment such as corridors false ceilings and in raised floors;

.4 Expected ducts, openings drillings in walls, floors, roofs, beams, and columns;

.5 Anchors;

.6 All supports located in technical shafts;

.7 In places as described in fire protection specification sections;

.8 This clause is not restrictive. Erection drawings may be required in areas deemed necessary by the Departmental Representative.

.2 Erection drawings must show clearly and precisely all the work involved, those of the discipline and those made by others.

.3 Preparation:

.1 Prepare drawings at an appropriate scale but never smaller than 1:50.

.2 Prepare erection drawings and coordinate with other mechanical and electrical trades.

.3 All erection drawings are to be prepared using the most recent version of AutoCAD in .DWG format, on paper or sepia as required. The layers on the AutoCAD drawings for each sub-contractor must respect AICQ Standards.

.4 Distribution of erection drawings:

.1 Provide fire protection erection drawings to Division 23 for inclusion into the global erection drawings. Revise and re-submit the drawings as required in order to ensure a proper coordination and to avoid incompatibilities.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Manuals:

.1 Submit all closeout documents and attach them to the "Operating and Maintenance Manual".

.2 Supply the operation, maintenance and performance sheets and incorporate them into the "Operating and Maintenance Manual".

.3 The operation, maintenance and performance sheets must be verified by the Departmental Representative before the final inspection. Final copies to be conserved by the Representative.

.4 Operation sheets are to include:

.1 Description of systems and their controls.

.2 Operation instruction for systems and component.

.3 Description of actions to be taken in event of equipment failure.

.4 Valves schedule and flow diagram.

.5 Colour coding chart.

.5 Maintenance sheets are to include:

.1 Servicing, maintenance, operation, and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required, and task time.

.6 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.7 The "Operating and Maintenance Manual" must also include the following:

.1 Shop drawings that have already been commented and corrected;

.2 The installation and position of all equipment, as installed in the project;

.3 The description and exact functioning, by steps, of all installed systems;

.4 The description of the point by point procedure for the start-up and shutdown of the installed systems to ensure a safe and reliable operation;

.5 A list of components liable to require replacement on a regular basis and indicate the frequency of replacement;

.6 A list of replacement parts, including the names, addresses and telephone numbers of the suppliers for every piece of equipment, motor, and the supplied and installed accessories. Include a reference to the appropriate specification article.

.8 Approvals:

.1 Submit for approval to the Departmental Representative a preliminary copy of the “Operating and Maintenance Manual”. Unless otherwise directed by the Departmental Representative, do not submit sheets individually.

.2 Perform the necessary modifications to the "Operating and Maintenance Manual" and resubmit it as directed by the Departmental Representative.

.3 Supply three final copies of the "Operating and Maintenance Manual".

.9 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.10 The "Operating and Maintenance Manual" must be presented in a three-ring binder and must respect the order of the articles in the specifications.

.11 Site records:

.1 Provide sets of prints as required for each phase of Work. Mark changes as Work progresses and as changes occur. Include changes to existing mechanical systems, control systems, and low voltage control wiring.

.2 Transfer information to reproducibles, revising reproducibles to show Work as actually installed.

.3 Make available for reference purposes and inspection.

.3 As-built Drawings:

.1 Prior to start of Testing, Adjusting and Balancing, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Departmental Representative for approval and make corrections as directed.

.4 Perform testing, adjusting, and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with "Operating and Maintenance Manuals".

.6 Submit one copy of each as-built and incorporate them into the final report detailing the tests, balancing and adjustment of the systems and installations.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Site Meetings:

.1 Hold site meetings in accordance with 01 32 16.07 – Construction Progress Schedule – Bar Chart.

.2 Field quality control by the manufacturer as described in article FIELD QUALITY CONTROL in PART 3 must include site visits at the following steps:

.1 Once all products have been delivered and stored on-site and all preparatory work has been completed but before starting the installation of equipment detailed in the present section;

.2 Twice during the advancement of the project, once at 25% completion and another time at 60% completion;

.3 Once when all work and cleaning operations have been finished.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

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

.3 Storage and Handling Requirements:

.1 Store materials off ground, indoors, in a dry location and in accordance with manufacturer's recommendations in a clean, dry, and well-ventilated area.

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

.3 Replace defective or damaged materials with new.

1.7 IMPLEMENTATION

.1 Location of Equipment and Materials:

.1 The drawings and specifications indicate in a schematic and approximate manner the location of equipment, ducts and pipes, etc. Before starting Work, verify exact dimensions and locations on-site and not on the drawings with a ruler.

.2 Install equipment, materials, and pipework in a manner that limits encumbrance and conserves the most amount of useable surface possible and this in accordance with the manufacturer's recommendations concerning safety, access, and maintenance.

.3 Inform the Departmental Representative of any problem that might be caused by the location of any equipment or material and proceed with the installation according to the Representative's instructions.

.4 If access doors are required to permit the access to or maintenance of a piece of equipment or material, obtain the approval of the Departmental Representative before proceeding with the installation. The supply and installation of access doors shall be performed at no additional cost.

.5 The location of devices and equipment may be modified at the demand of the Departmental Representative without additional cost or credit, on the condition that the position change does not exceed 5 m and that it is requested before Work has started.

.2 Protection of Work during Execution:

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

.2 Ensure that finished work or work in progress is sufficiently protected. Any work damaged or altered due to lack of protection must be replaced or repaired at no additional cost according to the requirements of the Departmental Representative.

.3 All open extremities of pipes and conduits installed by the Contractor must be hermetically sealed in a manner that restricts dust and waste from entering during the execution of Work. All machineries must be protected with a polyethylene cover against dust and adverse conditions.

1.8 COORDINATION OF WORK

.1 Each specialist contractor must examine all the construction drawings and all other documentation released after the awarding of the Contract, but before proceeding with the installation of equipment, to ensure that the equipment relevant to their discipline may be installed at the location indicated on the drawings without hindering the installation of equipment from other disciplines.

.2 Particular attention should be paid to equipment that is to be surface mounted or hung from the ceiling, as well as pipe risers in shafts or pipes installed on the surface or inside walls. Equipment that must remain accessible must be installed in a manner that their access is not hindered by other equipment, ventilation ducts, or inaccessible ceilings. Verify the depth of recessed equipment in the walls or ceilings to properly coordinate their installation.

.3 Particular attention should be paid to pipes and equipment located in areas considered patrimonial. The installation should be done in a manner that minimizes visual impact.

1.9 DEMOLITION

.1 Remove all existing fire protection equipment as indicated and in accordance with Section 02 41 17 - Selective Construction Demolition. Equipment shall be removed at the appropriate time.

.2 All existing equipment to remove:

.1 Shall be removed with all piping equipment and mounting accessories from its supply point to its point of use;

.2 Becomes the property of the Contractor who shall dispose it promptly.

.3 All existing paints are considered to contain lead. All interventions or contact with these paints must be done according to the specification section 02 83 12 - Removal of lead-containing paint coatings - Maximum Precautions

.4 All cement materials, cement coatings under plaster, cement debris, residual dust and particles are considered to contain asbestos. All interventions or contact with these materials must be done according to the specification section 02 82 00.03 – Asbestos Removal - Maximum Precautions.

1.10 STRUCTURAL SUPPORTS

.1 Horizontal and vertical reservoirs must be supported by a steel structure made of "I" or "H" beams or angle irons with reinforcements and cross bracing. Horizontal reservoirs must be placed on steel cradles.

.2 All floor mounted supports must have a steel plaque bolted to the floor at their base.

.3 Supply all steel structures required for the installation of equipment.

.4 Supports that are to be supplied by the manufacturer of the equipment are indicated in the section that describes the relevant piece of equipment.

.5 Supports that are not supplied by the manufacturer are to be made of galvanized steel.

.6 Supports must be braced to resist seismic forces according to the National Building Code.

1.11 CORROSION PROTECTION

.1 All non-protected metallic pieces, such as the pipe supports, anchors, machinery, etc., must be given a coat of anticorrosion paint on-site once the metal surfaces have been cleaned.

.2 All plugs, screws, and other devices located on the building’s exterior must be bronze or cadmium plated.

.3 Prime and touch-up marred finished paintwork to match original.

.4 Any surface too badly damaged for a coat of primer and touch-ups must be restored as new.

.5 Any element made of galvanized steel that is cut or perforated must be protected by paint such as Galvicon or an approved equivalent.

1.12 TEST AND CERTIFICATION

.1 At the termination of Work, start-up the equipment and mechanical systems, verify they are functioning properly, perform tests and adjustments, balance them, ensure they

respond to all points indicated on drawings and in specifications, and submit the reports relevant to these activities.

.2 Next, systematically demonstrate in the presence of the Departmental Representative that the equipment and systems function as indicated on drawings and in specifications. A second set of tests will be performed, as required, 2 weeks after the first set of tests. After these tests are completed, submit a report to the Departmental Representative.

.3 Refer to the descriptions in each section to determine the exact tests required.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 INSPECTION

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

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

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

.2 Unless otherwise directed, the Contractor must advise the Departmental Representative 48 hours before covering installed materials to permit the inspection of said materials.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Prime and touch-up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum the interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

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

.3 Perform site visits in accordance with the PART 1 - QUALITY ASSURANCE article.

3.5 DEMONSTRATION

.1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting, and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Following the basic commissioning, perform a demonstration of fire protection systems according to the requirements described in Sections 01 91 13 - General Commissioning (Cx) Requirements and 01 91 31 - Commissioning (Cx) Plan, in presence of the Departmental Representative. This commissioning will occur after receipt and verification of systems testing reports. Moreover, this demonstration will be conducted in coordination with Division 26.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials for reuse/recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management.

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

3.7 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for fire pumps to serve the fire protection systems.

1.2 RELATED SECTIONS

.1 Section 21 05 05 - Common Work Results For Fire Suppression

.2 Section 44 01 00 -Piping, Connections and Fittings.

.3 Section 44 05 00 - Valves and Fittings.

1.3 REFERENCES

.1 Unless otherwise indicated, perform all work in accordance with the current edition of the Quebec Construction Code, Quebec Safety Code and municipal by-laws.

.2 Also perform work in accordance with the current edition of any other code or standard having jurisdiction, including but is not limited to:

- .1 Canadian Standards Association (CSA)/CSA International.
  - .1 CSA C22.1, Canadian Electrical Code, 2010 edition.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC).
- .3 National Electrical Manufacturers Association (NEMA).
  - .1 NEMA MG-1, Motors and Generators.
- .4 National Research Council of Canada (NRCC).
  - .1 National Building Code (NBC-2010).
  - .2 National Fire Code (NFC-2010).
  - .3 National Plumbing Code (NPC-2010).
- .5 Underwriters Laboratories of Canada (ULC).
  - .1 CAN/ULC S543, Internal Lug Quick Connect Coupling for Fire Hose.
- .6 National Fire Protection Association (NFPA).
  - .1 NFPA-20-2013, Installation of Stationary Fire Pumps for Fire Protection.
  - .2 NFPA 25-2014, Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.
  - .3 NFPA 70-2014, National Electrical Code.
  - .4 NFPA 110-2013, Standard for Emergency and Standby Power Systems.
  - .5 NFPA 170-2012, Standard for Fire Safety and Emergency Symbols.
- .7 City of La Macaza.
  - .1 Municipal fire prevention by-law.

.8 Human Resources and Social Development Canada (HRSDC).

.1 FC 403, Standard for Sprinkler Systems.

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

.1 Material Safety Data Sheets (MSDS).

.10 Treasury Board of Canada Secretariat.

.1 Fire Protection Standard.

.11 Correctional Service of Canada.

.1 Chapter 3-6, Fire Protection Standard for Correctional Institutions.

1.4 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Product Data

.1 Submit manufacturer's printed product literature, specifications and data sheets for electrical fire pumps and controls. Product data to include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings.

.1 Shop drawings to show:

.1 Method of anchorage.

.2 Number of anchors.

.3 Supports.

.4 Reinforcement.

.5 Assembly details.

.6 Accessories.

.7 Indicate hydraulic and electrical characteristics including Net Positive Suction Head (NPSH) required, make and model number.

.2 Provide power and control diagrams.

1.5 CLOSEOUT SUBMITTALS

.1 Provide required closeout submittals and attach them to the Operations and Maintenance Manual in accordance with Section 01 78 00.

.2 Maintenance Data.

.1 Maintenance data to include:

.1 Manufacturer's Catalog Data, including specific model, year of manufacturing and power, flow or capacity, type and size for:

.1 Fire pumps;

.2 Motors;

.3 Fire pump control panels;

.4 Fire pump fittings;

.5 Excess pressure pump;

.6 Excess pressure pump motor;

.7 Excess pressure pump control panel;

.8 Supervisory switches;

.9 Valves, including gate, check, and globe;

.10 Mechanical couplings.

.11 Fire pump test header.

.2 Copy of performance curves from tests on each fire pump;

.3 Details of operation, servicing and maintenance;

.4 List of recommended spare parts.

.3 Provide a copy of NFPA 25 Inspection, Testing and Maintenance of Water Based Fire Protection Systems and include in Operations and Maintenance Manual.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21.

1.7 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00.

.1 Test reports:

.1 Submit certified test reports for fire pumps from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.2 Factory test each fire pump to provide detailed performance data and demonstrate compliance with NFPA 20 and this section. Submit pump performance curves.

.3 Test fire pumps hydrostatically to meet requirements of fire protection system to which they are connected.

.2 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.3 Instructions:

.1 Submit manufacturer's installation instructions.

.4 Manufacturer's field services:

.1 Submit prescribed reports.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

1.9 ACCEPTABLE PRODUCTS AND MATERIALS

.1 Where a particular brand name is stipulated, see Instructions to Bidders for procedure for requesting approval of substitute materials and products.

Part 2 Products

2.1 GENERAL

.1 All products used in fire protection facilities to be officially certified and labelled UL_C, ULC or FM.

.2 Provide fittings that can withstand standard pressure in the fire protection system.

2.2 PIPES AND CONNECTIONS

.1 Co-ordinate with Section 44 01 00.

2.3 VALVES AND FITTINGS

.1 Valves and fittings designed for fire protection systems.

.2 Co-ordinate with Section 44 05 00.

2.4 EXISTING FIRE PUMPS (PI-1 AND PI-2)

.1 Existing fire pumps did not work for the past 5 years. The Contractor shall dismantle the pumps and return them to the supplier for a complete maintenance of the components in contact with water (volutes, impellers, columns, shaft and discharge elbow). The existing pumps have been supplied by Natpro (514-421-0331) in the project 308534.

2.5 EXISTING CONTROL PANEL (PI-1 AND PI-2)

.1 The Contractor shall modify the acceleration and deceleration of the existing fire pumps. The time must be maximized as per NFPA.

2.6 SUPERVISORY SWITCHES

.1 General: to ANSI/NFPA 20 for use in fire protection systems.

.2 Valve devices:

.1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

.2 When valves are not already equipped with supervisory devices, they shall be added on site, in accordance with instructions.

2.7 PRESSURE GAUGES (MANOMETERS)

.1 Pressure gauges in accordance with Section 23 05 19.01.

.2 Maximum limit of at least twice normal working pressure at point of use.

2.8 IDENTIFICATION

.1 Nameplate for fire pump and pump motor: to NFPA 20.

.2 Identification of fire protection equipment to NFPA 170, Standard for Fire Safety and Emergency Symbols.

.3 Co-ordinate with Section 23 05 53.01.

2.9 FLOWMETER

.1 Flanged Venturi flowmeter for fire pumps testing as per NFPA.

Part 3 Execution

3.1 GENERAL

.1 Dismantle and install pump unit, verify and perform acceptance testing to NFPA 20.

.2 Manufacturer's instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with established standards and requirements of laws, regulations, standards and codes in effect, as well as manufacturer’s instructions.

.2 The fire protection Contractor has full responsibility for proper operation and co-ordination of the installation of pumps, including the detection system, and their start-up.

.3 Install fire pumps.

.4 Install pipes for pump tests.

.5 Connect pumps to their control panels.

3.3 TRAINING

.1 Contractor to plan and hold a four-hour training session for building operations and maintenance personnel in the presence of the Ministerial Representative.

.2 Training to include normal operation, emergency instructions and system maintenance to NFPA 25.

3.4 TESTS AND INSPECTIONS

.1 Perform following tests on fire pumps in accordance with NFPA 20:

- .1 Perform factory tests on each fire pump to provide detailed data on pump performance.
- .2 Perform flushing test in accordance with NFPA 20.
- .3 Perform hydrostatic tests on the entire pipe system at a pressure of 1,380 kPa for two hours.
- .4 Perform site tests on each fire pump to provide detailed data on pump performance and compare to factory test results.
- .5 Perform flow test on each fire pump at 0%, 100% and 150% of rated flow. Ensure no component overheats.

.6 Perform start test on each fire pump and reach rated speed without interruption for flow corresponding to pump's maximum load.

.7 Perform phase reversal test on electric motors on normal and emergency power.

.8 Perform at least six manual and automatic tests of the fire pump control panels in accordance with manufacturer's recommendations. Each test to last at least five minutes.

.9 For each fire pump, simulate a loss of main power. Check that transfer to emergency power occurs when pump is operating at maximum load.

.10 Simulate all alarm conditions for each fire pump and check that all alarm conditions are transmitted to the annunciator panel.

.11 Simulate all start failure conditions on the fire pumps on normal and emergency power to check sequence of operation of fire pumps.

.12 Operate each fire pump for at least one hour.

.2 Perform tests in the presence of the Ministerial Representative and furnish test certificates in accordance with NFPA 20.

.3 Provide and perform all tests with calibrated equipment. Calibration of equipment must have been done less than a year prior to tests.

3.5 REPORT AND CERTIFICATE

.1 Provide duly completed and signed inspection report and certificate to the Ministerial Representative upon completion of project. Attach results of all tests, duly recorded in a log, to the inspection report.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 21 05 05 - Common Work Result for Fire Suppression

1.2 SCOPE

.1 The Contractor shall provide all materials, equipment, labor, tools, machinery and all additional works required for the complete installation and complete and functional process equipment, machinery and piping and accessories as described in the division 44 and shown on the drawings. The work also includes the provisional acceptance test, commissioning and staff training, including performance testing and the floow up of the operation of the processes.

.2 Scope includes, without being limited to :

- .1 Modification of the acceleration ramp of the fire pumps;
- .2 Modification of the fire pumps discharge piping;
- .3 Addition of valves at the fire pumps discharge;
- .4 Addition of test header at the fire pumps discharge;
- .5 Replacement of the drinkable water distribution motors;
- .6 Replacement of the control panel.

.3 The Contractor is responsible for the installation of all the sensors or others regulation items mounted on the piping as well as the taps on the piping allowing the connection or insertion of diverses sensors or field instruments.

1.3 GENERAL REQUIREMENTS FOR MATERIALS AND PROCESSES

.1 Generalities

- .1 Scope
  - .1 This specification defines the general requirements concerning to the quality of materials used for mechanical equipment as well as applicable treatment processes, if necessary.
- .2 Reference standards
  - .1 As a general rule and not limitative, the most recent version of codes and standards published by the following organizations:

.1	ACNOR	Canadian Standard Association
.2	AFBMA	Anti-Friction Bearing Manufacturers Association
.3	AGMA	American Gear Manufacturers Association
.4	AISI	American Iron and Steel Institute

.5	AMEEC	Electrical and Electronics Manufacturers Association of Canada
.6	ANSI	American National Standard Institute
.7	ASME	American Society of Mechanical Engineers
.8	ASTM	American Society for Testing and Materials
.9	AWWA	American Water Works Association
.10	BNQ	Standards and Normalization Bureau of Québec
.11	CCE	Canadian Electrical Code
.12	CNB	National Building Code of Canada
.13	CSST	Commission on Health and Safety at Work
.14	CWB	Canadian Welding Bureau
.15	HY	Hydraulic Institute
.16	IEEE	Institute of Electrical & Electronics Engineers
.17	ISO	International Standard Organisation
.18	MMA	Monorail Manufacturers Association
.19	MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
.20	NFPA	National Fire Protection Association
.21	NSF	National Safety Foundation
.22	CGSB	Canadian General Standards Board
.23	REIC	Regulation on industrial and commercial
.24	SAE	Society of Automotive Engineers
.25	SSPC	Steel Structure Painting Council

Part 2 Products

2.1 NUTS AND BOLTS

.1 The screws, bolts, washers, nuts, fasteners and wiring must be in compliance with CSA standards. All fasteners coming in contact or close to wastewaters or sludge, must be mace of stainless steel 316.

.2 Nuts and bolts must be made in compliance with metric measure standards in effect in Canada and in the Province of Quebec.

.3 Equipment must be bolted to the frames and structures, the head of the bolt atop the devices to be connected so the bolts cannot come out even if the nut is lost. Information about the tension in the bolts and the tightness limitations must be indicated on the Contractor's drawings as needed.

.4 The protrusion of the bolts beyond the nuts, after being tightened, must be at least two exposed threads, without going over one diameter. Unless otherwise indicated, hexagonal nuts must be used.

.5 For bored holes, washers must be used with nuts and bolt heads.

2.2 WELDING

.1 The design, execution and inspection of welds must be in compliance with the most recent requirements of applicable standards, depending on the case, from CSA, W59 or ANSi B31.1.

.2 Preferably, the welds will be done in the manufacturer's workshop. Aluminum welds must be done exclusively in a workshop.

.3 The parts of the welds of which the pieces are machined in order to ensure an exact alignment, must be put through a stress relief heat treatment before machining is done.

.4 Results from non-destructive tests must be documented and submitted to the Ministerial Representative during production.

2.3 LUBRICATION OF BEARINGS

.1 Oil-lubricated bearings must be provided with a casing and level indicators. Grease lubricated bearings must be equipped with greasing nipples and extensions, if necessary.

.2 All equipment must be provided with lubricated and ready to operate ball bearings, rolling bearings, etc.

.3 All equipment must be furnished with adequate oil or grease splash guards during normal operation.

.4 All oils in contact with drinking water or that may be in contact with drinking water or that may contaminate it must conform to NSF-61.

2.4 ROTATING MACHINERY

.1 All equipment that have rotating mechanisms such as belts, pulleys, chains, gears, couplings, etc. must be designed to operate under all load conditions without shaking. Mechanisms that can not be physically enclosed in housings must be equipped with protective devices to ensure the safety of operating and maintenance personnel.

.2 The selection of these rotating mechanisms should be according to the standards defined by AGMA.

2.5 VIBRATION

.1 The equipment subject to transmit vibrations to the structure or building shall be provided with shock absorbers that can absorb those vibrations.

2.6 NOISE

.1 The noise level produced during the normal operation of a piece of equipment must not exceed 85 dBa when measured within one (1) meter of distance, in the predicted operating conditions, as specifed in recommendation R 495 of the "International Standard Organization (ISO). Should this noise level exceed 85 dBa, the Contractor will have to make the necessary corrections, at his own expenses (acoustic shelter, etc).

2.7 MATERIALS OF CONSTRUCTION

.1 In general, the materials must comply with the following requirements or be of an equivalent nature, i.e. having properties similar to those of the specified materials and if needed, being certified by means of compliance certificates.

.1	Structural steel	ACNOR G40.21M
.2	Structural aluminium	ASTM B 241 Alliage 6061-T6
.3	Ductile iron	ASTM A 48
.4	Stailess steel	ANSI type 316

.2 All surfaces in contact between two different metals must be separated by non-conductive materials, if there is a possibility of cathodic reaction.

2.8 CORROSION AND EQUIPMENT PROTECTION

.1 All the equipment parts installed in a wet or corrosive environment or in contact with water must be designed to resist corrosion for a minimum period of five (5) years, either by the nature of the manufacturing materials, by applying a proven protective coating or by covering with proven corrosion-resistant materials.

.2 For those cases where a protection by coating is used, unless the protection method is specified in the particular technical clauses, the equipment must be painted following a paint system that provides sufficient stability over time.

.3 The Contractor must guarantee that after a period of sixty (60) months, the degree of the rust must be equal or less than the level 7 on the SSPC scale (Steel Structure Painting Council) for anti-rust paints.

2.9 BALL BEARINGS AND ROLLING BEARINGS

.1 The L10 life of any bearing, calculated according to the standards of AFBMA must not be less than 100 000 hours.

2.10 PIPING, FITTINGS AND VALVES INTEGRATED TO THE EQUIPMENT

.1 The pipes class provided must be established by the Contractor according to the service conditions (temperature, pressure, etc.). However, PVC pipes cannot be used if the temperature of the conveyed fluid can exceed 25°C.

.2 All accessories that come with the provided piping such as fittings, couplings, bushings, sleeves, etc., must be made of the same type of material as the pipe to which they are connected.

.3 For all piping that is integral part of the equipment, the Contractor must also provide all the necessary supports, stops and expansion joints, in order to comply with the pipe manufacturer requirements regarding the maximum possible stress that can happen.

.4 All valves and taps provided with the equipment must meet the requirements of the AWWA, NSF61 or be of similar quality. The construction materials of the valves must be specified by the Contractor according to the service conditions (temperature, pressure, etc).

.5 All valves, regardless their size and type, whether they are motorized and/or automated or not, must have a mechanism for manual operation (steering wheel, lever, etc.) including the required release accessories, if they are motorized and/or automated.

.6 All valves, regardless their size and type, whether they are motorized and/or automated or not, must be equipped with an integrated lockout device. If the device allowing direct lockout of the valve is not available, the Contractor shall provide other devices (covers, chains, etc.) required to ensure lockout as described in the applicable CSA safety standards.

.7 All valves of diameter 150 mm or more, whether they are motorized and/or automated or not, must be equipped with a gear operation mechanism with wheel.

.8 Valves smaller than 70 mm can be threaded, but they must allow to be removed without requiring the dismantling of the piping.

2.11 QUALITY MANAGEMENT

.1 For the present project, the Contractor shall establish, document and apply a quality program, in conformity with ACNOR standard CAN3-Z299.4-85, ISO-9001 or equivalent.

.2 The "Document of quality verification" of the aforesaid program should be submitted by the Contractor within the next ten (10) days after the adjudication of the contract.

.3 The manufacture of equipment and products covered by this tender will be subjected to the quality control requirements of the ACNOR standard CAN3-Z299.4-85, ISO-9001 or equivalent.

.4 The Contractor shall submit to the Ministerial Representative during the presentation of the shop drawings, the various documents relating to inspections and tests that manufacturers / suppliers involved in the project intend to carry on the equipment to comply with the requirements prescribed in this tender document.

.5 The Ministerial Representative shall have access to the Contractor and its subcontractor’s facilities, as well as those of its manufacturers/suppliers during working hours, for the purposes of monitoring and/or audit quality.

2.12 IDENTIFICATION OF THE PROCESS ENGINEERING FACILITIES

.1 Generalities

.1 All pieces of process equipment and piping systems must be clearly and legibly identified as described below.

.2 The Contractor shall submit to the Ministerial Representative for verification, an equipment diagram with the name and identification number that he intends to use.

.3 This identification (name, numbers) must be the same everywhere, on the drawings, equipment, and in the operations manual.

.4 The nameplates, tapes, and identification tags must be prominently displayed and not be covered with paint or other. Unless otherwise indicated, nameplates, bands and identifications tags must be white background and black letters.

.5 Where isolation is required, the identification must be fastened to the insulation.

.2 Equipment identification

.1 The Manufacturer nameplates must be affixed to the equipment. These plates must indicate the Manufacturer name, model, serial number and, depending on the equipment, engine power, the type of power supply, the capacity of the unit and other relevant information.

.2 In addition to the Manufacturer's nameplates, all equipment such as valves, pumps, compressors, blowers, tanks, etc. must be identified by 50 mm φ polyethylene medallions. These medallions must comply with the standard (F) 24-

GP-3a-1967 of the Canadian General Standards Board (CGSB) entitled "Code, identification and classification of duct systems"

.3 For the equipment connected to the water treatment and transfer, the Contractor shall use the following colors of the medallions, panels and identification tags:

.1	Primary colour:	Yellow (dangerous product)
.2	Secondary colour:	Violet (poison/radioactive)
.3	Letters and numbers:	Black

.4 On the structures that operate with a high flow rate, or that have a large number of equipment, the Contractor must use PVC panels for the identification of the main equipment, reserving the medallions for the secondary equipments of the same series. The panels must be also in conformity with the CGSB standard above indicated.

.3 Piping identification

.1 All piping must be painted in accordance with applicable color code, described in the article "Finishing of equipment and piping".

.2 In addition to this painting, the Contractor shall complete the identification of all pipelines, including stainless steel and PVC, with yellow sticky labels (primary) and violet (secondary) of which include black lettering and arrows, indicating the nature and flow direction of the transported product.

.3 The identification labels should be placed at regular intervals along the pipeline, but not exceeding five (5) meters away, in order to have successively complete identification (letters and arrows) alternating with a single arrow.

.4 In particular, at strategic points (valves, taps, check valves, tees, crosses, cross partition or floor cross, etc), the above identification must be supplemented by an indication of the origin and destination of the transported product, all according to the principle shown in the figures at the end of this section and described in the CGSB standard.

.5 The identification labels must be in conformity with the CGSB Standard mentioned on the previous article and must be made by “Signis” or equivalent approved; their dimension must be adequate to the outside diameter of the pipe to identify; their position must permit a fast identification by the staff.

.4 Valves Identification

.1 The Contractor must carry out the identification of all valves, using the same panels, medallions and tags in the same way as for the equipment above specified in sub-article "Generalities" and of the article "Identification of the process engineering facilities".

.5 Use of pictograms

.1 In the systems identification diagram, the Contractor must use pictograms (symbols) clearly indicating the position of the various security facilities, installed in the facilites and other strategic points.

.2 These pictograms must also comply with the CGSB Standard, and be manufactured by Signis, or equivalent approved.

.6 Each of the treatment processes mentioned must meet the following requirements to be considered as acceptable:

.1 Mechanical performance

.1 The mechanical performance of each process components must be demonstrated during at least two (2) years of use. Besides, each component must have been used for at least one (1) year in a similar application to that proposed.

.2 Process efficiency

.1 The process must allow to meet the objectives of the performance tests described in the process engineering divisions (Division 44), and elsewhere in the tender document for each process.

2.13 EQUIPMENT AND PIPING FINISHING

.1 Workshop treatment

.1 All process equipment, piping and accessories (i.e. Couplings, flexible couplings, valves and faucets) in ferrous metal covered by the process engineering divisions (Division 44) standards, will receive a surface treatment as well as primer paint at workshop. All equipment that includes a finish coating in the designation of the manufacturer’s standard product will be provided with aforesaid coating.

.2 The surface preparation, the primer and the topcoats must be done in the manufacturer’s workshop, and must be compatible with the required service of the equipment as well as with the "local" operating conditions.

.3 Pieces or equipment made of bronze, aluminum, stainless steel, and galvanized steel, plastic and in PVC should not be painted; these materials must be properly cleaned after their manufacture.

.4 The galvanizing will be hot dipped after fabrication with zinc coating of at least 600 g/m², all in accordance with ACNOR G164 standard.

.5 Pumps, motors and all other equipment and accessory parts (fittings, valves, etc.) can be provided with the manufacturer’s standard finishing, given that they meet the following requirements:

.1 The protection system should be of a class that allows the appropriate resistance to the corrosion for an average duration (5-10 years) under the conditions that prevail inside the building, in the underground stations or in the exterior, and it should be certified by a manufacturer with experience of at least five (5) years in the application of this type of protection.

.2 On-site treatment

.1 After their installation on site, the Contractor will procede to the “finishing” painting of the piping and equipment, according to the applicable colors code.

.2 The paint type and the final colors choice for every system must be pre-approved by the Ministerial Representative.

.3 The number of painting layers to apply (minimum 2 layers) will assure a full covering of the original equipment manufacturer painting. The type of paint for the finishing layer should be compatible with the finishing of the equipment provided by the manufacturer.

.4 This painting treatment on site applies especially to all pipes, valves, fittings, flanges, brackets, supports, etc. in cast iron.

.5 Parts in bronze, aluminum, galvanized steel, stainless steel, plastic and PVC will not be painted: the materials must be properly cleaned after installation.

.6 Copper piping will be cleaned with a cleaner to remove all traces of grease and can receive two (2) layers of "uréthane" varnish, according to CGSB 1-GP-176b standard.

.7 All pieces of aluminum in contact with concrete will receive, at the workshop, a layer of undiluted bituminous paint, according to the requirements of CGSB 1-GP-108M, type 1 standard.

.8 It will be necessary to touch up the paint in the fixation places, on the supports and basis plates, etc, where the paint has been damaged during the transportation or the equipment installation. The touch up should be made with paint identical to the one applied on the equipment in compliance with the instructions of the suppliers.

.3 Colour code:

PIPES - EQUIPMENT	COLOUR	PAINT No.		
		C.I.L.	SICO Abandoned number	SICO New number
Drinking water	Light blue	3938-7	2035-61	3027-41
Non drinkable service water	Dark blue with "NON POTABLE" *	4848-9	2030-53	SM 820
Hot service water	Middle blue	3941-9	2036-42	3028-32
Raw wastewater	Gray	4072-8	2167-12	SM 1008
Sand washing water	Ocher	4701-9	2093-64	3100-64
Sand	Rust	4700-9	2113-43	3084-53
Primary sludge	Brown brown	4671-2	2135-63	3194-43**
Recirculated sludge and excess sludge	Light Brown	3072-8	2122-22	SQ 6569
Thickened sludge	Dark Brown	4611-2	2117-63	3060-63**
Digested sludge	Black	4673-2	2178-63	SM 1347
Process pressure air	Light-green	3529-9	2066-13	SM 986
Control compressed air	Dark green	4788-5	2066-64	SQ 6741
Chlorine	Light yellow	3117-5	2086-34	SQ 6245
Ozone	Violet	4353-9	2016-22	SQ 9769
Alum	White	4574-7	2164-11	SM 833
Chemicals	Orange	2637-5	2104-34	SM 650
Polymers	Rose	2504-8	2007-12	3056-12**
Emergency equipment	Red	4596-4	2005-55	SM 736
Valves, check valves, etc	Same color as the adjacent			

Note: Conduits of building mechanics and others according to the architect (without possible confusion with this code).

* Put the label "*NON POTABLE*" at the places where this water is used.

** Proposed number: non identical color but brought closer.

Part 3 Execution

3.1 RESERVOIRS DISINFECTION

.1 Following the work inside the reservoirs, all debris shall be evacuated and cleaning shall be conducted with a pressurized water jet, brush or scraper in conformity with section 2 of the norm for disinfection of water storage facilities (ANSI/AWWA C652).

.2 It is strongly recommanded that the reservoirs disinfection be conducted by a specialized contractor.

.3 The disinfection procedure of the reservoirs shall be as of AWWA C652. The chlorination method 1, 2 and 3 described in the norm are all acceptable.

.4 Filling of the new reservoir will be by the drinkable water production system upstream of the reservoirs.

.5 Prior to drainage of the chlorinated water, neutralisation of the residual chlorine is mandatory.

3.2 PLAN

.1 The plans will show, in a general manner, the location of the proposed running lines and equipment.

.2 When plumbing is indicated in a sketched manner, the location will be determined so as to keep a maximum vertical clearance (headroom) and so as to obstruct, as little as possible, the use of the rooms where it will be situated. Unless otherwise indicated on the plans, the minimal clearance under the running lines will be 2.100 m.

.3 The plans for the mechanical process work do not always indicate all the structural details; any information with regards to the exact dimensions of the building will be based on the dimensions quoted on the structural plans or dimensions taken on site, if necessary.

.4 The location of the running lines and equipment must take into consideration the dimensions shown on the plans; their location must not be determined from a scale readout of the plans.

.5 The Ministerial Representative can potentially require moving the equipment, up to one (1) meter, if deemed necessary and this, with no additional cost.

.6 There will be no supplement for the alteration(s) of the conduits, pipes, ducts, etc., which could be deemed necessary for the conditions of the site.

.7 If the Contractor thinks he will need to issue additional sketches for clarification, he must advise the Ministerial Representative, at least fifteen (15) days before the completion of the work.

.8 All the work or materials shown on the plans and not described in the specification or vice versa are part of the contract as well as all materials not indicated on the plans and specifications but required for completing the work.

3.3 EQUIPMENT

.1 The term equipment refers to all the required material needed for the erection of a component of the process. The materials that make up this equipment must be complete and the Contractor will include any other element he deems necessary for the good running order of each unit.

.2 Every piece of equipment must be built in order to provide an optimum performance. Each piece of equipment must be complete in itself and must include each part or necessary accessory by using the most heavy-duty materials with desirable characteristics to allow an efficient intermittent or continuous operation and an easy and proper maintenance. Therefore, all the materials must be chosen according to their specific use.

.3 Whenever possible, the work will be done with materials made and purchased in Quebec; if this is not possible, the preference will be given to materials made elsewhere in Canada, the whole in compliance with Quebec purchasing policy.

.4 All the equipment and materials have to be new, made, assembled and checked in shop and ready to be installed. There must be no visible or invisible damage which could cause any failure during the work process.

.5 The supplier must furnish the Contractor with all the diagrams, drawings and all the written instructions required for the proper installation of the equipment as well as any other information which, according to the Ministerial Representative, could make the job easier.

.6 A copy of these instructions must be submitted to the Ministerial Representative, before installation, for the purpose of work supervision.

.7 Unless otherwise indicated on the plans, the articles must be standard products from the manufacturer and the parts required for maintenance must be available at all times. Equipment of the same nature must be supplied by the same manufacturer.

.8 The Contractor will be responsible for the unloading, the Ministerial Representative's inspection, the storage, setting up and connection of the equipment arriving on site. Equipment not being installed will be stored under lock and key by the Contractor.

.9 If required, hoisting gear needed for handling the equipment, from the delivery site to the setting up site, will be at the Contractor's cost.

.10 The Contractor must make certain that the openings in the building for bringing in large equipment, are adequate.

.11 No piping, conduit or any other work will be covered before the Ministerial Representative's inspection and approval.

.12 Equipment must have proper dimensions and characteristics suitable to the locations where it will be installed.

3.4 ELECTRICAL WORK

.1 All equipment pieces referenced in division 40 and driven by an electric motor will be supplied by the supplier of the same equipment; they will be supplied complete and with their own respective motor.

.2 The Contractor must refer to division 26 and consult the electrical drawings as well as control and instrumentation diagrams so as to supply all points of contact or controls required by the electrical sequences and equipment controls.

3.5 MOTOR PUMPS

.1 All pumps must be provided by the same manufacturer.

.2 All equipment will be designed according to the latest standards of the "Hydraulic Institute" and "ANSI / AWWA E 101". They shall meet the performance tests level A of the "Hydraulic Institute".

.3 The motors casing will be AMEEC type, provided with wire fencing with openings and designed to operate continuously. The motors shall be manufactured to be able to operate at 40°C ambient temperature.

.4 When applicable, under explosion conditions, the TEFC explosion proof casing shall be ableo to withstand internal explosion without igniting the outside gas and meet the ACNOR Standard, class 1, division 2, groups C and D.

.5 The cage of the rotor will be made of aluminum bars with homogeneous aluminum caps. Ventilation should be done on both extremities of the motor; its construction shall prevent that the exhaust air produces hot spots.

.6 The motor must be manufactured to meet AMEEC standards, Design "B", insulation class "F", warm up "B", with sufficient capacity for continuous pump operation without abnormal temperature rise. Motors 30 kW (40 HP) and higher shall be equipped with temperature sensors for each phase, compatible with the relays of the starters' manufacturers. Motors of 149 KW (200 HP) and higher shall be equipped with two temperature sensors for each phase.

.7 All motor rotating parts must be individually balanced accurately, to get maximum vibration amplitude of 0.001 peak to peak.

.8 The motor driving force is rated such that it will never work in overload for all conditions encountered along the characteristic curve Q-H-BHP. In addition, the motor must have an overload factor of 15% above its nominal value (1.15 sf).

.9 The motors must be high efficiency and offer optimal performance equal or superior to the minimum performance requirements as defined in the most recent document published by Hydro-Québec called "high efficiency electric motors - Motors Directory". The motor must comply with all requirements defined in this document.

.10 The motor will be selected so that it has the best performance among all high efficiency motors offered by the manufacturer selected.

.11 The maximum permissible noise level should be 85 dB. The Contractor shall produce the data on noise levels broken down by octaves from 25 to 10 000 Hz and must be measured in accordance with Bulletin No. 85 of the IEEE.

3.6 INFORMATION REQUIRED ON MOTOR PUMPS

.1 The Contractor must submit performance diagrams of proposed pumps for approval by the Ministerial Representative.

.2 The following curves shall be submitted for each pump models:

- .1 Pump characteristic (Q-Hs);
- .2 Power consumption curve (Q-BHP);
- .3 Out-put capacity curve (Q-Hs-Eff);
- .4 NPSH required curve (Q-NPSH).

.3 These curves must be manufacturer certified (performance test) from non-witnessed tests (the presence of the Ministerial Representative or his representative shall not be required) performed in the workshop. Certified pump curves shall be submitted to the Ministerial Representative for approval prior to shipment from the pumps factory.

.4 The manufacturer must also provide the following information:

- .1 The flow rates provided by pumps at the heads specified in the technical sheets;
- .2 The diameters of the impellers used;
- .3 The maximum powers required by the pumps when they operate with their specified impellers, as well as the dynamic heads and the flow rates corresponding to these powers;
- .4 A drawing showing the main dimensions;
- .5 A complete description of the materials used.

.5 Unless otherwise indicated, the efficiencies of the pumps must be such that the power requirements must not exceed the specified power ratings of motors, and this without using in whole or in part the overload factor, at any point of the different curves.

3.7 VIBRATION AND BALANCING TESTS

.1 Motor pumps

.1 The Contractor shall coordinate the presence of the motor pump manufacturer during the execution, at the construction site, of vibration and balancing tests of the pumping units.

.2 All rotating parts must be supplied machined and balanced so that no excessive vibration occurs during the commissioning of the equipment. All excessive vibration related to the provision of equipment may result in the rejection of the equipment.

.3 Balancing of the pumping unit must be carried out unless the amplitude of the vibrations measured is lower than 2.5 mm/s.

.4 The mass of each pump and their distribution must be such that any resonance during operation should be avoided. The vibration should not exceed 7.6 mm/s at all operating speeds. The ratio of the rotation speed to the critical speed of the pump or the unit components must be less than 0.8 or greater than 1.3. The critical speed of the pump under test shall be measured with a vibration analyzer.

.5 The pump supplier must verify the pump installation at the start-up and report to the Ministerial Representative and to the Contractor all observed installation problems. Vibration measurements will be executed in presence of the Ministerial Representative.

.6 For all equipment whose rotation speed is superior to 600 r/min, a measurement of the vibrations speedaccording to the frequency must be taken; when the unit reached its working temperature.

.7 For all equipment whose rotation speed is equal or lower than 600 r/min, the measurement of the vibrations displacement must be taken.

.8 The vibrations must be measured at all levels of the equipment, including those of the motor and speed reducer. Vibration must be measured in three axes: horizontal, vertical and axial.

.9 The vibrations of the equipment with variable speed operation are measured throughout the range of working speeds. All vibration measurements are entered in a report of equipment installation, submitted to the Ministerial Representative. After the balancing, adjustment and/or modification of a unit, new test and vibration measurements on the site must be made by the Contractor, without additional cost to the Ministerial Representative, and to his satisfaction.

.2 Blowers

.1 (Not applicable)

END OF SECTION

Part 1 General

1.1 CODES AND STANDARDS OF REFERENCE

.1 Unless otherwise specified, perform all work in accordance with the current edition of the "Building Code of Quebec" and the "National Building Code".

.2 In addition, design and carry out the work in accordance with any code or any other standard having jurisdiction, according to the current edition, including but not limited to:

- .1 American Iron and Steel Institute (AISI).
  - .1 AISI, Specification for the Design of Cold-Formed Steel Structural Members.
- .2 American Society of Civil Engineers (ASCE).
  - .1 ASCE 96, Structural Applications of Steel Cables for Buildings.
- .3 Canadian Standards Association (CSA) / CSA International.
  - .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steels.
- .4 American Society for Testing Materials (ASTM).
  - .1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - .2 ASSTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A475, Standard Specification for Zinc-Coated Steel Wire Strand.
  - .4 ASTM A603, Standard Specification for Zinc-Coated Steel Structural Wire Rope.
  - .5 ASTM A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
  - .6 ASTM E488, Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
- .5 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
  - .1 ASHRAE, A Practical Guide to Seismic Restraint.
- .6 American National Standards Institute (ANSI)/National Fire Protection Association (NFPA).
  - .1 ANSI/NFPA 13, Installation of Sprinkler Systems.
- .7 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
  - .1 ANSI/SMACNA 001, Seismic Restraint Manual: Guidelines for Mechanical Systems.

1.2 CHARACTERISTICS OF SEISMIC PROTECTION SYSTEMS

.1 Seismic protection systems shall be fully integrated and compatible with the following:

.1 Prescribed acoustic and vibration devices;

.2 Design characteristics of the building and electrical and mechanical installations.

.2 Each specialized Contractor and Supplier is responsible for seismic measures related to his discipline.

.3 When an earthquake occurs, seismic protection devices must withstand without damage to the maximum expected relative motion of the structure during the construction of the building and must prevent mechanical and electrical systems to move, fall over and cause injury to occupants during the earthquake.

.4 Design of devices and systems for seismic protection developed by an engineer specialized in the field of seismic engineering and member of the Quebec Order of Engineers (OIQ).

1.3 DOCUMENTS/SAMPLES TO BE SUBMITTED

.1 Refer to Section 01 33 00 "Documents/Samples to be Submitted" and 44 00 50 " General Instructions Specific to Process Engineering".

1.4 DOCUMENTS/ELEMENTS TO BE SUBMITTED UPON COMPLETION OF WORKS

.1 Refer to Section 01 78 00 "Documents/elements to be submitted upon completion of the works" and 44 00 50 "General Instructions Specific to Process Engineering".

1.5 LEVEL OF PROTECTION

.1 Install anchoring and seismic stabilization devices for process pipelines, equipment, tanks and piping other than fire protection in accordance with the requirements of the manual "ASHRAE, A Practical Guide to Seismic Restraint" and the standard ANSI / SMACNA 001.

.2 The expected level of protection for the building is SHL-"X" where "X" is defined according to SMACNA 1338, and determined and calculated for the region of the project for the different systems encountered (pipes, ducts, chemical tanks, equipment, etc.) by the specialized engineer, designer of seismic protection systems.

.3 In addition, the specialized Engineer appointed by the Contractor and the Supplier shall take into account the risk category as specified by the Building Code of Quebec.

Part 2 Products

2.1 SUPPLY SOURCE

.1 Devices and systems for seismic protection shall be provided by a single manufacturer with experience in the field.

2.2 GENERAL

.1 Devices and seismic protection systems must prevent permanent displacement and damage caused by horizontal, vertical and overturning movements.

.2 Devices and seismic protection systems must be compatible with electromechanical design. They should not interfere with normal operation of electromechanical systems.

.3 Devices and seismic protection systems must be smooth, continuous and in all directions in order to mitigate the effects of shock.

.4 Fasteners and attachment points must be able to withstand the same maximum loads as the devices and seismic protection systems.

.5 Fixation devices and seismic protection systems of structures in reinforced concrete:

.1 Anchors shall be of the expandable type and with a high degree of strength.

.2 No anchor shall be installed with a nail gun.

.6 No device or related support, or plot should yield before the structure or the structure yields.

.7 Seismic devices consisting of elements in cast iron, threaded pipes or other fragile materials are not accepted.

.8 Seismic devices must not interfere with the operation of the fire prevention devices or nor compromise their integrity.

.9 Stabilize all accessories, such as diffusers and light fixtures, installed in suspended ceilings.

.10 For the seismic systems, the specialized engineer must select materials (stainless steel, FRP, etc.) resistant to ambient conditions, if required as appropriate (i.e. chemical room).

2.3 STEEL ANGLES

.1 Angles shall be manufactured from a plate cold formed and meet the requirements of AISI, having a minimum tensile strength of Fu = 410 MPa (59 ksi) and a yield stress of Fy = 300 MPa (43 ksi).

2.4 "C" PROFILE

.1 "C" Profile shall be built according to the standards ASTM A1011/A1011M GR 33 and CSA G40.20/G40.21

2.5 STRUCTURAL PIPING

.1 Structural piping shall be built according to the standards ASTM A53/A53M, type E or S, Grade B.

2.6 CABLE

.1 Cable shall be constructed in accordance with the standards ASTM A603 or ASTM A475 with at least seven wires, covered with a layer of class A.

.2 Connection parts shall be according to the requirements of ASCE 96 and capable of supporting 110% of the ultimate stress of the cable.

2.7 BOLTS

.1 Bolts shall be manufactured according to the standard ASTM A307, Grade A, hexagonal head.

2.8 SEISMIC PROTECTION FOR STATIC SUPPORT EQUIPMENT

.1 Attach devices to the hanging brackets, which must be attached to the frame.

.2 Install devices for preventing the oscillation of the apparatus in the horizontal plane, the tilting of devices in the vertical plane and the sliding or buckling of devices in the axial plane.

.3 Use suspension rods resistant to buckling.

2.9 SEISMIC PROTECTION FOR ELASTIC SUPPORT EQUIPMENT

.1 Attach devices to the hangers, which must be held to the frame with rigid rods in all three axes.

.2 The devices must be smooth and continuous. For this purpose, they shall contain elastomer elements or other means to reduce the effects of shock.

.3 Seismic protection devices should in no way interfere with the action of soundproof and anti-vibration elements. During normal operation, the clearance between the devices for seismic protection devices and equipment must be 6 mm (¼ in.) to 12 mm (½ inch).

.4 In that case that seismic type isolators are used, they must be designed and installed to withstand minimum acceleration forces.

.5 The devices must never be compressed to the point of losing their effectiveness.

.6 Devices and systems for seismic protection must prevent complete unloading of anti-vibration devices and systems.

.7 In the case that standard insulators are used, seismic protection devices should be incorporated in the anti-vibration equipment to prevent reversal of the latter.

Part 3 Execution

3.1 GENERAL

.1 Attachment points and fastening devices

.1 Verify that anchor bolts, the diameters of the ankles, the depth of depressions in concrete as well as the length of welds conform to the drawings submitted for approval.

.2 Bolt to the frame or to the structure all equipment that is not insulated against vibration transmission.

.3 Oblong openings for bolts adjustment are prohibited.

.4 For earthquake purposes, small diameter pipes can be attached to larger diameter pipes that will hold. The opposite practice is prohibited.

.5 Anchor points in concrete slab must stay away from the edges according to the standard ASTM E-488 and the manufacturer's recommendations for anchors.

.6 Anchors in concrete slabs must be pushed in at least eight times the diameter of the latter.

.7 Install retaining clips called "Restraining Strap” to all "C "" C-Clamp" brackets used to support the pipe in order to hold them to their anchor during an earthquake. Fasteners shall be manufactured by the same manufacturer as the brackets.

.2 Retaining cables

.1 Connect retaining cables to suspended appliances so that their axial incidence matches the center of gravity of the protected apparatus.

.2 Tighten the fasteners for cable fixation according to manufacturer's recommendations.

.3 Use cable pass through, lugs and other hardware to ensure proper alignment of seismic devices to prevent cables bending at the fixing points.

.4 In the case of equipment suspended from the ceiling, arrange the retaining cables at an angle of 90° relative to each other in the plane, and attach them to the frame of the building at an angle of 45°.

.5 Adjust the tension of the cables so that they do not seem loose, and that they do not impede the normal functioning of anti-vibration devices.

.6 Tighten the cable to reduce slack to 40 mm (1 ½ in.) under thumb pressure. In normal operation, the cables must not bear the weight of the material retained.

.3 Install devices and systems for seismic protection at least 25 mm (1 in.) of any device or any utility line.

.4 Other equipment non-isolated against vibration.

.1 Bolt material to the mounting base and then to the frame using through bolts

.5 Coordinate connection operations with other disciplines.

.6 Vertical tanks:

.1 Anchor tanks to their mounting base and against the frame using through bolts.

.2 Install the steel strip clamps above the center of gravity.

.7 Horizontal tanks:

.1 Provide at least two retaining straps with anchor bolts to the frame.

.8 Brace equipment independently of process ducts or pipes.

.9 Never use two types of bracing in the same direction.

.10 Do not stabilize appliances or equipment where the length of the suspension rods is less than 300 mm (12 in.).

.11 Do not install devices and systems for seismic protection with an angle greater than 60 ° or an angle less than 45 ° measured from the horizontal.

.12 Install transversal devices and systems for seismic protection perpendicular to the direction of the pipe or tubing with a maximum angle variation of 2.5 °.

.13 Install longitudinal devices and systems for seismic protection parallel to the direction of the pipe or tubing with a maximum angle variation of 2.5 °.

.14 Install at least two transversal devices and systems for seismic protection, as well as a longitudinal device and system for seismic protection for each section of pipe or straight pipe.

.15 Install transversal and longitudinal devices and systems for seismic protection to a maximum distance of 100 mm (4 inches) of vertical support, which should be strengthened as needed.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Comply with requirements and recommendations and manufacturer's written specifications, including product technical bulletins, instructions for the handling, storage and installation of products, and indications of data sheets.

3.3 ENTRY OF UTILITY LINES IN THE BUILDING

.1 Provide means to ensure the flexibility of piping in order to prevent any breach in case of earthquake.

3.4 ON-SITE QUALITY CONTROL

.1 Upon completion of the installation, devices and systems for seismic protection shall be inspected and certified by the engineer, appointed by the Contractor.

.2 Submit to the Ministerial Representative, together with the certificate of compliance, a written report signed and sealed.

.3 Where applicable, the Contractor shall make corrections and adjustments based on the written report presented by the specialized Engineer.

3.5 DOCUMENTS REQUIRED FOR THE START-UP

.1 Once certification is complete and the report is accepted, submit to the Ministerial Representative a complete copy of the project file revised and commented on to show the conditions after execution.

3.6 INSTALLATION OF PIPING OTHER THAN FIRE PROTECTION

.1 Perform installation and design of seismic systems according to the manual "ASHRAE, A Practical Guide to Seismic Restraint" and the standard ANSI/SMACNA 001.

.2 Devices and systems for seismic protection must be able to meet requirements for anchoring and guiding of pipes.

.3 Stabilize piping of Nominal Diameter 3 and more.

.4 Stabilize piping for fuel, medical gases and compressed air of Nominal Diameter 1 and more.

.5 Install mechanical restraint devices for piping at the following minimum frequency:

- .1 For transversal stabilization:
  - .1 Nominal Diameter 8 and less: 12.2 m (40 pi).
  - .2 Nominal Diameter 10 and more: 6.1 m (20 pi).
  - .3 Reduce by half the distances for gas piping, not ductile or screwed.
- .2 For longitudinal stabilization:
  - .1 Nominal Diameter 5 and less: 24.4 m (80 pi).
  - .2 Nominal Diameter 6 and 8: 12.2 m (40 pi).
  - .3 Nominal Diameter 10 and more: 6.1 m (20 pi).
  - .4 Reduce by half the distances for gas piping, not ductile or screwed.

.6 For plastic piping, a standard support bracket must be provided according to the manufacturer's recommendations or halfway between the joints.

.7 The transversal devices and systems for seismic protection of a pipe section can act as longitudinal devices and systems for seismic protection of a pipe of the same size connected perpendicular to the first one, if the braces are located within 600 mm (24 in.) of an elbow or "T" fitting.

.8 Install the seismic separation assemblies where piping crosses a seismic separation of the building. Stabilize transversely, vertically and longitudinally this assembly at less than 1.83 m (6 ft) on each side of the separation.

.9 Stabilize each side of a change in direction at 90 °, cast iron and glass piping.

.10 Do not stabilize the piping suspended by supports, located less than 300 mm (12 in.) of the structure.

3.7 RIGID RODS AND ATTACHMENT POINTS

.1 Connect retaining rods to the suspended material so that their axial incidence passes through the center of gravity of the equipment to be protected.

.2 Use rods of appropriate diameter and consistent with the requirements of the manufacturer of seismic supports.

.3 Vertical, lateral and longitudinal rods must be installed accordingly to the recommendations of the support’s manufacturer.

.4 No welding can be performed on site.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 This section covers the different types of process piping up to 0.9 m outside the exterior walls of the building, unless otherwise indicated.

.2 Scope will include, without being limited, the following items:

- .1 Discharge of the fire pumps;
- .2 Tests of the fire pumps;
- .3 Discharge header of the fire pumps;
- .4 Insulation of the existing chlorine piping;
- .5 Discharge of the sampling.

.3 All pipes, short parts, special parts, fittings, gaskets, flexible joints, expansion joints, bolts, washers and nuts, brackets and accessories necessary to link and complete all the process circuits for filtration, cleaning, chemical, etc., as stated in the specifications or required to complete and operate the equipment.

.4 The general list above is not exhaustive and is intended only to inform the Supplier of the scope of work.

.5 The text of the section describes several types of pipes, joints and couplings, which may not necessarily be used in this project.

1.2 RELATED REQUIREMENTS

.1 The Contractor will meet the general instructions applicable to division 44, section « 44 00 50 – General Instructions Specific for Process Engineering ».

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Sections « 01 33 00 - Submittal Procedures » and « 44 00 50 – General Instructions Specific for Process Engineering »

.2 Before fabrication, submit for approval to the Ministerial Representative the isometric drawings of the piping, based on the dimensions taken on the site. The isometric drawings must include a list a all components and their size.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section “01 78 00 - Closeout Submittals” and section « 44 00 50 – General Instructions Specific for Process Engineering ».

1.5 OPENINGS IN THE STRUCTURE

.1 In the case of a new construction, the work will be well coordinated in order to avoid piercing the walls or slabs after concrete has been poured.

.2 Indicate clearly the exact location and elevation of all the anchors, supports, sleeves and pipes. Supply and install all wall sleeves and anchor bolts. Validate the location and elevation of those items before pouring the concrete.

.3 Unless otherwise noted, all lines going through concrete wall shall have an angular ring with a continuous weld on its entire perimeter in contact with the pipe to obtain complete watertightness (water stop).

Part 2 Products

2.1 ACIER INOXYDABLE

.1 The stainless steel pipes must be in accordance with ASTM A312, 304L. Submerged pipes and the ones localized in a humid atmosphere must be in stainless steel ASTM A312, nuance 316L. All pipes shall be in schedule 10S and able to subsist to complete vacuum. If necessary, pipes shall be reinforced

.2 The stainless steel couplings must be in accordance with ASTM A403, 304L. Submerged couplings and the ones localized in a humid atmosphere must be in stainless steel ASTM A403, nuance 316L. All couplings shall be in schedule 10S and able to subsist to complete vacuum.

.3 All elbows with a diameter equal or under 600 mm must be of pressed type. All elbows must be of long radius unless space available does not allow it.

.4 The Supplier shall provide, upon request, mill certificates for each batch of major pipe delivered to the site, especially for pipe segments 316L stainless steel. In addition, they should ensure that the products conform to ANSI and NSF61.

.5 Couplings

.1 The Supplier shall install flanges, removable couplings and/or pipe sleeves, wherever flexibility or pipe dismantling is required. In general, such couplings shall be spaced in order to limit the length of a pipe section to six (6) meters maximum. However, pipe fittings in stainless steel, such as elbows, tees, crosses, Y branches, as well as pipes crossing walls, floors or ceilings can be welded. Unless otherwise specified, the coupling dimensions shall be, in general, in accordance with the standard MSS-SP43 for butt welded couplings.

.2 Flexible joints are to be retained in cases where there might be slipping due to vibration or water hammer. Where space is limited and a flexible joint is needed, coupling shall be of the appropriate “Victaulic” model.

.3 All rigid joints shown shall be flange type. These flange type joints can be replaced by an appropriate grooved type coupling of appropriate model.

.4 Unless otherwise indicated, all grooved type coupling models shall be hot galvanised ductile iron complying to ASTM A-536. Grooved type couplings adapters shall have machined grooves. Roll grooves are not accepted. Grooved type coupling seals shall be “Flush Seal”.

.5 When the flange joints are used, the nozzles are angled flange-type thickness less than the thickness of the pipe. The retaining clips are steel ASTM A 36 hot dip galvanized. The boss drilling flanges shall conform to ASME B16.5 Class 150 for those with a diameter less than or equal to 600 mm and in accordance with ASME B16.47 CL 150 Series A for those with a diameter between 660 mm and 1 220 mm .

.6 Bolts and nuts shall be in stainless steel 316 series heavy hex. Full width linings are natural rubber and red of a thickness of 3 mm.

.6 Welding

.1 Unless otherwise specified, welding shall comply with the most recent ASME Section IX codes. The procedures of welding shall meet the general requirements relating to materials and process in Section 44 00 50.

.2 Welding procedures of the Supplier responsible for this section and those of the manufacturing will be required. These procedures must be submitted to the Ministerial Representative as shop drawings. A copy of the welding procedures of the Supplier shall be maintained at the site office of the Supplier at all times.

.7 Pipe finishing

.1 Stainless steel pipes shall be cleaned at the workshop (according to ASTM A380) with a nitric and hydrofluoric acid solution at 55°C and then rinsed in hot water. Field welding shall be cleaned with a chemical paste in order to make the welding similar to the ones obtained at the workshop.

2.2 DUCTILE IRON

.1 All ductile iron pipes shall comply with the most recent revision of standards AWWA/ANSI C151/A21.51. Flanged pipe fittings such as elbows, Tee's, laterals, etc. shall comply with the most recent revision of standards AWWA/ANSI C110/A21.10.

.2 The design of ductile pig iron pipes shall comply with the most recent revision of standard AWWA/ANSI C150/A21.50 for an operating pressure of 1 034 kPa plus an overpressure of 689 kPa.

.3 Flanged pipes shall be of class 54, with maximum operating pressure of 1 725 kPa. Buried pipes shall be of suitable class.

.4 Pipes as well as pipe fittings shall be provided with an internal cement lining, in conformity with standard AWWA/ANSI C104/A21.4, except for:

.1 Pipes for scum removal, whose interior wall must be protected with a vitrified lining;

.2 High pressure air pipes, whose interior wall must be free from cement.

.5 Whenever feasible, 90° elbows shall have a long radius.

.6 Jointing

.1 Pipeline connections shall be flanged, class 125, according to standards AWWA/ANSI C115/A21.15 or Victaulic type style 31, rigid cut for non-buried pipes. Flange drilling and raising shall be as per standard ANSI B16.1.

.2 For flexibility and the pipes dismantling, victaulic flexible cut couplings style 31 will be used wherever necessary to reduce vibrations and to facilitate equipment dismantling. Victaulic couplings shall be made of hot galvanized ductile iron as per ASTM A-536. Seals for Victaulic couplings shall be "Flush Seal" type.

.3 Buried pipes will be joined using mechanical joints such as Tyton, Mechaholder or equivalent approved by the Ministerial Representative. Joints shall comply with the most recent revision of AWWA/ANSI C111/A21.11 standards.

.4 These joints must be selected to allow a maximum flexibility to pipes installed under concrete structures and where soil settlement is likely to occur.

2.3 PVC AND CPVC PIPES

.1 PVC pipes and fittings shall be schedule 80 conforming to standards ACNOR B137.3, ASTM D1784 for type 1, class 1, and ASTM 1785. Pipes and couplings shall be assembled by cold welding using a solvent-based cement, as per ASTM D 2564.

.2 All pipes and couplings in CPVC shall be schedule 80, as per ASTM D 1784 for type 4, class 1 and ASTM F 437, F 439 and F 441. Jointing shall be by means of a solvent-based cement as per ASTM F 493.

.3 Pipes shall be cylindrical and straight with ends trimmed at 90°. Finishing shall be smooth, without defects such as grooves or undulations.

.4 The Supplier shall install enough couplings to allow flexibility for pipes dismantling. Unions shall be installed on connection of equipment and for each straight length of more than 6.0 m.

.5 When there is not enough bends to allow for thermal expansion and contraction on long pipes sections, and where there is not enough space for the installation of expansion-bends, mechanical expansion joints compatible with the conveyed fluid shall be used.

2.4 REINFORCED CONCRETE PIPES

.1 The Supplier must provide reinforced concrete pipes according to ASTM and BNQ 2622-120 standards, of suitable class. Joints shall be rubber.

2.5 STEEL CYLINDER REINFORCED CONCRETE PIPES

.1 The Contractor must provide steel cylinder reinforced concrete pipes according to the requirements of AWWA C301 and AWWA C303 standards.

.2 Buried pipes must be of suitable class and be provided with steel spigot and bell ends, in order to allow flexible joint connection. Each joint must be equipped with a cotton band of suitable length, to be wrapped around the assembled joint, and filled with mortar grout, according to the manufacturer recommendations.

.3 Seals must be rubber composites ensuring permanent water tightness of the joint as per AWWA C301 standard.

.4 In case pipe jointing may require fastening, these joints shall have sufficient flexibility to follow the normal movements due to soil settlement, expansion and contraction.

.5 Pipes inside a building shall have flanged or welded joints. Flanged joints of class D shall comply with AWWA C207. Flanges drilling pattern shall comply with ANSI B16.5, class 150. Welded joints shall comply with AWWA C 206. Shop drawings submitted must show the exact location of all weldings.

.6 On-site welding shall be carried out by the steel cylinder reinforced concrete pipe Supplier, who will offer a full warranty. Every joint must be covered with concrete on the exterior and the interior faces to offer a uniform section.

2.6 COPPER PIPES

.1 Copper pipes, installed inside a building, shall be made of rigid “L” type copper tubes with welded 95/5 (tin/antimony) joints.

.2 Fittings shall be “to be weld” type, in cast bronze or in forged copper and bronze. Buried copper pipes shall be of malleable “K” type, silver welded.

.3 The piping should be washed with hot water to remove dust, oil or any matter that may be in or on the pipes. During the manufacture and installation on site, care must be exercised so as not to damage the pipe or special parts. Any pipe or any part bearing marks of tools, chains, cables, etc., or contamination, will be rejected and replaced at the expense of the Supplier.

.4 All pneumatic connections (compressed air for service application) of type flexible tubing 1/8 inch to ½ inch nominal diameter must be assembled with the Swift-fitting system made the of the company Alpha Fittings & Accessories or approved equivalent by the Ministerial Representative. Fittings shall be nickel-plated brass. Nominal pressure of fittings: 250 psi vacuum. Nominal temperature of fittings: 0 to 160 °F. Isolation valves must be of brand Alpha Fittings & Accessories or equivalent approved by the Ministerial Representative, and be equipped with a locking system with padlock.

.5 In general, the compressed air piping shall be solid copper type "L". The nominal diameter of service lines shall not be less than ½ inch. All compressed air piping in copper must be protected by two (2) coats of urethane applied on site.

2.7 CARBON STEEL PIPES

.1 Carbon steel pipes shall conform to ASTM A53 standard, grade B, caliber 120, with flanged connections in steel as per ASME, Class 150.

2.8 STANDARD COUPLINGS

.1 The Contractor must provide flexible couplings where required to facilitate maintenance or pipe installation. These couplings must be selected to be compatible with the pipes, ambient atmosphere, and operating pressures.

.2 Pipes subject to important temperature changes shall be provided with joints able to absorb thermal expansion.

.3 Pipes subject to important vibrations shall be provided with joints able to absorb these vibrations.

.4 Couplings of different types of pipes shall be watertight and well isolated with dielectric connections in case of contact with incompatible metals, in order to avoid any corrosion.

.5 Couplings used for connecting pipes having different external diameters shall be adequate and submitted to the Ministerial Representative for approval.

2.9 PIPE AND ACCESSORIES SUPPORTS

.1 Pipes and accessories shall be supported on concrete bases and/or on metallic structural elements.

.2 The Supplier shall determine the locations and/or minimum spacing between supports according to the "SPACING BETWEEN PIPE SUPPORTS" table at the end of this section. The Supplier shall submit for approval the proposed supports' drawings. Belt bands design of the manifold must be signed and stamped by an engineer member of the Quebec Order of Engineers. Refer to MSS SP-58 and SP-59 standards.

.3 Anchoring in ceilings or in walls, shall be compatible with the pipes to be installed (ductile iron, stainless steel, galvanised steel, PVC, etc.). Supports and anchors sizing (size of clamps and/or metallic structures, as well as their spacing) shall be adequate to support the weight of pipes and accessories (valves, fittings, etc.), as well as the load of the conveyed liquid and stresses due to pressure and water hammers.

.4 Each pipe support, rod or fastener shall handle its portion of the total load. Supports shall be adjustable to maintain pipes alignment.

.5 The Supplier shall supply all bolts and other required fasteners.

.6 Supports, rods and fasteners of metallic components shall be hot-dipped galvanised steel with a zinc coating of a least 600 g/m², as per ACNOR G164-M1981. The galvanizing primer shall be rich in zinc, ready to be used, according to the most recent standard CGSB 1-GP-181M. When used to fasten stainless steel pipes, metallic components shall also be in stainless steel of the same type as the supported pipes.

.7 Unless otherwise indicated, fasten equipment supports, suspension devices, braces to steel structures with approved clamps. Drilling in steel framework shall not be authorised.

.8 Unless otherwise indicated, attachments by welding or drilling is no allowed without written consent of the Ministerial Representative.

.9 Prevent any contact between dissimilar metals using dielectric insulator in order to avoid galvanic corrosion. The Supplier shall ensure that pipes are well supported and he shall pay particular attention to the establishment of the slope required for good drainage.

.10 Pipes at the suction and the discharge of the pumps shall be supported to ensure that no reaction is transferred from the pipes to the equipment.

.11 Support piping on both sides of valves, flow meters, etc., so as to permit removal, and at less than 300 mm of each horizontal elbow. Vertical pipes will be supported at the base and at the floors.

.12 Piping supports, and particularly those of the manifold, must comply with Section 44 07 00 (seismic protection systems).

2.10 GUIDES

.1 Guides shall be supplied and installed for all pipes. Guides should be located according to the following:

Piping	Maximum Distance between guides
100 mm and less	10 meters
150 mm and 200 mm	20 meters
250 mm and more	25 meters

.2 No guide shall be installed near a bend at a distance less than forty (40) times the diameter of the pipe to be guided.

.3 For vertical pipe sections, supply and install guides for each pipe. These guides shall not be spaced more than sixty (60) times the pipe diameter

2.11 ACCESSORIES FIXED TO PIPES

.1 Pipes and their welded accessories shall be of the same material and welded using the same procedure as for pipes. No penetration shall be allowed for pipes and accessories longitudinal or rim welding. Connections for branching, process sampling lines, process detection, shall comply with the relevant specifications.

2.12 DRAINS AND VENTS

.1 Wherever necessary, install drains and vents at high and low points of water, sludge, air and scum pipes. Spacing between drains shall be less than 50 m.

2.13 SAFETY AND EXPANSION VALVES

.1 Supply and install safety and expansion valves when required by the plumbing codes and standards and/or in accordance with regulations of the Province of Quebec

.2 Safety valves shall conform to ASME “Code for Unfired Pressure Vessels”.

2.14 INSULATION AND JACKETING OF PIPE, VALVES AND ACCESSORIES

.1 On all new pipes, valves and accessories, the insulation will have a thickness of 25 mm, covered by a protective PVC jacketing of 0,5 mm (0,020 po).

Part 3 Execution

3.1 PRECAUTIONS DURING CONSTRUCTION

.1 Pipe ends, couplings and other accessories shall be protected to prevent ingress of foreign bodies during construction.

3.2 TESTS

.1 Pressure tests

.1 Unless otherwise specified, the Supplier shall perform under his own expenses the hydrostatic pressure and water tightness tests on all pipes, by applying a pressure of 860 kPa during four (4) hours, under the supervision of the Ministerial Representative. If any joint or pipe happen to be defective, the Supplier shall take the necessary actions to repair these pipes and carry out new tests.

.2 Tests must be performed before laying the insulation or sound-proofing material.

.2 Temperature

.1 No pressure tests will be allowed on site before the equipment and the fluid conveyed are approximately at the same temperature

.2 The minimum test temperature varies with the type of fluid in the system and the test agent used. This must be taken into account in each case to ensure that no brittle fracture will occur.

.3 When running tests on tanks, metal temperature should not be below 15 °C. Do not deviate from this clause without the written permission of the Ministerial Representative.

.4 Do not test the pipe when the metal temperature is below 12 °C, except in the case of austenitic steel or steel that has undergone impact tests at approximately 20 Joules according to Charpy test.

.5 Testing austenitic piping can then be executed at temperatures that are not below the Charpy test temperature: minus 10 °C.

.6 When it is necessary to conduct tests at an ambient temperature below 4 °C, a water-glycol mixture will be the best agent to use. Drain completely the network as soon as the test is completed.

.3 Test Agents

.1 Except for the exceptions below, carry out hydrostatic tests using clear water or a water-glycol solution.

.4 Process pipes

.1 Process pipes, operating at a maximum pressure of 175 kPa or less, will be tested under a pressure of 260 kPa.

.5 Works under Atmospheric Pressure

.1 It is not necessary to carry out pressure tests on vents, drains and pipelines downstream pressure relief valves, as well as pipes open to atmospheric pressure.

.2 For liquids that are open to the atmosphere, fill the piping with water and make the test to the maximum static head.

.6 Hydrostatic Tests on Pipes Connected to the Equipment

.1 Once the equipment is assembled, it is not allowed to carry out tests on a group of pipes or a network if the maximum test pressure exceeds 1½ times the equipment design pressure for cold service.

.2 If the test pressure of the equipment is less than the test pressure of the pipes, the Supplier must either disconnect the pipes from the equipment, or isolate this latter using valves or plugs and connect the equipment to the atmospheric pressure.

.3 If the equipment is not designed to undergo complete hydrostatic tests, or if it is not designed to convey water, isolate the equipment during the test and open it to the atmosphere.

.7 Compressed Air Pipes

.1 Compressed air networks shall be subjected to a hydrostatic test under an operating pressure of 1100 kPa for a duration of 4 hours at least, once all the exits are closed and the compressors are isolated from the networks. The head loss during the test should not exceed 10 kPa.

.8 Compressed Air Tests

.1 In certain cases, if hydrostatic tests could cause damage (such as with compressed air pipes), compressed-air or nitrogen tests could serve as substitute. The permission of the Ministerial Representative must be obtained.

.2 The pressure during compressed-air tests must be 120% of the design pressure. The pressure shall be gradually increased until the final test pressure is reached, according to the procedures of the standards BNQ 3650-900 and ASME B31.1.

.3 A preliminary check test shall be carried out at a manometric pressure of 100 kPa. Make sure that there is no leakage in welding and joints by performing a soap solution test.

.4 The final test pressure shall be maintained during at least 10 minutes or during the time required to inspect all joints and welding, using a soap solution or any other means to detect leakage.

3.3 PREPARATION BEFORE THE TESTS

.1 Open all vents and other fittings that can serve as vents during the filling so that the air flows before applying the test pressure to the network.

.2 When the tests are in progress, all the orifice plates that obstruct the filling, ventilation and draining shall be removed.

.3 All special expansion joints, which cannot be protected from deformation, shall also be removed or disconnected during the tests.

.4 When the tests are in progress, the lines supported by springs or counterweight shall be temporarily blocked in order to be able to support the hydrostatic load.

.5 Before carrying out the pressure test, inspect all lines and/or networks to make sure that all parts connected but excluded from the test such as safety and expansion valves, rupture discs, etc. are isolated from the system under test.

3.4 PROCEDURES

.1 The use of test plugs is allowed during the on-site tests. Any test plug that is used for the field tests during the period of construction must be provided by the Supplier.

.2 On-site tests on pipes shall be carried out before installing the soundproofing material. If the soundproofing material is installed before the tests are carried out (except when the welding underwent hydrostatic tests in the workshop or in the factory), leave exposed all joints and welding done on site, until the test is finished. When the hydrostatic tests are finished and the network is approved by the foreman, all the lines and equipment shall be drained in order to remove the testing liquid. Ventilate the network during the drainage to avoid vacuum conditions.

.3 When a line contains check valves, the pressure source must be upstream the check valve, in order to be able to apply the pressure under the seat. The drainage point must be downstream the check valve. If this is not possible, either the valves shall be temporarily reversed or the disc shall be removed. After the satisfactory execution of the hydrostatic tests, the following shall be carried out:

- .1 Remove all the temporary plugs and drain the network;
- .2 Install all the valves, taps, orifice plates, expansion joints, small pipe section and other equipment excluded from the test;
- .3 Open all the valves that were closed exclusively for test purposes;
- .4 Remove all the temporary supports after having performed the drainage;
- .5 Close hermetically the tapping done for test purposes.

3.5 RADIOGRAPHIC EXAMINATION

.1 The examination must comply with sections B31.1 or B31.3 of the ASME code.

.2 A radiographic examination shall be carried out according to the percentage specified in the Code on butt-welded pipes, on the entire welding circumference.

.3 Ministerial Representative will instruct, if deemed necessary, a laboratory to perform radiographic examinations, according to the percentage specified in the Code, to the butt welded piping over the whole circumference of the weld.

.4 Welds tested must be representative of the welds sizes, the welding procedures and the welders.

3.6 NETWORK RINSING

.1 All the process and water supply networks shall be rinsed with fresh and clean water flowing at a velocity of two (2) meters per second. The flowrate shall be maintained for fifteen (15) minutes or more, until all dirtinesses is completely removed from the network.

.2 The pipe must be entirely cleaned of any remains and be left in a perfect state of cleanliness. The Contractor must empty it completely to allow for its inspection.

.3 During the rinsing, collect all the sediments flushed from the pipes using a temporary flanged suction sieve having a No. 40 mesh, installed on all suction pipes of pumps.

.4 Blow all the compressed air pipes as well as the vacuum pipes, using oil-free compressed air or nitrogen. Maintain a sufficient flow rate to thoroughly clean the network.

.5 Finish the rinsing and blowing before installing control valves and special devices.

3.7 DISINFECTION

.1 All drinking water conduits must be disinfected with a solution of chlorinated water containing 50 ppm of free chlorine, before being put into service. Quantities required to obtain this concentration are shown in the following table.

TABLE
Quantity of chlorine per 100 m of conduit

Diameter of the conduit mm	Chlorine 100 % kg	Chlorine 1 % liters
100	0,04	3,97
150	0,09	9,06
200	0,16	16,27
250	0,25	26,33
300	0,36	36,51
350	0,50	49,54
400	0,65	64,83
450	0,82	82,09
500	1,02	101,22
600	1,44	145,81
750	2,26	227,77
900	3,28	327,97
1 050	4,46	446,58
1 200	5,84	583,30

.2 It shall be ensured that the solution penetrates into all pipelines of the network. To do this, the valves must be open for a few minutes, until a characteristic odor of chlorine is noticeable. The solution should remain in the lines for twenty-four (24) hours.

.3 Bacteriological analyses (faecal and total coliforms) using the membranes method must be performed by a laboratory recognized and accredited by the Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP) on water samples taken by a representative of the laboratory in the presence of the foreman. Two (2) samples must be analyzed for each piping system disinfected. A time interval of at least 24 hours should be left between the two (2) samples. Samples must show no presence of coliform bacteria. If tests show that the water from the pipes is contaminated, disinfection and laboratory analysis must be repeated.

TABLE 1: SPACING BETWEEN PIPES SUPPORTS (mm)

Nominal diameter (mm)	Carbon steel	Stainless steel gauge 11		CPVC and PVC	Cast iron	Asbestos	Copper	
		Water	Air		(1)	(2)	Water	Air
Up to 20								
25	2 100			1 200			1 500	2 100
32	2 100			1 300			1 800	2 400
40	2 100			1 400			2 100	2 700
50	2 700	2 500	3 000	1 500			2 400	3 000
65	3 000	2 700	3 600	1 600			2 400	3 400
80	3 400	3 000	3 900	1 800			2 700	4 000
100	3 700	3 600	4 300	1 900			3 000	4 300
125	4 300	4 300	5 500	2 000			3 700	4 900
150	4 900	4 500	5 700	2 200			4 000	5 500
200	5 200	4 800	6 000	2 400			4 300	5 100
250	5 800	5 000	7 300	2 600			4 900	7 000
300	6 100	5 700	7 900	2 800			5 500	7 600
350	7 000	6 000	8 500	3 000			5 800	8 500
400	7 600	6 400	9 400	3 200				
450	8 200	(2)		3 400				
500	8 500			(2)				
600	9 100							
750	9 800							
	10 100							

(1) 3 000 mm. One (1) support per section close to the joint or at each jointing. Support also at changes of direction and branching. One (1) support on each side of valves, flow meters, etc.

(2) According to Manufacturer's recommendations

* Spacing mentioned above are maximum, unless otherwise specified by the Manufacturer.

FIN DE LA SECTION

Part 1 General

1.1 SCOPE

.1 This Section will concentrate on motor driven, vertical turbine pumps for drinking water.

.2 See chart(s) for groups of motor driven pumps used and the data sheet(s) giving a detailed description of each of the groups of motor driven pumps at the end of the present section.

1.2 RELATED REQUIREMENTS

.1 The Contractor will meet the general instructions applicable to division 44, section « 44 00 50 – General Instructions Specific for Process Engineering ».

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Sections « 01 33 00 - Submittal Procedures » and « 44 00 50 – General Instructions Specific for Process Engineering »

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section “01 78 00 - Closeout Submittals” and section « 44 00 50 – General Instructions Specific for Process Engineering ».

Part 2 Products

2.1 PUMPS

.1 Pumps will be of the vertical turbine type. All drinking water pumps must be supplied by the same manufacturer.

.2 All equipment will be designed according to the latest standards of Hydraulic Institute and ANSI/AWWA E 101. They must meet level A performance tests of the Hydraulic Institute.

.3 Pump stages

.1 The stage will be made of poured cast iron ASTM A 48, class 30, with a tensile strength of 207 MPa (30,000 psi), with no pouring holes, sand holes or any other defect, machined with precision and perfectly adjusted. The body of the pump must include a wearing ring made of bronze. The inner surface will be covered with a porcelain enamel coating.

.2 Unless otherwise specified, the impellers will be of a closed type, made of one-piece poured bronze, precision adjusted and perfectly balanced mechanically and hydraulically. They will be securely locked to the pump shaft with a conical stop sleeve. The body and the impeller will be designed with free passages so as to ensure an efficient operation. The impellers must be adjustable with a bronze nut, placed at the top of the electric motor. All the inner locks must be made of stainless steel 316.

.3 Each stage will be equipped with a wearing ring made of bronze which can be replaced as needed.

.4 The impeller shaft will be made of stainless steel 416, cold treated and with specifications according to A 582 of the ASTM. The impeller must be supported with dies made of bronze. The diameter of the pump shaft will be designed so as not to produce excessive deflection.

.5 When specified, the suction pipe will be of identical quality as that of the pump columns.

.6 When specified, the suction bell will be made of poured cast iron ASTM A 48, class 30, with a suction diffuser equipped with a bronze die, permanently sealed and lubricated with an insoluble grease.

.7 Unless otherwise specified, the screens, when indicated, will be made of stainless steel 316 of a conical type (in a well) or of a basket type (in a tank).

.4 Discharge column and transmission shaft

.1 The columns of the pump are made of steel ASTM A 53 suited to the diameters and in accordance with ANSI B58.1 and AWWA E 101.

.2 Columns of 200 mm diameter or less shall be screwed together except if they have an epoxy coating in which case, they shall be flanged with stainless steel 316 bolts and nuts.

.3 Columns of 250 mm diameter of more shall be flanged with stainless steel 316 bolts and nuts.

.4 Maximum length of column sections are specified in the data sheets.

.5 The transmission shaft must be precisely turned and polished, up to a finished surface no greater than 40 RMS. Of adequate size, it will allow the pump to function without distortion or vibration for the maximum power of the motor operating the pump. The shaft will be supplied in interchangeable sections of compatible lengths to the sections of the column.

.1 When water lubrication is indicated, unless otherwise specified, the shaft will be made of stainless steel 416 ASTM A 582 with threaded connections made of the same material.

.1 Neoprene dies will be supplied at each joint of the column. Where the dies will be installed, the shaft will be protected with a replaceable sleeve made of stainless steel 304, ASTM A 269. The dies will be solidly fixed with a bronze support on the flange columns and connections with supports made of poured cast iron ASTM A 48, class 30 on the screwed columns.

.2 When forced water lubrication is indicated, unless otherwise specified, the transmission shaft will be made of stainless steel 416 ASTM A 582 with a threaded connection made of the same material.

.1 The shaft will be protected with a protective tubing of suitable diameter to allow a good lubrication of the shaft under all operating conditions. It will be made of black steel ASTM A 53, extra heavy type, schedule 80, with a continuous electrical welding. The tubing lengths will be 1.5 m, interchangeable and the end-to-end dimension will be the same as the column. The protective tubing will be firmly fixed at every 6 meters, at least, with a bronze support, on the flange columns and with connections with supports made of poured cast iron ASTM A 48, class 30, on the screwed columns.

.2 The tubing dies will be made of bronze ASTM B 505 with machined threads and grooves for a proper lubrication. They will be installed at each end of the tubing.

.3 When oil lubrication is indicated, the transmission shaft will be made of carbon steel ASTM A 108, grade C1045, with a threaded connection made of the same material.

.1 The shaft will be protected with a protective tubing with tubing dies, identical to the ones described in b).

.5 Discharge head

.1 The discharge head will be made of steel ASTM 53, grade B and designed for a variable frequency drive (see data sheet). Unless otherwise specified, the discharge flange will be machined with a piercing stencil which meets the standards for cast iron flanges ANSI, class 125 or steel flanges ANSI, class 150. See data sheet and/or plans for positioning the discharge elbow, under or above the floor.

.6 Miscellaneous

.1 When specified, the epoxy coating of the levels, columns or discharge head will be of type 1 Engard 480, 0.28 to 0.30 mm thick, in accordance with standard BNQ 36600950.

.2 The head shaft will be made of stainless steel 416 ASTM A 582.

.3 The discharge heads will be equipped with packing assembly casings and all necessary accessories for the type of lubrication required.

.4 Each pump will be equipped with a bottom plate, either made of poured cast iron or steel, with machined surface.

.5 If the Contractor opts for the bottom plate with a machined surface, the dimensions of the plates will be determined by the pump manufacturer. The plates will have a minimum thickness of 13 mm, which will vary according to the size of the pump.

.6 Each new pump will be installed on a mud slab. See division « Structure » and mechanical process plans for fabricating details of mud slabs. The concrete mud slabs will be supplied by the « Structure » division.

2.2 MOTORS

.1 Each pump will be powered with a vertical motor with an empty shaft of induction type, with squirrel cage. Please note that a horizontal motor mounted vertically will not be accepted.

.2 The motor casing will be of type AMEEC, equipped with screens with openings and designed to function in a continuous manner. The motors are built so as to be able to operate in an ambient temperature of 40° C. The ends are made of poured steel with anti-corrosive hardware. The cap will be made of aluminum or other light material so as to be easily removed by one person. The hoisting hooks must be an integral part of the casing.

.3 When applicable in a deflagration condition, the TEFC anti-deflagration envelop will withstand inner explosions of gas, without igniting the exterior gas and will be in accordance with the ACNOR standard, class 1, division 2, groups C and D.

.4 The rotor cage will be made of aluminum bars with homogeneous aluminum end caps. Ventilation will be done at both ends of the motor, thus avoiding the creation of hot spots.

.5 The motor must be manufactured in accordance with AMEEC standards, design B, class "F" insulation, temperature rise "B," with enough capacity to operate the pump continually without any abnormal rise of temperature. The motors of 30 KW (40 hp) and more, must be equipped with temperature sensing elements for each phase, compatible with safety switch heaters from the manufacturers of the starters indicated on the electrical specification. The motors of 149 KW (200 hp) and more must be equipped with two temperatures sensing elements for each phase.

.6 The motor must be built so as to be an integral part of the motor-driven pump. The thrust bearings must be of suitable capacity so as to support the static and dynamic heads induced by the operation of the pump, plus all the non-balanced hydraulic thrusts of the impellers of the pump and with a suitable safety factor. The motors will be equipped with a ball-type ratchet-locking action.

.7 All rotary parts of the motor must be individually and accurately balanced, and this, with a maximum amplitude of 0.001 from one crest to the other.

.8 The nominal propelling force of the motor will be such that it will never operate in overload in all encountered conditions, following the characteristic curve Q-H-BHP of the chosen pump. As well, the motor must have an overload factor of 15% of its nominal value.

.9 The motors must be high efficiency and should offer an optimal performance equal or superior to the required minimum, as stated in the most recent Hydro-Quebec document the "Moteurs électriques à haut rendement - Répertoire des moteurs". The motor should be in accordance with the whole of the requirements stated in this document.

.10 The chosen motor will be the one offering the best performance among all the high efficiency motors offered by the selected manufacturer.

.11 High efficiency motors will also have to be in accordance with the whole of the requirements described within the present article on motors.

.12 The manufacturer of the motor will have to supply the performance sheets of its standard motor and of its high efficiency motor.

.13 The power supply characteristics are explained in the technical sheets of the pumps. The motors will have to be able to operate at a maximum speed which is specified in the technical sheets of the pumps.

.14 The maximum allowable level of noise must be 85 db. The manufacturer must supply data on the noise levels, broken down by octaves of 25 to 10,000 Hz and must be measured in accordance with bulletin no. 85 of the I.E.E.E.

Part 3 Execution

3.1 INSTALLATION

.1 The installation of the pumps and the accessories will be done in accordance with the manufacturer's instructions and as per the details on the plans.

.2 The Contractor will have to carry out all the required tests to prove the good working order of the equipment. The requirements of the specifications must be met before this equipment is approved by the Ministerial Representative.

.3 Any defective equipment will be repaired or replaced by the Contractor; any system failure will be corrected to the satisfaction of the Ministerial Representative.

TABLE FOR GROUPS OF MOTOR DRIVEN PUMPS

ITEM #	DESCRIPTION
PD-1 PD-2	Replacement of the existing vertical turbine pump motor Existing pump motor: 30 kW (40 HP) 600V, 3ph, 60 Hz Natpro (514-421-0331), project 308534 The new motor must be inverter duty for use with VFD

General notice:

1. Paint of the valves and its accessories shall be realized by the manufacturer in its plant, with the standard code of the manufacturer and shall comply to the applicable ambient conditions. A minimum of on (1) layer of primer and two (2) layer of paint shall be painted on each valve. Before application, the paint system chosen shall be submitted to the Ministerial Representative for approval.

2. Certified pump curves shall be supplier to the Ministerial Representative for approval before delivery of the pumps to the site.

3. See required vibration tests in section 44 00 50.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 This section covers the eccentric plug valves, butterfly valves, gate valves, check valves and other valves as well as the different types of operators.

.2 The text of the section describes several devices that are not necessarily used in this project.

.3 See the valves table at the end of the current section. The Contractor shall refer to the P&ID for the selection and dimensioning of smaller items.

.4 This table is only to help the Contractor and does not include all valves. It is the Contractor responsabilities to supply all valves present on the drawings or otherwise necessary for the completion of the work.

1.2 RELATED REQUIREMENTS

.1 The Contractor will meet the general instructions applicable to division 44, section « 44 00 50 – General Instructions Specific for Process Engineering ».

.2 Section 21 05 05 - Common Work Results For Fire Suppression

.3 Section 21 30 00 - Electrical Fire pumps

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section « 01 33 00 - Submittal Procedures ».

1.4 GENERAL REQUIREMENTS

.1 All valves of the same type shall be supplied by the same Manufacturer and shall comply with the following requirements:

.1 Connections: joints must be welded, threaded or flanged, depending on the type of installation. End flanges shall comply with ANSI B16.1, Class 150, unless otherwise specified.

.2 Requirements: Valves must be compatible with their respective operating nominal pressure and their seals must withstand the operating temperatures.

.3 Diameter: valves' diameter must be the same as the connecting pipe diameter, unless otherwise specified.

.2 In all cases, valves opening must be counter clockwise. In general, a valve must be installed on each pipe connecting to a header or to an equipment.

.3 All valves whose handwheel or lever axis is located 2 000 mm above the floor level or higher, shall be equipped with a chain actuator, to facilitate their operation from the floor level.

.4 All valves, regardless of their size and type, whether they are motorized and/or automated or not, must have a mechanism for manual operation (steering wheel, lever, etc.) including the required release accessories if they are motorized and/or automated.

.5 All valves, regardless of their size and type, whether they are motorized and/or automated or not, must be equipped with an integrated device enabling them to be locked (padlock). If a device that allows a direct locking is not available, the Supplier shall provide the devices (covers, chains, etc.) required to lock the valve, as described in the applicable CSA safety standards.

.6 All exposed nuts, bolts, springs, washers, etc., will be made of stainless steel for all applications.

.7 All valves shall be protected using at least three (3) coats of epoxy paint certified NSF61.

.8 The Supplier must produce detailed calculation sheets (calculation of CV values and cavitation conditions) for each modulating valve.

.9 If applicable, actuator enclosures, terminal blocks and/or any electrical accessories, must be compatible with the ambient conditions specified in the technical sheets, according to the following standards or specifications:

Ambient Conditions	Enclosure
Humid and splashing	AMEEC 4
Explosive	ACNOR, class 1 div. 2, groups C and D waterproof and explosion proof AMEEC 4 and 7
Humid and/or corrosive	AMEEC 4X

1.5 FIRE PROTECTION

.1 All valves and accessories associated directly to the fire pumps shall be ULC homologated for use in a fire protection system.

Part 2 Products

2.1 ECCENTRIC PLUG VALVES

.1 Unless otherwise specified, the valve body shall be full port in cast iron and shall conform to the standard ASTM A-126 Class B. Valves 75 mm and more shall incorporate an "integral" seat welded in nickel at least 3 mm thick. The turn of the valve must be coated with a stretchy neoprene to ensure a tight seal. The shaft seal will be of adjustable multiple chevron type with internal thrust bearing in PTFE, allowing its replacement while keeping the system under pressure.

2.2 BUTTERFLY VALBES

.1 In general, all valves will be supplied with a gear operator with hand wheel.

.2 Unless otherwise specified, the valve body will be cast iron, flanged, and shall conform to the standard ASTM A-126, Grade B. The enclosure of the operator will be in cast iron. In general, the butterfly valve shall comply with the most recent revision of the standard AWWA C504 and/or will be certified NSF61. The wafer type is not accepted, unless otherwise specified.

2.3 ROTARY VALVES

.1 Rotary valves installed on PVC pipes shall be ball type, PVC, with double threaded union. Except if otherwise specified, the valves of 50 mm diameter or less shall have threaded connections but valves of 63 mm of more shall have flanged connection.

.2 Rotary valves installed on stainless steel pipes shall be full port ball type, iron ASTM A126, class “b”, covered by fusion bonded epoxy with the ball made out of iron covered by PTFE. Nuts and bolts shall be in stainless steel. The flanges will be in accordance to ANSI B16.1, class 125.

2.4 GATE VALVES

.1 Gate valves shall withstand pressures up to 1000 kPa and shall conform to the most recent version of the AWWA C 500 standard.

.2 The gate valve body will be cast iron as per ASTM A126, Grade B standard, with monobloc gate and internal parts in bronze. The gate will be a solid wedge disc. Wedges will be furnished with a bronze crown. The stem will be made of bronze as per ASTM B16 standard and will be sealed with a double O-ring system in Buna-N where it leaves the valve bonnet. The stem will be fixed, with internal threading.

.3 Gate valves 400 mm diameter and larger shall be equipped with a bypass device, with a bypass valve.

2.5 CHECK VALVES

.1 Ball

.1 The valves shall be equipped with a hollow steel ball coated with a thick vulcanized nitrile rubber and an access door for removing the mentioned ball.

.2 The body of the valves shall be nodular ductile iron and will be covered with one primer coat, two (2) coats of asphalt anti-rust varnish. The valve can withstand a pressure of 1000 kPa and 80 °C.

.2 Disc

.1 Unless otherwise specified, disc check valves shall be equipped with external springs with lever and counterweight. These check valves will be installed in a horizontal pipeline.

.2 The valve body with an access hatch will be cast iron in accordance with standard ASTM A-126 Class B. The disc will be ductile iron, the stem and springs will be stainless steel 17-4PH and the seat will be aluminum-bronze ASTM B148.

.3 The check valves will include a lifting eye for their handling.

.4 When specified, the closing speed of oil or air amortized valves shall be adjustable.

.3 Dual-door wafer type

.1 The valve body shall be in cast iron according to standard ASTM A126 Class B. The doors will be in bronze ASTM B148 with spring in 316 stainless steel and seat in Buna-N.

.4 Silencing wafer or globe type

.1 The valve body shall be in cast iron according to ASTM A126, Grade B, with seat and door in bronze ASTM B584, and spring in stainless steel 316.

.5 Rubber flapper

.1 The valve body shall be in cast iron according to standard ASTM A126 Class B, with hinge in Buna-N.

2.6 HYDRAULIC CONTROL VALVES

.1 Each valve will be of straight body type, hydraulic operation, equipped with a seat, a disc and a membrane or a double-diaphragm piston for valves 250 mm and more.

.2 The frame will be in ductile cast iron, ASTM A-536, high strength, and the inside and outside will be covered with a fusion epoxy according to the standards NSF-61 and AWWA C-210. Valves shall have a removable and replaceable seat in stainless steel 316, and a resilient and reversible inner disc in EPDM. The actuator stem will be in 316 stainless steel and will be guided at each extreme with pads placed respectively in the cover and the seat of the valve. This system will ensure a perfect alignment of the shaft and smooth operation without shaking of the valve. The membrane will be in reinforced synthetic rubber. All valve parts are accessible without having to remove the valve. Valves shall be stable until a minimum flow of 4 L/min. The entire valve is guaranteed for three (3) years.

.3 Each valve shall be provided with pilot isolation valves, a position indicator, flanged fittings and all the control piping including drivers, screens and other accessories required to meet the specified application.

.4 Where required, each control valve will be equipped with a solenoid electric valve and limit switches. The solenoid valve will be of 3-way type, compatible with atmospheric conditions. The valve shall be provided for an electric power of 120 Volts, AC, 60 cycles, and include a manual operator.

.5 A drainage conduit is required for discharging the water released during the closing and opening of the valve. Conduits shall be in rigid copper and will be connected to the closest discharge floor drain.

2.7 AIR VALVES

.1 The body and cover the air valves will be in cast iron according to the standard ASTM 48, Class 30. The floater of the air valves shall be made of stainless steel according to the standard ASTM A240.

.2 The air valves shall allow air discharge from piping when pumps start or are in operation. In addition, they will allow the intake of air in the pipes when the pumps are stopped to prevent the formation of a vacuum. All air valves shall be equipped with an isolation valve and a discharge pipe directed to the nearest floor drain, as shown in the drawings.

2.8 NEEDLE VALVES

.1 Needle valves shall be of the «needle» type, made of PVC, with double threaded unions. The valves shall be of the same diameter as the piping on which they will be installed.

2.9 KNIFE GATE VALVES

.1 The valve body shall be in cast iron or stainless steel 304 according to specifications. The interior of the body shall be shaped so that the turbulence of the fluid carried allows continuously cleaning the material at the bottom of the valve body which might otherwise accumulate. Side guides must maintain the knife in contact with the seat.

.2 The knife gate shall be stainless steel 304 and have the bottom edge beveled to present a sharp edge on the side of the seat.

.3 The stem shall be stainless steel 304 and is bolted to the knife with at least two bolts.

2.10 VARIABLE ORIFICE CONTROL VALVE

.1 Variable orifice control valves will be of the guided shutter type, with body in cast iron according to the standard ASTM A126 Class B. The shutter will be hydraulically balanced and the guidance system shall be of anti-cavitation type and low noise generation. Valves shall be provided with a pneumatic actuator globe type, with return spring in closed position

2.11 ACTUATORS

.1 Quality of materials

.1 In general, on all actuator types, whenever applicable, plastic or aluminium cylinders, and plastic, aluminium or brass gears are not acceptable.

.2 Manual actuators

.1 In general, manual actuators will be of the wheel type with gear and they can be locked with padlocks in two (2) positions.

.2 When a locking device is not directly available to an operator, the valve must be equipped with a lid and/or other locking accessory designed for this purpose.

.3 When a wheel is specified, the direction of rotation, opening and closing must be clearly indicated on the wheel.

.4 Wheels shall be calibrated to give a proper couple of maneuvers without using leverage or keys.

.5 When required by the specifications, the gear mechanism shall be equipped with a wheel. The gear housing shall be in cast iron, waterproof and weatherproof, with bronze friction bearings or ball bearings.

.6 Lubrication openings will be planned for the lubrication of bearings and gears.

.7 In the event that a chain mechanism is required, valves with multiple drive shall include a wheel specifically designed for operation with chain.

.8 All operating devices must ensure the opening and closing of the valves under nominal pressure conditions specified for such valves. Devices for manual operation shall require a force not exceeding 18 kg to produce traction to the required torque in order to operate the valve at its rated pressure.

.3 Pneumatic actuator

.1 The manufacturer of the valve will be fully responsible for the choice of size of proposed actuators and the functional compatibility of the assembly valve-actuator. The actuator shall be mounted on the valve.

.2 The actuators will be oversized in order to provide for occasional overloads and provided with protection against excessive torque.

.3 The actuator will be double action with cylinder, limit switches mounted in housings and a 4-way solenoid valve with full speed control for closing and opening and manual operation button with emergency wheel disengaged with auto-manual lever lockable in two positions.

.4 Controls and accessories will be grouped near the actuator so as to form a compact and functional assembly.

.5 When a valve with pneumatic actuator acts as a check valve without mechanical valve over a pumping unit, the actuator shall include the additional solenoid valve and the accessories required to enable rapid closure of the valve in case of power failure.

.6 At any time, the pneumatic actuator mounted on an eccentric plug valve shall include solenoid valves and accessories needed to enable rapid closure at the

beginning and an adjustable closing speed later, in normal operation, in addition to accessories for fast closing in case of power failure.

.7 When a modulating valve is required, provide an electropneumatic positioner. Unless otherwise indicated, the limit switches are not required on a modulating valve.

.8 The solenoid and limit switch boxes must be compatible with the expected atmospheric conditions in accordance with the standards detailed in Section "1.2 General Requirements".

.9 Air pressure of 550 kPa will be available for the operation of the valves unless otherwise specified in the technical sheets. The cylinder shall have an air capacity of at least 1000 kPa.

.4 Electric actuator

.1 Where required, fixed electric actuators will conform to the latest AWWA C 540 and/or certified NSF61.

.2 The electric actuators will be either of multi-turn movement, or quarter-turn movement, consistent with the type of valve that will activate it.

.3 The manufacturer of the valve will be fully responsible for the choice of size of proposed actuators and the functional compatibility of the assembly valve-actuator. The actuator shall be mounted on the valve, unless otherwise indicated.

.4 The solenoid valves and limit switch boxes must be compatible with the expected atmospheric conditions in accordance with the standards detailed in section "1.2 General Requirements".

.5 In general, all actuators of type open/close, multi-turn movement and quarter-turn movement should include:

.1 Housing: construction must be tight, compatible with atmospheric conditions;

.2 A gear drive system;

.3 An emergency hand wheel detachable, with auto-manual lever lockable in two positions;

.4 The limit switch contacts required for the operation, as well as two additional contacts for opening and closing position. Unless otherwise indicated, in the case of a power failure, the actuator will remain in the position where it was before the failure, unless the valve is manually operated;

.5 Electrical compartment(s): the limit switch contacts will be mounted in one or more integrated compartment(s) to the actuator with the reversing contactor, the control transformer, over-torque contacts on opening and closing and interposed relays, if necessary. Compartments shall include an electric heating element with sufficient power to keep the compartments dry.

.6 Integrated controls: local controls shall include a rotary/push knob for the functions for OPEN, STOP, CLOSE, a three-position mode selector,

operation LOCAL / REMOTE / OFF, and two indicator lights, red and green, to indicate that the valve is open or closed:

.1 All control accessories shall be mounted on the housing of the valve actuator or on the wall for easy access;

.2 The connection of all electrical components forming part of the actuator will be done to a terminal plate mounted in the electrical compartment so as to facilitate external connections;

.7 Local position indicator with needle and dial, indicating: open, intermediate and closed.

.8 When the remote control is required, the electric actuator shall have the electrical wiring diagram and contact points allowing:

.1 To indicate remotely:

.1 Valve open (effective end of course)

.2 Valve closed (effective end of course)

.3 Alarm over default of the electrical actuator and when the LOCAL / OFF / REMOTE is put in a position other than "REMOTE"

.2 To receive the following remote commands:

.1 Open

.2 Stop

.3 Close

.3 The minimum and maximum durations for the complete opening/closing of the valve will be determined by the Supplier in accordance with the application of the valve.

.5 When a modulating valve is specified, provide the proportional control block required, in addition to the equipment described above. The ability of the actuator will be sufficient to ensure a continuous modulating operation without overload or overheating.

.6 The actuator of a modulating valve shall have, in addition to the remote controls described above, the following functions:

.1 Receive an analog signal (4-20 mA) of current, ensuring the positioning of the valve in proportion to the signal;

.2 Transmit an analog signal (4-20 mA) of current proportional to the valve opening (for confirmation).

.7 The electric motors will have a duty cycle of 30% for on/off actuators and a duty cycle of 100% (continuous operation) for modulating actuators.

.8 In addition to the previously described elements, multi-turn movement actuators shall include:

.1 When required and according to the manufacturer, an electric motor: high efficiency, low inertia and high starting torque, specially designed for the operation of valves, power 600 volts, 3 phase, 60 cycles, unless otherwise specified, protected

with an overheating contact incorporated in the motor windings, with average torque after starting not exceeding 40% of its rated torque.

.2 A reversing contactor electrically and mechanically inter-locked with sufficient capacity to ensure the engine supply, and a control transformer for power supply of control circuits at 120 volts.

.3 Coupled contacts for opening and closing.

.9 In addition to the facilities described above, quarter-turn movement actuators shall include, unless otherwise stated, a high-efficiency electric motor for power supply 110 V/120 V, 1 phase, 60 Hz, protected by an overheating contact. The Supplier shall provide the following spare parts:

.1 A set of seals for each type and size of valve.

.2 A spare valve of each type, including the actuator and positioner.

.3 A solenoid valve of each type used.

Part 3 Execution

3.1 INSTALLATION

.1 Installation of valves and check valves and their accessories will be conducted in accordance with manufacturer's recommendations and in accordance with the details shown in the drawings.

.2 The Supplier shall perform all the tests required to demonstrate the correct operation of the equipment. The specification requirements must be met before such equipment is approved by the Ministerial Representative.

.3 All defective equipment will be repaired or replaced by the Supplier; system failures will be corrected to the satisfaction of Ministerial Representative.

.4 Connect the pneumatic actuators to the compressed air system using the appropriate accessories, if applicable.

END OF SECTION

1.1 SET POINTS

.1 All set points shall be adjustable at the control panel.

1.2 INSTRUMENTATION

.1 Existing

- .1 LIT-1 for the level in the drinkable water tank.
  - .1 Display the level.
- .2 LSL-1 for the level in the drinkable water tank.
  - .1 Alarm.
  - .2 Stop pumps PD-1 and PD-2
- .3 LSH-1 for the level in the drinkable water tank.
  - .1 Alarm
- .4 LIT-2 for the level in the water tower.
  - .1 Display the level.
- .5 Fire pumps controller
  - .1 Display state
- .6 The Contractor shall connect and display all existing instrumentation to the new control panel.

.2 New

- .1 PE-101, PE-102 and PIT-100 for the pressure of the drinkable water discharge manifold.
  - .1 Display of the pressure.
  - .2 The probe are redundant one another. If one fails, the other enters in function and an alarm is activated.

1.3 DISTRIBUTION PUMPS

.1 PD-1 and PD-2

- .1 Drinkable water distribution pumps with variable frequency drives.
- .2 The two pumps can work together at the same time.
- .3 The acceleration and deceleration ramp of the VFDs must be adjusted to 20 seconds.

1.4 ALTERNATION OF THE PUMPS

.1 When the two pumps are not working, alternation of the pumps occurs. The pump that was P1 becomes P2 and the pump that was P2 becomes P1.

1.5 SELECTOR

.1 The control panel shall have a selector for the two operation modes.

.1 Mode ÉTÉ

.2 Mode HIVER

1.6 FUNCTIONAL DESCRIPTION

.1 Operation in mode ÉTÉ

.1 Start of P1;

.2 Adjust the rotation speed of P1 to maintain the pressure set point at 510 kPa at PIT-100;

.3 When the rotation of P1 hits 100%, start P2;

.4 Adjust the rotation speed of P1 and P2 to maintain the pressure set point at 510 kPa at PIT-100;

.5 Stop P2 when P1 can maintain pressure at 95% of its rotation speedp

.6 Draining of the water tower

.1 Pumps P1 and P2 shall be stopped at 9h00. At this moment, no pumps are working;

.2 The pressure must reduce to 475 kPa. Once this set point reached, the control starts as normal.

.2 Operation in mode HIVER

.1 When the pressure at PIT-100 reaches a pressure of 475 kPa or less for 10 seconds, start P1 at 100% of its rotation speed;

.2 If pressure at PIT-100 reaches a pressure of 450 kPa, Start P1 and P2 at 100% of its rotation speed;

.3 When pressure reaches 510 kPa or more for 10 seconds, stop P1 et P2.

.3 Water level in the water tower

.1 Stop P1 and P2 when high level at LIT-2

.2 Start P1 and P2 when low level at LIT-2

.4 Operation with fire

.1 Under confirmation of a start of one fire pump (Fire Pumps control panel), pumps PD-1 and PD-2 shall be stopped.

FIN DE LA SECTION