

# SECTION

## GENERAL TECHNICAL SPECIFICATIONS

Department Foreign Affairs and International Trade Canada

ARAF project 16848 AACR12102

Chancery Water filtration System Replacement



# Water Treatment at the Canadian Chancery - Haiti

## Section General Technical Specifications

Tetra Tech Project n°: 25288 (60DVC)


Prepared by:



Simon Léveillé  
5029541  
QUÉBEC  
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Simon Léveillé, Eng., M.Sc.A

Checked by:



Catherine Caron, Eng. 2016/04/20

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**GENERAL TECHNICAL SPECIFICATIONS**

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## GENERAL TECHNICAL SPECIFICATIONS

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### 1. PRIORITY OF DOCUMENTS

All documents are made to complete each others. In case of contradictions among the documents, the priority of the technical documents is described in the “Special technical specifications” section. In case of contradiction, the section “Special technical specifications” have priority over the section “General technical specifications”.

This section describes many features of the work to be done and is not intended to be in any way limiting.

### 2. SECTIONS

Bidders are asked to refer to the following sections:

- Demolition and dismantling
- Shop drawings
- Tests, training and manuals
- Process requirements
- Piping and accessories
- Welding of stainless steel piping
- Manufacture of equipment
- Equipment identification
- Equipment installation
- Hot dip galvanization
- Sandblasting and painting
- Equipment disinfection





# **GENERAL TECHNICAL SPECIFICATIONS**

## **“DEMOLITION AND DISMANTLING”**



**GENERAL TECHNICAL SPECIFICATIONS  
DEMOLITION AND DISMANTLING**

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**GENERAL TECHNICAL SPECIFICATIONS**  
**DEMOLITION AND DISMANTLING**

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**1. GENERAL**

This section describes many features of the work to be done and is not intended to be in any way limiting. The Contractor has the obligation to provide related works that need to be undertaken to provide the Owner work consistent with the drawings and specifications. For the work to be performed according to this section, the Contractor shall refer to all drawings and sections of the tender documents.

**1.1 Scope of work**

At each location on the drawings where it is indicated to remove, drill, dismantle, demolish or any similar work otherwise indicated, the Contractor shall proceed with the complete removal of the works thus designated and dispose of the works off-site unless otherwise indicated.

**1.2 Standards**

CSA S350, Code of Practice for Safety in Demolition of Structures.

**1.3 Condition of the works to be demolished or dismantled**

Undertake the demolition and dismantling of the works in their condition at the time of the site inspection before the bid submission.

**1.4 Protection**

Take all necessary measures to avoid any movement, cracks or collapse of works, walls, piping or other equipment to prevent them from being damaged. Supply and install the reinforcing components and shoring and perform the underpinning work required. Repair works damaged during the demolition.

Properly support the works and, if it appears that the demolition or dismantling constitutes a threat to adjacent structures, stop work and notify the Consultant.

Ensure that demolition will not endanger water distribution and fire protection required to be maintained in working condition and the electrical and mechanical systems which must remain operational.

Carefully dismantle equipment to be reinstalled, relocated or maintained to be stored by the Owner to allow its reinstallation and relocation.

**2. MATERIALS**

Hidden or finishing materials shall be as specified in other sections of the specifications, if applicable, or first quality and brand approved by the Consultant and shall be in all respects similar to existing materials.

For rehabilitation work, use new materials identical to existing materials.

If the use of a different construction method or different new materials appears to be more advantageous, submit the construction method or new materials to the Consultant for approval before making any changes.

For all equipment to be dismantled and reinstalled, the Contractor shall provide for the replacement of items that cannot be reused by new items similar to existing. All supporting brackets and all mounting hardware for equipment shall be reused or replaced, according to their conditions.

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**DEMOLITION AND DISMANTLING**

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### **3. EXECUTION**

#### **3.1 Identification, preparation and coordination**

The Contractor shall inspect the site prior to commencing work under this section to identify items that should be removed, disposed of, recycled, recovered and those which must remain in place. A list of the removed items shall be supplied by the Contractor to the Owner before proceeding to the removal of those items. The list must be reviewed by the Owner or the Consultant before proceeding to the removal.

#### **3.2 Safety Codes**

Unless otherwise indicated, carry out demolition work in accordance with safety practices and in compliance of the legal requirements which applies.

Blasting activities are forbidden.

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

- Workplace Hazardous Materials Information System (WHMIS). Submit to owner, or owner's representative, pertinent MSDS information;
- Applicable local safety operating procedures;
- Owner's safety practices;
- National Fire Protection Association – NFPA, and the National Fire Code of Canada 1995;
- OSHA 29 CFR 1910.147. Control of Hazardous Energy Sources ( United States Department of Labor).

#### **3.3 Demolition**

Demolish, dismantle, reinstall and/or relocate all structures, equipment, pipes, valves, fittings, and accessories as shown on the drawings and as required for the execution of the Work.

Dispose of materials, refuse and equipment removed and not recovered by the Owner, in accordance with applicable standards and regulations.

Remove materials, pipes and other elements that impede demolition work, rehabilitation or repair of existing surfaces, and reinstall them as the work proceeds.

During Work and at the end of each working day, ensure that no item can slump, cave in or collapse. Protect from the elements the parts of the building, structures or works which must not be demolished.

All materials or equipment damaged and rendered non reusable shall be replaced by equivalent materials or equipment by the Contractor.

Demolish only what is strictly necessary, as the Contractor shall be held responsible of repairing any damaged surfaces.

Take all necessary precautions to avoid inconveniencing the Canadian chancery staff.

Any damage to the interior or exterior of the facilities shall be repaired by the Contractor to the satisfaction of the Owner.

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**3.4 Cleaning and Repair**

Upon full completion of the Work, ensure that all damages have been repaired.

Clean premises during the Work and carry out the final cleaning.

1. Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.
2. Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site.
3. Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
4. Remove waste material and debris from site at end of each working day.
5. Dispose of waste materials and debris off site.
6. Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
7. Store volatile waste in covered containers, and remove from premises at end of each working day.
8. Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

**3.5 Decommissioning of pipes**

Decommissioned pipes that cannot be removed must be capped. The cap shall be made of compatible material and ensure proper sealing. Openings in walls, floors or any other structure, resulting from the decommissioning of pipes must be sealed and the affected area rehabilitated.





**GENERAL TECHNICAL SPECIFICATIONS**  
**“SHOP DRAWINGS”**



**GENERAL TECHNICAL SPECIFICATIONS**

**SHOP DRAWINGS**

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# GENERAL TECHNICAL SPECIFICATIONS

## SHOP DRAWINGS

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### 1. SCOPE OF WORK

The term “Shop Drawing” shall be considered equivalent to “Working and Assembly Drawings.”

Submit to the Engineer, for comment, shop drawings, product descriptions and required samples. Prepare and provide the Engineer with one (1) “paper” or electronic (\*.pdf, \*.dwg, \*.doc, \*.xls, etc.) copy of all shop drawings and/or technical data sheets for the Engineer’s approval. Scanned documents (pdf format) furnished electronically shall be of good quality; otherwise, they shall be submitted in “paper” version. Paper documents shall be approved, scanned (pdf format) and returned electronically via the internet to the Engineer. The same will apply to documents submitted electronically. The Contractor shall be responsible for printing and copying approved documents for purposes of preparing manuals, etc. The procedures for sending electronic files and retrieving approved documents should be presented at the project’s kick-off meeting.

The review of shop drawings by the Engineer is for the sole purpose of ascertaining general conformance of the work with contractual requirements. Comments and/or corrections affixed to these drawings do not relieve the Contractor of his obligation to comply with the terms of the contract nor do they constitute an endorsement or approval in the event of non-compliance with these terms.

It is forbidden to undertake any work of which the shop drawings, samples and product descriptions have not been returned with the Engineer’s comments.

Upon receipt of the contract award notice, the Contractor with his subcontractors and/or suppliers shall immediately proceed to the preparation of working and assembly drawings as well as the preparation of specifications and conformance documentation.

Submit new shop drawings prior to any modification of drawings that have already been reviewed.

The Contractor shall furnish to the Owner an electronic version of the final shop drawings and technical data sheets.

### 2. DOCUMENTATION

#### 2.1 Shop drawings

Working and assembly drawings include technical data sheets and documents demonstrating conformance with standards.

Submit comprehensive shop drawings for equipment to be supplied and installed.

Working and assembly drawings must show the configuration and dimensions of the equipment as well as all technical details allowing an assessment of the quality and performance of the equipment.

The shop drawings must show installation details for all piping, fittings and hangers. They must clearly indicate all anchors, sleeves and pipes as well as the position and characteristics of bases, supports and anchor bolts.

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### SHOP DRAWINGS

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In some cases, schematic drawings normally provided by the manufacturer, specifications in catalogues, diagrams, tables, charts, illustrations and ordinary descriptive information may take the place of working and assembly drawings. This documentation should not contain any information that is not relevant to the project and the basic information must be supplemented by additional details specific to the project.

The shop drawings shall indicate the location of required openings in concrete structures and required parts to be incorporated into concrete.

#### 2.2 Samples

Submit samples with the prescribed dimensions and in the quantity required.

#### 2.3 Contractor responsibilities

Verify shop drawings, characteristics and samples before submitting to the Engineer.

Verify:

- On-site dimensions and condition of existing structures;
- Execution criteria;
- Catalogue numbers and other related data.

Match the documentation submitted with the requirements of the work and the contract documents. The drawings will not be approved individually. Verification will be done when all related drawings have been submitted.

The Contractor is not relieved of responsibility for errors and omissions in the documentation submitted, even if the Engineer has verified the documentation.

The Contractor is not relieved of responsibility for deviations from the requirements of the contract documents even if the Engineer has verified the documentation submitted, unless the Engineer expresses in writing his acceptance of specific deviations.

When submitting documents, advise the Engineer in writing of deviations contained in the documentation submitted.

Do not distribute copies before having received drawings duly commented by the Engineer.

#### 2.4 Documents signed and sealed by an engineer

Shop drawings that represent structures and required engineering calculations in their preparation must be signed and sealed by an engineer member in good standing of Professional Engineers Ontario. For example, works that will be prefabricated according to specific performance specifications or plans that do not contain all engineering details (such as platform or footbridge with guiderail) must be shown on drawings that are signed and sealed.

Drawings of manufactured or mass-produced articles that are not necessarily designed for a particular project do not require the signature of an Engineer.

Assembly drawings that identify the required elements of a project but do require engineering calculations do not require the signature of an Engineer.

#### 2.5 Temporary works drawings

Before starting work, the Contractor shall submit to the Engineer, for information purposes, temporary works drawings describing the preferred method for the construction or repair of a permanent structure.

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### SHOP DRAWINGS

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Without limitation, these drawings shall include the following: shoring, erection and hoisting system, opening of temporary supports, blasting plans, demolition of existing structures, recovery device for demolition materials, waste, transfer and crushing areas, access and hauling roads, use of borrow pits, etc.

If the work provided in the temporary works drawings is likely to harm a third party, the Contractor shall obtain their permission in advance and provide them with additional copies.

The Engineer does not provide temporary works drawings. By way of exception, if the Engineer provides the drawings and if they form part of the plans and specifications of the contract, they shall have the same value and be monitored with the same rigor as the construction plans.

Temporary works drawings representing works that required engineering calculations must be signed and sealed by an engineer member in good standing of Professional Engineers Ontario.

#### 2.6 Document submission procedures

Shop drawings, working drawings, assembly drawings, technical data sheets and/or conformance documents submitted to the Engineer must be accompanied by a shop drawings transmission sheet, which shall include the following information:

- Name of Contractor and his representative;
- Name of subcontractor and his representative;
- Name of supplier and his representative;
- Plan reference;
- Specification reference;
- Transmission date;
- Drawing and/or revision number.

In addition, different transmission sheets shall be used for each of the specialties and/or each supplier.

All parts, piping, valves and accessories indicated on the drawings, technical sheets or documents shall be identified and numbered with the same codes indicated in the plans. Coordinate numbering with the Engineer.

Incorrectly identified drawings submitted to the Engineer shall be returned to the Contractor without having been verified.

### 3. LIST OF DRAWINGS

The Contractor shall furnish to the Engineer a complete typed list of the drawings he intends to submit. The list must include the following information:

- Project name;
- Consultant file number;
- Description of drawing submitted;
- Transmission date of drawing submitted;
- Type of drawing submitted (TDS = Technical Data Sheet, SD = Shop Drawing, CD = Conformance Drawing).

Four (4) additional columns will be left blank for use by the Engineer.

The Contractor may, upon request, obtain a sample list following contract award.

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The Engineer will return the approved list to the Contractor following verification and addition of drawing numbers.

The Contractor shall provide shop drawings using the reference numbers on the list.

The Contractor shall keep an up-to-date copy of the list and regularly provide a copy to the Engineer.

#### **4. FINAL PLANS AND REPORTS**

Upon work completion, the Contractor shall furnish to the Engineer two (2) copies of all final shop drawings of all process equipment such as filters, dosing system, pumps, piping, reservoirs, etc. in paper format and one (1) copy of all these final shop drawings of process equipment in electronic format, AutoCAD 2008 version or more recent (only accepted file format). The final shop drawings must be to scale and show all equipment as it was delivered to the site.

The Contractor shall furnish to the Consultant the final shop drawings in accordance with the requirements set out in "Special Technical Specifications".



**GENERAL TECHNICAL SPECIFICATIONS  
“TESTS, TRAINING AND MANUALS”**



## GENERAL TECHNICAL SPECIFICATIONS

### TESTS, TRAINING AND MANUALS

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## GENERAL TECHNICAL SPECIFICATIONS

### TESTS, TRAINING AND MANUALS

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#### 1 GENERAL

This section describes many features of the work to be done and is not intended to be in any way limiting. The Contractor has the obligation to provide related works that need to be undertaken to provide the Owner work consistent with the drawings and specifications. The Contractor shall refer to all drawings and sections of the tender documents for the work to be performed according to this section.

The Contractor shall carry out commissioning of all installed equipment for whose provision he is responsible, carry out tests, trials and performance verifications as required by the contract or prescribed by applicable laws and regulations in order to verify the proper functioning of all the equipment and accessories he has supplied. The Contractor shall also supply all equipment manuals and preventative maintenance logs and conduct training of client personnel to explain proper operation and maintenance of the equipment supplied.

#### 2 DESCRIPTION OF WORK

The work of this present section includes, without limitation:

- Providing a test protocol;
- Providing a testing schedule;
- Performing all tests and verifications required by the contract;
- Providing a complete report for each series of tests;
- Training of personnel responsible for operation of the installations;
- Providing manuals for the equipment installed.

A commissioning work planning program shall be prepared jointly with the Consultant representative. Overall coordination is done by the Contractor.

#### 3 PERFORMANCE AND FUNCTIONAL TESTING

The Contractor shall supply, at his own expense, all qualified workforce, materials and all that is required to perform tests described in this section (pressure gauges, current clamps, filters, pump, etc.) and required chemical products for testing. This list is not exhaustive. The Contractor must inform the Owner and the Consultant at least one (1) week before proceeding, in his presence, to the final test proving the proper operation of equipment. Tests with the Owner and the Consultant shall be executed only if the Contractor has already made himself his own trial and corrections. If the tests prove inconclusive, the Contractor shall take the necessary corrective and redo the tests to the satisfaction of the Owner.

The amperage for each equipment must be taken and noted in manuals on three occasions:

- During functional testing;
- During provisional acceptance;
- One month before the end of the equipment warranty period (final acceptance).

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The Contractor shall conduct performance tests to verify that required performance criteria are met. These tests are performed when previous function tests and corrections, if any, have been made. In some cases, functional and performance testing can be conducted simultaneously.

The Contractor must demonstrate to the Consultant that the functioning of the installations meets the manufacturer's curves and/or performance criteria approved in the shop drawings. Present the obtained curves and/or performance results during testing at the site and provide all information relevant to evaluation of the systems.

All testing activities including the report are at the expense of the Contractor. Test protocols must be submitted to the Consultant for approval.

For each performance test, a full report must be submitted containing the results obtained. The report shall summarize the following:

- Test protocol used;
- Conditions during testing;
- Instrumentation diagrams;
- Interpretation and discussion of results;
- Conclusions and recommendations.

#### 4 COMMISSIONING

The Contractor, in collaboration with his subcontractors and suppliers, shall carry out commissioning of each system and provide all equipment necessary for the successful implementation of activities and tests. The Contractor shall also take the usual precautions such as oiling, greasing, checking the direction of rotation, checking for obstructions, etc.

The Contractor shall ensure that manufacturer's instructions are followed and respected. He shall provide written notice to the effect that all installations have been commissioned, all verifications have been made and all equipment supplied is free of design and manufacturing defects.

This work may be briefly described as follows, without limitation:

- Dry testing of all structures and treatment equipment;
- Leak tests;
- Commissioning and functional testing of mechanical, electrical and control equipment;
- Commissioning and functional testing with clear water of mechanical process equipment with peripheral devices such as fans, pumps, controls, etc.;
- Calibration of all measuring devices;
- Performance tests and reports;
- Function and performance tests of mechanical process equipment and instrumentation and control equipment. These tests are performed with to be treated water;
- Continuous testing;
- Presentation of equipment service manuals;

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- Assistance during equipment commissioning and testing and instructing operating personnel.

#### 4.1 Details of testing (test types, methods, standards)

The following sections specify the nature of the tests to be performed. These can vary from one installation to another and may involve, in some cases, more complex work requiring the use of a specialized firm. The method to be used depends on the type of installation and conditions stipulated in the contract. It is the responsibility of the Contractor, if he has doubts about the methods to be used, to check with the Consultant regarding the testing and reporting requirements before setting his prices.

Maintenance of the equipment during the period between installation, testing and provisional acceptance is provided by the Contractor. He shall include in his lump sum prices all costs necessary for providing maintenance (transport, equipment, labor, etc.). The Contractor must submit a maintenance schedule once every installation is completed.

#### 5 CONTINUOUS TESTING

The Contractor shall start and run continuously (i.e. 24 hours a day without stop) for a period of fifteen (15) consecutive days, all systems covered by the contract. If the operating conditions encountered during these continuous tests are not representative of actual operating conditions, the Contractor shall take, to the possible extent, the measures required to simulate actual conditions of operation.

During the continuous tests, the Contractor ensures operation and maintenance of the installations in accordance with all conditions defined in the operation manual and other manuals referred to in the section entitled "Assembly, operation and maintenance manuals and as-built drawings" of this specification section.

If, in the course of the fifteen (15) days testing period, a main component causes a shutdown due to breakage, continuous testing shall resume once the part is repaired and restarted.

If it is impossible to simulate real conditions of operation of certain equipment forming a sub-system, due to lack of raw materials or atmospheric conditions, provisional acceptance is automatically deferred until continuous testing of this equipment has been performed. The warranty period described in the general conditions of contract for these installations will begin only when continuous testing has been completed.

#### 6 PUMP TESTS

##### 6.1 Calibration

Calibration shall include measurement of the pumping rate of all possible pump combinations provided by the automatic operation sequence in three (3) operating points, namely normal level of operation, on a closed valve and at an intermediate point. The methodology used shall be determined by the possibility of isolation.

The calibration report must be typewritten and include the following information:

- Methods used and conditions during testing;

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- Illustrate on a sketch the calibration area of the pumping system and provide calibration height;
- Results and values obtained (flow rate and pressure);
- Provide voltage and amperage drawn during calibration of pumps and pump groups;
- Calibration results shall be recorded on the pump operation curves.

All data shall be included in the operation manuals.

The report must be to the satisfaction of the Consultant. Incomplete reports shall be corrected at the expense of the Contractor.

#### a) Basic premise

Site testing allows verification of the proper functioning of the pumping system as a whole as well as the ability of the system to meet specified requirements.

All required tests shall be performed on each pumps.

#### b) Methodology

The evaluation methodology of pumping system performance shall be the following:

The pumping rate "QP" is equal to the volume between the "stop" and "start" levels of the pump, divided by the pumping time.

- Isolate the pump using appropriate valves;
- After starting the pump, measure the pumping time "Tp" between the starting and stopping of the pump;
- Calculate pumping rate using a water meter

#### c) Implementation and precautions

- Clearly identify the pumps and their controls as well as the nameplate by permanent number;
- The equipment necessary for checking pump flow is a chronometer, a water meter;
- The pumping time must be greater than sixty (60) seconds in order to obtain a normal pumping regime prior to the start of calibration;
- Special attention must be paid to the outlet valves of the pumps:
  - If a pump not in operation rotates when another pump is running or if the discharge pipe is full, this indicates that the check valve on the pump's discharge pipe is defective;
  - Always listen, whenever possible, for flow noise in the check valves when the pumps are stopped.



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When an accessory (check valve, valve, etc.) is defective or absent, it is impossible to verify pump flow because neither the true input rate nor the true pumping rate is known if there is more than one pump. Therefore, verify that all valves are open and all check valves are functioning properly before proceeding with necessary corrections prior to calibration.

If the theoretical rate is known, it must be compared to the actual flow. Too large a difference must be reported immediately to the Consultant, as this may mean that the pump is faulty.

Always check the rotation direction of the pumps before calibration.

For the results to be valid, always measure the pump flow rates using their normal operating levels.

All normal pumping sequences shall be measured at their operating levels and this level must be noted in the report.

1) Between the first "start" level and the "stop" level:

- Pump #1 only
- Pump #2 only
- Pumps #1 and #2 simultaneously

#### **d) Results of calibration**

The Contractor is required to provide in his report following calibration the results and values obtained as well as text explaining the methodology used.

For the calibration of each pump, provide the following information:

- Illustrate on a sketch the calibration area of the pumping station and provide calibration height;
- Provide a plan including the dimensions of the reservoirs and the location of equipment in the calibration area;
- Provide calculations of total volumes.
- Identify and provide static and dynamic pressures during calibration of each pump (check the accuracy of the gauge);
- Provide pressure fluctuations at pump stoppage;
- Provide the amperage drawn during calibration of pumps and pump groups;
- Provide the voltage during calibration;
- Provide the pumping station calibration and inspection records;
- Always obtain three (3) tests for each pump calibration;
- Type up the flow measurement sheets;
- Provide Supplier's pump curve;
- Insert calibration results into the pump operation curves.

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#### 6.2 Plant trials

Perform plant trials using clean water with a temperature below 30°C and in accordance with the 14<sup>th</sup> edition (1983) of *Hydraulic Institute Standards for Centrifugal, Rotary and Reciprocating Pumps (HIS)*. The tests shall simulate all anticipated conditions on the network. All control sequences shall be verified in the presence of the Consultant.

#### 6.3 Site trials

Consider all possible conditions when evaluating the performance of vacuum pumping units and other pumps.

During calibration of pumping stations, observe the following precautions:

- Clearly identify the pumps and the corresponding control unit;
- Ensure that any upstream pumping stations are not operating during the measurement period;
- Carry out each measurement at least three (3) times to ensure the validity of results.

Provide pump curves with the report and record the results of the calibration on the operation curves. Provide all data relevant to the evaluation of the system such as pressure levels during measurements, amperage, etc. Carry out each measurement at least three (3) times to ensure the validity of results.

Complete the following documents in all cases:

- Provisional acceptance test sheet;
- Data sheet describing dimensions and calculations as well as the adjustment values;
- Pumping test results sheet;
- Control panel verification sheet.

## 7 CONTINUOUS MEASUREMENT AND ANALYSIS SYSTEMS

### 7.1 General

In all cases, submit a report that includes all necessary system evaluation data including the data sheet for the current on-site system.

### 7.2 Magnetic or ultrasonic flowmeter

Verify the accuracy of the signal by simulating various conditions of 0 to 100% or 4 to 20 mA. Compare readings of the flowmeter and the combined pump operation hour meters with the calibration rates over a period of three (3) days.

Verify installation of grounding rings.

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#### **7.3 Equipment (primary elements, transmitters, analyzers and regulators) with 4 20 mA analog signals**

Verify accuracy of the signal by simulating various conditions of 0 to 100% and/or 4 to 20 mA (minimum 4 points per device).

Verify accuracy of the analysers by conducting on site analysis of the parameters. Chemical and analysis instrument, if not available on site, must be supplied by the Contractor (minimum 3 analysis per device).

### **8 LEAK TESTING OF PIPES AND ACCESSORIES**

#### **8.1 General**

The Contractor shall execute the leak tests before installing the final connections on all piping, with fittings and accessories being installed.

Shop-fabricated pipe sections, with or without flanges, must be submitted to water leak testing at the factory before shipment.

Piping installed on site shall be tested for leaks in order to make sure all joints and piping are leak free.

#### **8.2 Cleaning**

All piping shall be cleaned, generally by rinsing.

Pieces of equipment such as flow meter, water meter, probe, gauge, etc., must be either set aside during assembly or piping removed before cleaning:

The following pieces of equipment must be sealed or isolated before cleaning:

- Relief valves;
- Connected instruments;
- Inlet pipe and outlet pipe of each equipment

Water flow must be at a speed of at least 2,5 m/s during rinsing.

#### **8.3 Testing**

Prior to commissioning, all pipes must be subjected to hydrostatic tests by the Contractor. The Owner must witness all tests. It is the responsibility of the Contractor to notify the Owner and the Consultant of the test date to come. The Contractor shall bear all expenses incurred for the performance of these tests.

The Contractor shall provide and install all temporary components, such as valves, relief valves, flanges, and all required equipment for the testing of piping materials.

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### TESTS, TRAINING AND MANUALS

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Unless otherwise stated, the leak tests shall be performed at pressures specified in document NQ 1809-300 / 2004.

Once the pressure stabilized, no pressure loss shall be allowed for a period of two hours.

When the pipe elements are rejected due to poor welds, poor quality work and/or leaks, repairs must be made and the job resubmitted before the end of the commissioning. Defective welds must be redone by the Contractor as required by the Consultant. Welded joints leaking during pressure testing must be welded again and subjected to a new trial to the satisfaction of the Project Manager. Minor repairs can be made without further testing.

Once the test is completed, the installation of all supports, mounting hardware, additional bases as well as all adjustments and modifications deemed necessary by the Consultant must be made promptly by the Contractor.

Once testing and cleaning are completed and approved by the Consultant, the Contractor shall remove all temporary piping and replace the removed parts. The cost of testing must be included in the price of the pipes. A full report for provisional acceptance and summarizing the final acceptance test date, methodology and results shall be produced in three (3) copies. These reports must be signed and sealed by an engineer member of the OIQ or by a Professional Engineer member of an Engineer Order of North America.

### **9 ASSEMBLY, OPERATION AND MAINTENANCE MANUALS AND AS-BUILT DRAWINGS**

When the Supplier makes available to the Consultant for provisional acceptance all or part of the work covered by the contract, he must provide to the Consultant all assembly, operation, and maintenance manuals and all as-built drawings, as explicitly requested in the contract or as deemed necessary by the Consultant for the operation and maintenance of the works.

All documents shall be submitted to the Consultant in a first draft version in one (1) copy. After review and acceptance of this first version by the Consultant, the Supplier shall produce a final version to be submitted to the Consultant in three (3) copies.

The manuals shall consist of 8.5 x 11 loose-leaf sheets in a three-ring, vinyl hardcover binder. An electronic copy of the final version in PDF format shall also be provided to the Consultant. These manuals concern specifically all equipment sold by other suppliers to the Supplier and installed by the latter.

Each manual submitted to the Consultant shall be written in FRENCH. Upon delivery of the equipment to the site, the Supplier shall obtain from the Supplier the assembly, operation and maintenance manual.

The manual must be divided into sections as indicated below and each section must be clearly identified by a labeled plastic tab attached to a rigid divider sheet. A comprehensive manual shall be prepared by the Supplier for each piece of equipment, or for each set of identical parts.

As-built drawings shall be placed in pockets appended to the assembly, operation and maintenance manuals.

## GENERAL TECHNICAL SPECIFICATIONS

### TESTS, TRAINING AND MANUALS

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The contents of each manual shall include the following:

**A title page identifying:**

- The client, with complete address;
- The name of the Supplier, with complete address.

**A second page showing:**

- Equipment identification: name and brand.
- Equipment location; pumping station, treatment plant or other location;
- Order number of the Supplier;
- Model number;
- Serial number;
- Significant overall dimensions;
- Date of manufacture;
- Date of delivery.

**A third page with:**

- A table of contents describing the sections of the manual, which shall be as follows:

**Section 1: Introduction**

- General (Supplier's technical data sheet describing the equipment);
- Description of equipment warranty (date, subject, duration, etc.);
- Procedure in case of damage during shipping, gaps, errors;
- Storage of equipment, whether or not assembled.

**Section 2: Installation (assembly of equipment)**

- Installation drawings with detailed dimensions;
- General instructions for installation;
- Specific instructions according to the present project;
- Anchor drawings, if applicable;
- Electrical connections if applicable with drawings;
- Mechanical and plumbing connections if applicable with drawings.

**Section 3: Start-up and operation**

- Relationship between equipment concerned and related equipment;
- General and specific safety instructions;
- Drawings of the control system, the control box components and a description of the facade of the housing;

## GENERAL TECHNICAL SPECIFICATIONS

### TESTS, TRAINING AND MANUALS

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- Start/stop;
- Normal operation: manual, automatic;
- Abnormal operation: troubleshooting guide, emergency instructions;
- Results of testing.

#### **Section 4: Controls, regulation and protections**

- Regulation of other equipment;
- Thermal and other protections;
- Adjustments and calibration;
- Signals, alarms and telemetry;
- Operating hours meter;
- Operation timer;
- Heating and ventilation.

#### **Section 5: Preventive and corrective maintenance**

- Cleaning: frequency, method, products;
- Lubrication: frequency, method, products;
- Adjustments: frequency, method, products;
- List of items to be checked;
- Problem solving guide;
- Procedures in case of breakage or major repairs.

#### **Section 6: Inventory of parts and supplies**

- Complete parts list with exploded view of the equipment and parts numbered for positive identification;
- List of common wear parts with name, address and telephone number of the supplier(s);
- List of maintenance products with name, address and telephone number of the supplier(s);
- List of local repair specialists (ex: electricians, plumbers, etc.) with name, address and telephone number;
- Inventory of parts and products supplied.

#### **Section 7: Special conditions**

- Description provided in section "Special Technical Specifications."

#### **A last page containing the following:**

- Written guarantee of the work supplied (labor and materials) for the duration requested in "General Conditions of Contract".

## GENERAL TECHNICAL SPECIFICATIONS

### TESTS, TRAINING AND MANUALS

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The contents of each manual must be adjusted according to the work, structures and equipment specified in the "Special Technical Specifications" section. However, the requirements of this section must be met by the Supplier with respect to the sections, premise and format of the manuals.

#### 10 TRAINING OF OPERATING PERSONNEL

During testing and commissioning, the Supplier shall provide training to the Owner's representative or operating personnel in the operation and maintenance of the equipment supplied, until the operating personnel considers their understanding of the information provided to be complete and satisfactory. These explanations shall be included in the service manuals. Explanations must be provided in French. Ensure presence of manufacturer representatives who will train personnel. Maintenance manuals shall be provided prior to training.

Training of personnel shall cover the following topics, without limitation:

- Description of the treatment system, including biological and physico-chemical systems;
- Description of the operation of each system;
- Description of the control logic and operating parameters;
- Description of the use of the human machine interface (HMI);
- Description of monitoring and operation follow-up ;
- In-situ analysis;
- Optimization of the use of chemicals;
- Troubleshooting;
- Use of diagnostics;
- Procedures for system maintenance.

Instruction shall be provided by appropriate staff and Supplier representatives shall be present during trials and commissioning. Representatives of each equipment item shall devote a minimum of four (4) hours, in addition to the testing and commissioning periods, for review of service manuals and equipment operation with operating personnel.

The content of the training sessions shall be communicated to the Consultant by the Supplier for approval prior to commencing training of the Owner's representatives or operating personnel.

Appropriate equipment Supplier representatives shall be available on request to detect defects during commissioning and operation during the warranty period.





**GENERAL TECHNICAL SPECIFICATIONS**  
**“PROCESS REQUIREMENTS”**



**GENERAL TECHNICAL SPECIFICATIONS  
PROCESS REQUIREMENTS**

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## **GENERAL TECHNICAL SPECIFICATIONS**

### **PROCESS REQUIREMENTS**

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#### **1. GENERAL**

This section contains requirements applicable to the provision of process equipment, instruments and accessories. These requirements apply to all equipment, accessories, instruments, piping and valves for the project.

Supply and commission all equipment, piping, valves and all accessories, as necessary for the proper functioning of the overall works and each element thereof.

Division of the supply of equipment and materials, allowing a breakdown of costs, is given for guidance purposes only. It does not limit in any way the liability of the Contractor, who must provide all required components, ensure coordination during installation work and ensure proper functioning of the equipment supplied.

Equipment shall be delivered in operating condition. Include in the price of equipment all parts and accessories required for proper and efficient operation of all specified devices.

The Contractor shall refer to all drawings and all sections of the tender documents for the work to be performed under this section.

Note that all contract documents are mutually complementary and comprise general and special conditions of contract and general and special technical specifications.

The Contractor shall supply all mechanical equipment identified in the general and special technical specifications and as shown on the drawings, and follow manufacturer instructions and recommendations.

The labor, materials, tools, accessories and services for the supply and installation of items are included in the item price.

The Supplier shall assemble and adjust all equipment components as required before delivery to the site and conduct commissioning as prescribed by the special specification section entitled "Tests, training and manuals" of this section.

A sufficient number of appropriate hangers and supports shall be provided for all piping supplied and equipment requiring support, whether or not such hangers or supports are shown on the plans. This requirement includes all additional supports and braces that may be required following equipment commissioning and accessories to eliminate vibrations covered by this specification.

#### **1.1 General description of work**

The work under this division is described in the text below and/or indicated on the plans.

#### **1.2 Mechanical process – Priority of documents**

In the case of a contradiction between the provisions of this section and equipment specific sections, the latter shall prevail.

#### **1.3 Codes and standards**

The equipment, construction, inspection and testing of all components covered by this specification shall conform to the latest version of the codes and standards referred to in "General Conditions of Contract" and to the following codes and standards, without limitation:

- Canadian Standards Association (CSA)
- American Society for Testing Materials (ASTM)
- American Gear Manufacturers Association (AGMA)
- American Society for Mechanical Engineers (ASME)
- Antifriction Bearing Manufacturing Association (ABMA)

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- Joint Industry Conference (JIC)
- American Welding Society (AWS)
- American National Standards Institute (ANSI)
- American Water Works Association (AWWA)
- Canadian Electrical Manufacturers Association (CEMA)
- National Electrical Manufacturers Association (NEMA)
- American Standards Association (ASA)
- Manufacturers Standardization Society (MSS)
- Canadian Government Specifications Board (CGSB)
- Standard National Association (SNA)
- Instrument Society of America (ISA), Standards S5.1 and S5.2
- National Sanitation Foundation (NSF)
- National Building Code of Canada (CNB)
- Normes du bureau de normalisation du Québec (BNQ)
- Canadian Electrical Code
- Electrical Equipment Manufacturers Association of Canada (EEMAC)
- Anti-Friction Bearing Manufacturers Association (AFBMA)
- American Iron and Steel Institute (AISI)
- Alloy Casting Institute (ACI)
- American Society of Civil Engineering (ASCE)
- Institute of Electrical and Electronic Engineers (IEEE)
- Compressed Air and Gas Institute (CAGI)
- Canadian Government Specifications Board (DGSB)
- Canadian Welding Society (CWS)
- International Electrical Commission (IEC)
- Scientific Apparatus Makers Association (SAMA)
- Underwriters Laboratories of Canada (ULC)
- Hydraulic Institute (HI) Standards
- ASHRAE Guide
- NSF – Standard 61

#### 1.4 Works Included

Include with the equipment the following works, without limitation:

- The programming of the equipment
- Couplings;
- All supports, bases, anchors, wedges, nuts, bolts, gaskets and whatever else is necessary for a

## GENERAL TECHNICAL SPECIFICATIONS

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complete installation of all machinery and equipment;

- Primer and topcoat as necessary;
- Flushing oil and final oil for all machinery, equipment and connected lubrication lines including extensions for lubrication points;
- Required protective cases for belts and all belt-driven equipment;
- Verification and realignment of constituent parts of the machinery and equipment aligned in the shop by the manufacturer prior to installing permanent studs.

#### 1.5 Standardization

Pay particular attention to the standardization of machine components to minimize number of replacement parts. Indicate the construction materials of all components.

#### 1.6 Preparation for transport

Equipment shall be supported and packaged to prevent damage or deformation during transport or unloading.

All machined surfaces shall receive a protective coating before shipping.

Prior to testing and shipping, all surfaces shall be cleaned of all contaminants.

Tests shall be carried out in line with manufacturer procedures unless codes and regulations stipulate otherwise.

All equipment shall be subject to size and alignment verification prior to shipping.

Equipment requiring lubrication shall be protected before shipping with anti-corrosion oil acceptable to the Consultant. This equipment shall be clearly identified by a label indicating all the details of the oil it contains and a warning that reads DO NOT OPERATE PRIOR TO PROPER LUBRICATION.

Prepare the equipment for shipping in a manner to protect machined surfaces and assembled parts against damage that may be sustained during transport and handling;

Bolts of different sizes and categories shall be packed separately. The ends of pipes and tubes and equipment connections shall be blocked or covered for shipping. Small parts must be suitably packed.

#### 1.7 Paraseismic measures

The contractor must design and install protective devices to meet seismic requirements of the Canadian Building Code and to meet all local regulations. The devices must be compliant with codes and standards such as SMACNA SEISMIC RESTRAINT MANUAL, latest edition. The specialist engineer appointed by the Contractor will determine the level of seismic protection required by SMACNA: level of protection a, b or c. Provide plans and specifications signed and sealed by a professional engineer member of l'ordre des ingénieurs du Québec or an approved equivalent Canadian order / association which described the paraseismic devices and protections.

The contractor must provide to the Owner a certificate of conformity of the seismic protection of all installed components, such as a certificate which could be provided to the Régie du bâtiment du Québec (RBQ). This certificate must be signed by an engineer member of the Ordre des ingénieurs du Québec or an approved equivalent Canadian order / association.

#### 1.8 Operating warranty

Treatment units shall be delivered in working condition. The Supplier shall include in his price all parts and accessories necessary for normal functioning of all specified devices.

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#### **1.9 Instruction manuals**

The Contractor shall provide instruction manuals with all installation information and manufacturer instructions on the operation and maintenance of equipment according to the requirements.

#### **1.10 Experience**

The Contractor performing the work described in this section shall have experience in at least five (5) similar projects at facilities still in operation.

### **2. PRODUCTS**

#### **2.1 Spare parts**

Submit to the Consultant a complete list of spare parts for each type of equipment proposed. This list shall indicate the original manufacturer product numbers of standardized components.

#### **2.2 Lubrication of bearings**

Oil-lubricated bearings shall be fitted with guards and level indicators. Bearings lubricated with grease shall be provided with grease nipples and extensions, if necessary.

Equipment shall be supplied with all bearings, ball bearing units, etc. lubricated and in working condition.

All equipment shall be equipped with appropriate safeguards against oil and grease spatter that may occur during normal operation.

#### **2.3 Rotating mechanisms**

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

Selection of these rotating mechanisms shall be done according to standards set by the AGMA.

#### **2.4 Vibration**

Equipment prone to transmitting vibration to the structure or building shall be equipped with dampers capable of absorbing the vibration.

All pumps, blowers and motorized rotating equipment prone to vibration must undergo vibration analysis and dynamic balancing based on the most recent industry standards. These activities must take place before provisional acceptance and before final acceptance. The work must be performed by a company expert in the field. A full report must be delivered to the Consultant before provisional acceptance and before final acceptance. This report shall present all results and compare existing vibrating conditions to those obtained after balancing. The report shall indicate the severity criteria for vibrations and include conclusions and recommendations regarding corrective measures if necessary.

#### **2.5 Noise**

Unless otherwise indicated in the equipment specifications, the level of noise produced during normal operation by a piece of equipment measuring (1) meter shall not exceed 85 dBA in anticipated operating conditions, according to the measurement standards defined by the International Standard Organization, Recommendation 495 (ISO/R 459)". If the noise level generated by the equipment exceeds 85 dBA, make the necessary corrections.



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#### 2.6 Materials of construction

In general, materials of construction must comply with the following requirements or be of an equivalent nature, meaning having properties similar to those of the specified materials and certified by certificates of conformity as required.

- Structural steel                    CSA G40-21M
- Structural aluminum            ASTM B241 Alloy 6061-T6
- Ductile iron                        ASTM A48
- Stainless steel                    ANSI Type 304, 304L, 316 or 316L

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

#### 2.7 Bearings and ball bearing units

The L<sub>10</sub> lifespan of all bearings, calculated according to AFBMA standards, shall not be less than 100,000 hours.

#### 2.8 Integrated fittings, piping and valves

The class of pipes supplied shall be established by the supplier according to service conditions (temperature, pressure, etc.). PVC piping cannot be used if the temperature of pumped fluid may exceed 55°C.

All accessories supplied with piping such as fittings, gaskets, couplings, rings, sleeves, etc. must be made of the same type of material as the pipes to which they are connected.

For all integral piping include supports, stops and expansion joints required to ensure compliance with the type of pipe supplied according to the maximum loads that may occur.

All valves supplied with the equipment must meet AWWA requirements or be of similar quality. The manufacture materials of the valves must be specified by the Supplier according to service conditions (temperature, pressure, etc.). All valves with a diameter of 150 mm or more that are not motorized and/or automated must be equipped with a gear wheel control mechanism. Valves less than 70 mm in diameter may be screwed in but must be removable without dismantling the pipe.

#### 2.9 Various installation materials

Anchor bolts – with hex nuts and washers, to ASTM A307-68.

Site assembly bolts - with a semi-finished resistant hexagonal nut and a hardened steel washer, to ASTM A307-68. Minimum bolt diameter: 19 mm.

Concrete anchors – HILTI anchors.

Welding electrodes compatible with base metal and procedure used and in accordance with CSA W59-1982.

Steel structure in accordance with CSA CAN.3 G40.21-M81 300W. Welding to be performed by experienced welders certified by the Canadian Welding Bureau.

Steel shims, parallel faces (do not use corners) and approved by the Consultant.

“Loctite Anti-Seize No.767” lubricant or approved equivalent on the threads of all bolts, studs and nuts.

### 3. EQUIPMENT DETAILS AND ACCESSOIRES

#### 3.1 General

Provide overall dimensions and detail plans for installation and assembly of equipment and accessories in accordance with the requirements of the "Shop Drawings" specification of this section.

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Floor and structure elevations indicated on drawings submitted as part of this tender may be nominal. The Supplier shall determine the precise elevations he deems necessary for the preparation of the detail plans requested using official references.

There may be a discrepancy between the actual locations of the axes of the columns and those indicated on the drawings. The Supplier shall take all measures with respect to official references.

No claims will be accepted for additional work caused by discrepancies between the nominal and actual elevations of floors and structures and between the actual locations of columns and the axis lines indicated on the drawings.

Provide motor data and weight of machinery and equipment.

Provide installation instructions for equipment and their components.

Include all parts and minor works necessary for installation.

#### **4. FINISHES**

##### **4.1 Shop treatment**

All process equipment, piping and associated parts (e.g. fittings, flexible gaskets, and valves) in ferrous metal shall receive a shop surface treatment and primer.

All equipment that includes a topcoat in the manufacturer's standard product designation shall be provided with such coating.

Surface preparation, primer and topcoats by the manufacturer must be compatible with the required service as well as "local" operating conditions.

No part or appliance in bronze, aluminum, stainless steel, galvanized steel, plastic or PVC shall be painted: these materials must be properly cleaned after fabrication.

Use hot dip galvanization after fabrication with minimum zinc coating of 600 g/m<sup>2</sup>, in accordance with CSA G164. Assembly at the site must be done mechanically. On-site welding of galvanized steel is not permitted.

Pumps, motors and other equipment and accessories (fittings, valves, etc.) may, however, be supplied with a manufacturer's standard finish provided that it is of a class allowing adequate corrosion resistance for an average duration of 5-10 years in the conditions prevailing inside the building, in underground stations or outside, and is certified by a manufacturer with at least five (5) years' experience in the protection of such equipment.

Apply at least one (1) coat of zinc-rich primer and two (2) coats of finish to stirrups, anchor devices, supports and ferrous metal parts before shipping to the site, unless provided in stainless steel, aluminum or galvanized steel.

##### **4.2 On-site treatment**

After installation on site, apply finish paint to piping and equipment if necessary according to applicable colour code.

Paint type and final colour choice for each system must be pre-approved by the Consultant.

The number of paint coats to be applied (minimum 2 coats) must ensure full coverage of the original manufacturer's paint. The paint type for the topcoat must be compatible with the finish of the equipment supplied by the manufacturer.

All aluminum parts in contact with concrete must receive a layer of undiluted bitumastic paint in the shop as required by Standard CGSB 1-GP-108M, Type 1.

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Retouch the paint on fastening points, supports and base plates, etc., where it has been damaged during transport or installation. Retouches must be made with exactly the same paint as originally applied to the equipment in accordance with supplier instructions.



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**GENERAL TECHNICAL SPECIFICATIONS**  
**PIPING AND ACCESSORIES**

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**1. GENERAL**

This section of the specifications describes the particularities associated with the piping and accessories and is not intended in any way to be limiting. The Contractor has the obligation to provide related works that need to be undertaken to provide the Owner work consistent with the drawings and specifications. For the work to be performed according to this special section, the Contractor shall refer to all sections of the drawings and specifications.

**2. WORK DESCRIPTION**

The work pertaining to this general technical specification is described in the text below. The work covered by this specification includes, but is not limited to, the provision, installation, testing and commissioning of all piping and accessories and all other components required for the proper functioning of the mechanical process systems.

All work shall be performed in accordance with best practice in order to provide to the Owner finished works of the highest quality.

**3. DIAGRAMS**

The Contractor shall refer to the plans and diagrams of the different systems shown on the drawings to be aware of all the piping as well as all the equipment and accessories required.

**4. GENERAL ARRANGEMENT AND PIPING DRAWINGS**

For approval by the Consultant, the Contractor is required to submit general arrangement and piping plans for the work covered by these specifications. These plans must show the full integration of the scope of supply of all suppliers, including but not limited to equipment, materials, accessories and piping, into the facilities. The Contractor must also provide plans demonstrating that the size of equipment, piping and accessories is in compliance with all safety regulations (distance of one (1) m from electrical panels, etc.) and leaves sufficient space for maintenance activities. Plans must be signed and sealed by a qualified engineer.

**5. SHOP DRAWINGS**

The Contractor shall provide, in accordance with the requirements of this section, shop drawings showing all details of equipment connections, piping and various accessories required (sleeves, valves, check valves, etc.) to the Consultant for approval. These drawings must include the different relative elevations of the pipes.

For all tap, valves and accessories, shop drawings must include, but is not limited to, the following information's:

- Identification number of the item in accordance with drawings and specifications;
- Type of tap, valve and accessory;
- Brand;
- Complete number of the model;
- Diameter and size;
- Maximum pressure;
- Details of each included accessories;
- Notes.

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#### 6. PIPING MATERIALS

The Contractor shall refer to the diagrams of various systems shown on the plans or to the different sections of the specifications for the type of materials used for various pipes.

#### 7. DRINKING WATER

For any facility of drinking water, the Contractor shall provide equipment which complies with the latest versions of the following standards:

- NSF – Standard 61 – Drinking Water Systems Components – Health Effects;
- AWWA.

#### 8. PIPING – GENERAL

##### 8.1 Piping alignment

Piping connected to the inputs and outputs of the equipment must be properly aligned so as not to produce forces or stresses on them.

##### 8.2 Coupling sleeves, expansion joints, couplings, flanges and fittings

The Contractor shall provide all coupling sleeves and expansion joints required on equipment and piping and all couplings required for easy disassembly at all times of piping and its accessories, etc. The couplings and joints must withstand all requisite tests.

Unless otherwise indicated, the Contractor shall supply and install coupling sleeves and/or flanges at all locations required. The sleeves shall be of a make and model approved by the Consultant, of the best quality available, well-suited to their use and according to the plans and specifications.

A minimum clearance of 200 mm is required between the flange and a concrete wall.

In addition to allowing easy disassembly of the piping and accessories, the sleeves must also allow for shrinkage and expansion and provide a flexible connection to the piping.

At a minimum, the Contractor shall provide coupling sleeves on steel pipe, at expansion joints in concrete structures and in places where the length of pipe in a straight section is equal to or greater than 10 meters.

The coupling sleeves must be of steel with wedge shaped rubber gaskets and steel adapters with sufficient bolting, allowing a perfect fit with the contour of the pipes to be joined. They must be made to withstand a pressure of 1035 kPa.

At all times, in places where sleeves are installed, the piping must be properly secured with fasteners and supports provided for this purpose.

For protection against corrosion of the sleeves, refer to section “Sandblasting and Painting” of Division F.

For bolts, refer to Article 7.4 "Bolts and anchor bolts" of this section.

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#### 8.3 Supports and fasteners

The Contractor shall provide all supports and fasteners required to support the equipment, piping and accessories included in the scope of supply covered by these specifications. All piping and accessories to be hung on walls or ceilings or floor mounted must be supported using supports specifically designed for this purpose. The size and number of supports, rods and fasteners must be able to support the weight of the pipe with the transported fluid, overpressure, water hammer and all accessories. Any rigid pipe is to be supported on at least one third (1/3) of its circumference and on a length at least equal to the diameter of the pipe.

The supports must be in galvanized steel, unless otherwise indicated. The Contractor must provide seals compatible with the transported fluid of a width and thickness sufficient to avoid direct contact between the supports and the pipes.

For bolts, refer to "Bolts and anchor bolts" of this section.

Any other item not specified here but necessary for the proper functioning of the system shall be supplied and installed and made part of this section.

#### 8.4 Bolts and anchor bolts

The Contractor must provide all bolts and anchor bolts required for the proper installation by the Phase 2 Contractor of all equipment, piping, valves, accessories, supports and other components to be installed covered by these specifications. Bolts with rods and nuts must be complete and all components must be composed of the materials specified in Table 1 below.

Components made of galvanized steel must conform to ASTM A325. Rods, bolts and nuts must be zinc plated by electroplating.

Bolts and anchor bolts must also conform to ASTM A307-76B.

Whether stainless or galvanized steel, components must at all times be suitable for their use and of sufficient capacity.

The Contractor must coat the threads of all pre-assembled bolts with a lubricant such as "Never-Seez® Pure Nickel Special Grade."

Bolts shall protrude beyond the end of the nut by at least two thread pitches when properly tightened without exceeding the equivalent of one diameter. Unless otherwise indicated, hex nuts must be used.

Washers of the same material must be installed under all nuts and bolt heads over slotted holes.

**Table 1**

APPLICATION	BOLT MATERIAL
For all submerged installations	316 stainless steel
For anchoring all non-submerged supports	304 stainless steel or galvanized steel, depending on type of support and piping used
For linking non-submerged coupling sleeves	Galvanized steel
For linking non-submerged Victaulic gaskets	Galvanized steel

## GENERAL TECHNICAL SPECIFICATIONS

### PIPING AND ACCESSORIES

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Anchor bolts shall be Hilti brand or approved equivalent and made entirely of the same material. Unless otherwise specified, anchor bolts shall be chemical. Fastening bolts must be superior strength and quality.

#### 8.5 Miscellaneous

Unless otherwise specified, all steel and other materials used shall be new. All piping shall be properly straight, to the satisfaction of the Consultant.

In choosing accessories, the Contractor shall factor in the demands of intensive operation and the most severe conditions anticipated for this type of process.

Piping and all accessories and supports must be designed to withstand stresses due to normal and occasional working pressures (especially during testing), their own weight and that of the liquid being transported, ambient conditions, buoyancy forces and temperature variations.

All equipment must be supplied with brackets and anchors of proper size and in sufficient quantity. Any contact between two different metals (stainless steel, aluminum steel, etc.) shall be avoided. If such cannot be avoided, the parts shall be separated by a neutral material such as neoprene or approved equivalent to prevent surface corrosion.

When two dissimilar metals are in contact, the Contractor shall provide and install dielectric insulators such as Hamlet & Garneau, Walter Vallet Co. or approved equivalent.

Pipes subject to significant temperature variations must be provided with joints capable of absorbing thermal expansion.

Pipes subject to strong vibrations must be provided with joints capable of absorbing them.

## 9. STAINLESS STEEL PIPING

### 9.1 Stainless steel piping

Stainless steel piping shall comply with ASTM A240.

Unless otherwise specified, stainless steel piping shall be Schedule 10S 304L with welded and flanged joints, as outlined in these specifications.

Pipes shall have a 1D surface finish.

Unless otherwise specified, if piping is not submerged, backing flanges shall be "slip-on" type galvanized steel, Class 150 lbs with butt welded press neck collar in 304L stainless steel.

When submerged, welded flanges shall be "slip-on" type in 316L, Class 150 lbs stainless steel.

Nitrile (Buna-N) sealing joints shall be provided at all times.

All welding of stainless steel pipe shall conform to the work described in "Welding of Stainless Steel Piping".

### 9.2 Finish

Stainless steel pipe shall be chemically treated at the manufacturing plant or the Contractor's plant to the original finish of the steel and to remove foreign material on the surface of the pipe.

The Contractor shall clean all welds and final wash all pipes, according to the manufacturer's recommendations.

## GENERAL TECHNICAL SPECIFICATIONS

### PIPING AND ACCESSORIES

---

#### 10. PVC PIPING

PVC plastic piping used for applications in mechanical process (chemical dosing, aeration system, etc.) shall comply with ASTM D-1784. The piping must be compatible and able to withstand the chemicals to be transported.

Installation and connections shall be made in accordance with the recommendations of the chemical product Contractor (ferric sulfate, sodium aluminate, phosphoric acid, caustic soda, sulfuric acid, etc.).

Welded connections shall be PVC, to ASTM-D-2466.

The Contractor shall plan to provide expansion joints on plastic piping if necessary, according to the manufacturer's specifications and recommendations.

#### 11. CARBON STEEL AND GALVANIZED STEEL PIPING

Piping shall be Schedule 40 unless indicated otherwise, and to ASTM-A53, Grade B.

Hot dip galvanization shall conform to the work described in "Hot Dip Galvanization" in Section F.

#### 12. COPPER PIPING

Unless otherwise stated, the piping is in Streamline copper, type L, when above ground..

The fittings are wrought copper and welds are made using the dough 95-5 (95% tin, 5% antimony).

#### 13. PEHD PIPING

All PEHD shall complies to the follow standards :

- ASTM-F-714 : Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter;
- ASTM D-3350 : Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

#### 14. VALVES

The Contractor shall provide all valves necessary for the proper functioning of the equipment supplied under the scope of supply covered by these specifications.

Valves shall be suited to the operating conditions. All valves must be the same diameter as the piping on which they are installed.

All accessories attached to a valve must come from the manufacturer of the valve and be assembled at the manufacturing plant (unless otherwise indicated).

The Contractor shall ensure the compatibility of the gaskets of all valves and the material used for piping.

In all cases, a single brand valve shall be supplied to limit diversity of replacement parts and complexity of maintenance.

For all valves, actuators are oversized with a safety factor of 50% more than the torque required to operate the valve in the worst operating conditions with turning upstream for water charged for plug valves. Unless otherwise noted, the opening for all valves must be counterclockwise.

Each valve must undergo a hydrostatic test and a check of seats.

## GENERAL TECHNICAL SPECIFICATIONS

### PIPING AND ACCESSORIES

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#### 14.1 Ball valves

PVC ball valves shall be threaded double union and equivalent to Chemline Type 21. The body, ball and connections shall be in PVC and the O-Rings in EPDM when the fluid flowing in the valve is not corrosive and does not exceed 120°C. If these conditions occur, follow the manufacturer's recommendations for valve seat and seal material (PTFE, Viton, etc.)

Stainless steel ball valves shall be two-piece, body and ball in CF8M stainless steel, full port, SS304 lock handle, female NPT threads, PTFE seal, 200 psi WOG. Approved model: Watts Model S-FBV-1 or equivalent.

#### 14.2 Tap and sampling valves

The tap and sampling valves will be provided with a sleeve coupling for a flexible hose.

The tap and sampling valves will be equivalent to the model # 594J for JENKINS. They will have a diameter of 20 mm.

Provide a sampling valve for each water treatment step and each type of piping.

#### 14.3 Globe valves

Globe valves body will be with rising stem and external thread. Globe valves will be operated with a wheel of the appropriate dimension for the valve diameter. Globe valves will be equivalent to the 2342J figure JENKINS. The valve body will be in cast iron "B" class and the globe, the seat ring and the rod are made of bronze.

Globe valves smaller than 50 mm must be equivalent to the valves JENKINS 2032J.

#### 14.4 Solenoid valves

Solenoid valves will be threaded types (NPT) with bronze body and diaphragm Buna "N". Unless otherwise noted, they will be such as the series "General Series" of ASCO and will be provided in a NEMA 4X enclosure and will include a manual control.

The valves type two (2) lanes will be provided normally closed. Unless otherwise stated in drawings or specifications, they will be at the voltage required by the application.

### 15. CHECK VALVES

The Contractor shall provide and install all check valves required for the proper functioning of the various processes.

The valves must be adapted to the operating conditions of the various networks.

All check valves must be of the same diameter as the pipe on which they are installed.

All check valves shall conform to the work described in section "Sandblasting and Painting" of these specifications.

The Contractor shall ensure the compatibility of the check valve seals and the material used for the piping.

In all cases, a single brand of valve must be provided by type of check valve, so as to limit the variety of replacement parts and complexity of maintenance.

Ball check valves are not accepted.

Check valves must have a section for water flow which equal 100% of that of the pipe, without any obstacles at any place whatsoever.

## GENERAL TECHNICAL SPECIFICATIONS

### PIPING AND ACCESSORIES

---

#### **16. ACCESSORIES AND VARIOUS WORKS**

The Contractor shall provide all accessories required for the various equipment supplied under the scope of supply covered by these specifications so that the proposed facility is complete, whether or not such accessories are described in these specifications.

All accessories and various works required for the complete execution of work not specifically mentioned in the plans and/or other specification sections shall form part of this section.

##### **16.1 Metal/metal and metal/plastic connections**

Unless otherwise indicated, metal/metal and metal/plastic connections must be done with a coupling manufactured by Clow, Viking Johnson, Straub, Victaulic, Robar or approved equivalent. The Contractor shall choose the proper assembly of the coupling ends to fit the outside diameter of the pipes. The Contractor shall also, if necessary, prepare pipe surfaces according to the selected fittings at no additional cost (ex. groove with Victaulic joint).

##### **16.2 Union connectors**

For flanged piping other than PVC, provide union type connectors wherever necessary to facilitate disassembly and cleaning of piping and accessories. For PVC pipe, the connectors shall be spaced so as to limit the maximum length of a pipe section to 6 m.





**GENERAL TECHNICAL SPECIFICATIONS**  
**“WELDING OF STAINLESS STEEL PIPING”**



**GENERAL TECHNICAL SPECIFICATIONS  
WELDING OF STAINLESS STEEL PIPING**

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**GENERAL TECHNICAL SPECIFICATIONS**  
**WELDING OF STAINLESS STEEL PIPING**

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**1. GENERAL**

For the work to be performed according to this section, the Supplier shall refer to all plans and all sections of the tender documents.

**2. DESCRIPTION OF WORK**

Tasks to be performed according to this section are described in the following text and/or indicated on the plans.

Tasks described in this section are related to the welding of thin walled austenitic chromium-nickel stainless steel, in the workshop and on the construction site.

**3. CERTIFICATION**

Welding procedures and welders shall be qualified under the following standard:

ASME Boiler and Pressure Vessel Code - Section IX – “Qualification Standard for Welding and Brazing, Procedures, Welders, Brazers, and Welding and Brazing Operators” - latest edition

Qualified procedures and list of qualified welders shall be submitted to the Consultant by the Supplier before or during work, should the Consultant request these documents.

Any welding task, including spot welding required for assembly, shall be performed by qualified welders, as abovementioned.

If the quality of a weld is insufficient, questionable, inconsistent or does not meet the general requirements of the present document, the Consultant may demand the welder requalify.

The costs of all qualification testing are at the Supplier's expense.

**4. FILLER METAL**

Filler metals used to weld Grade 304 and 304L sheets must be Grade E308 or E308L.

Filler metals used to weld Grade 316 and 316L sheets must be Grade E316 and E316L at least.

Classification of the filler metals used must be clearly visible on the welding consumables.

Filler metals must be in accordance with the welding procedures in use.

Coated electrodes must be stored and handled in accordance with the manufacturer's recommendations. Moreover, the electrodes must spend at least one (1) hour in an oven at 350°F before use. In addition to this, the electrodes should stay in the oven until they are needed, so that none is exposed to the ambient moisture for more than four (4) hours. Visibly damaged or moist electrodes must never be used and must be disposed of.

Electrodes exposed to ambient air for more than four (4) hours must spend eight (8) hours in the oven at 350°F before being reused. An electrode shall not be reused more than once.

**5. WELDING PROCESSES**

Shielded metal arc welding (SMAW) may be performed without written permission from the Consultant.

Other processes, such as gas tungsten arc welding (GTAW) and/or gas metal arc welding (GMAW) may be used.

## **GENERAL TECHNICAL SPECIFICATIONS**

### **WELDING OF STAINLESS STEEL PIPING**

---

However, when using the GTAW process, the inside and outside of the pipe must be purged with argon and nitrogen respectively, in order to prevent oxidation.

#### **6. PREPARING THE WELDING JOINT**

Preparation and handling of the piping and other austenitic stainless steel components must be in accordance with the CSA W59 Standard and must comply with the following:

- Extremities of the piping or tubing to be welded must be prepared by machining, sawing, plasma cutting or a combination of these techniques. Mechanical saws should be avoided. Streaks must be filed down. Cuts must be clean.
- The equipment used for the preparation of the welding joints and the handling of the austenitic stainless steel must be protected or covered, so that the surfaces to be welded are not contaminated by mild steel.
- The equipment used to prepare the welding joints, such as steel brushes, steel wools, cutters, files, hammers and ground clamps, must be made of austenitic stainless steel and marked as such. This equipment may only be used with austenitic stainless steel components.
- If a grindstone is necessary, only the ones specific to austenitic stainless steel are permitted. They cannot be used with any other material.
- Air carbon arc gouging is permitted under written approval by the Consultant. In such an event, the cutting surface must be ground to a depth of 1.6 mm to prevent carbon contamination.
- Joints must be prepared and assembled so that the weld penetrates fully.
- For seamed pipes, longitudinal welds must not be aligned with the seams. A rotation of about 90° must be observed between the longitudinal welds of the pipes of the same joint and they must also overlap both sides of the vertical, and be located in the lower section of the pipe.
- All the parts to be welded must be free of grease, oil, paint or other contaminants. Only acetone or alcohol may be used for cleaning the parts.
- Alignment of the joints must be done by mechanical means and must be free of bumps and dips. No heating and no hammering is permitted during the alignment of joints.
- Because of the thin materials being used, alignment tolerances of 0.8 mm are permitted between both ends of the joint. However penetration must be full.
- The Supplier must include the preparation of the joints to be used in the welding procedures. Bevel, root opening and strip must be specified.

#### **7. WELDING**

The weld throat must be at least 2.4 mm thick. For all practical purposes, maximum throat thickness is 3.2 mm.

Pipes thicker than 1.6 mm require 2 layers or 2 passes to ensure the tightness of the weld.

Interpass temperature must not exceed 120°C to prevent or reduce carbon precipitation.

Dross must be cleaned between passes and after the final pass.

The current must be as low as possible while ensuring good arc formation and adequate fusion.

## GENERAL TECHNICAL SPECIFICATIONS

### WELDING OF STAINLESS STEEL PIPING

---

The arc must be as short as possible, but the welder has to make sure not to overheat the electrode.

The welding joint must be narrow.

Backstep welding is to be used to prevent distortion and dip formation at the end of the weld.

No pre-heating or post-heating is required.

All welding joints must be ground. A minimum thickness of 2.4 mm must be kept. All the welds are to be ground smooth and polished. The joints and the surfaces in contact with the product must be polished to Grade AISI no4 to prevent corrosion.

No mechanical marking can be done on the pipe wall. The welder responsible for each weld must be recorded on the plans or any adequate document, and written on the pipe wall with a marker.

#### 8. PASSIVATION AND FERROXYL TEST

Passivation and detection of iron contamination on the pipes and welds are required to prevent corrosion.

##### Passivation

All the weld joints must be brushed clean with a solvent (alcohol or acetone) or painted with a solution of phosphorous acid 15%, in order to remove all traces of iron and oxides.

This operation must be followed by a complete rinse with warm clean water.

Contaminated parts are wetted with an aqueous solution of 20% (volume) nitric acid.

At 120-140°F, immersion time is 15 to 30 minutes.

Cold immersion requires the solution to be sprayed continuously for one (1) hour.

This method may be replaced, under written approval by the Consultant, by one of the two following methods:

- a) Thorough washing, done locally for 5 to 10 minutes, with a solution of hydrofluoric acid 4% (volume), nitric acid 15% (volume) and distilled water. Overexposure of the surfaces to this solution must be avoided.
- b) The solution mentioned hereinabove, mixed with diatomaceous earth (Fuller's earth).

A complete rinse with warm clean water is required immediately after passivation.

##### Ferroxyl test

On the construction site, a solution of ferroxyl (composition detailed below) must be applied on the surfaces so that contaminated sections can be identified and treated specifically.

Any iron particle will cause the solution to turn dark blue.

- Distilled water	1000 cm <sup>3</sup>
- Nitric acid	20 cm <sup>3</sup>
- Potassium ferricyanide	30 g

Test is positive if dark blue spots appear within 30 seconds after the solution is applied. Contaminated surfaces or welds must be cleaned, ground, polished and passivated again, after which a new ferroxyl test must be conducted.

100% of the surfaces and welds must return a negative ferroxyl test result, unless the Consultant states otherwise.

**GENERAL TECHNICAL SPECIFICATIONS**  
**WELDING OF STAINLESS STEEL PIPING**

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The surfaces or welds that cannot be passivated by the method detailed above shall be reported to the Consultant, who may then approve another method or give up the passivation for specific surfaces or welds.

The ferroxyl test operations, detailed above, must be followed by a thorough wash.

**9. QUALITY AND INSPECTION**

Quality of the work must comply with the demands of the present document. Inspection must be performed in accordance with the same demands.

The welds must look consistent. Their throat thickness must range from 2.4 mm to 3.2 mm.

Visual checks shall not reveal porosity, cracks, grooves or streaks.

Weld surfaces on the inner wall of the pipes must be consistent and projection-free.

All butt welds must penetrate fully. However, a lack of penetration in the start/stop region with the SMAW technique may be tolerated for a maximum length of 25.4 mm. The section where the root pass is not fully penetrating cannot exceed 25% of the pipe perimeter and must present at least 60% of penetration or effective throat.

If the Consultant deems it necessary, X-ray testing may be conducted to ensure the full penetration of the welds.

Because of the thinness of the pipe walls (7 and 11 Gauge US), no fusion defect such as porosity, lack of fusion or presence of dross is permitted, in order to ensure the required performance and tightness levels. However, isolated defects of less than 0.8 mm in diameter are acceptable. Every crack is rejected. X-ray testing may be replaced, under written approval by the Consultant, by ultrasonic testing.

The Supplier shall cooperate with the Consultant for the non-destructive testing of ten (10) weld joints, needed by the Consultant. Testing costs are at the Supplier's expense. If a weld is flawed, further inspection is conducted at the Supplier's expense on the previous and following welds done by the same welder.

Every corrective work that is required must be performed at the Consultant's satisfaction.

Post-correction inspection costs are at the Supplier's expense.

These inspections must be conducted by a certified inspector in accordance with CSA W178 Standard.

**10. TESTING**

Hydrostatic testing at 690 kPa (100psi) pressure or otherwise stated in the specification, must be conducted to ensure the tightness and quality of the welding joints.



**GENERAL TECHNICAL SPECIFICATIONS**  
**"MANUFACTURE OF EQUIPMENT"**



**GENERAL TECHNICAL SPECIFICATIONS  
MANUFACTURE OF EQUIPMENT**

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**GENERAL TECHNICAL SPECIFICATIONS**  
**MANUFACTURE OF EQUIPMENT**

---

**1 GENERAL**

This section of the specifications describes the particularities associated with the manufacture of equipment and accessories and is not intended in any way to be limiting. The Contractor is responsible for planning all work necessary to provide the Owner with works in conformity with the specifications. For the work to be performed according to this section, the Contractor shall refer to all sections of the tender documents.

**2 PURPOSE**

Unless otherwise stated in writing, all materials and equipment supplied must be new, of high quality in all aspects and be constructed and finished faultlessly.

The equipment shall be of modern design and shall not have been in service at any time prior to installation except as required by tests. All units must be supplied with safety devices such as guard belts, etc.

The general design of all machinery shall be such that all moving parts are easily accessible for inspection and repairs, easily replaceable, and each and all parts are appropriate to the service required. Particular attention shall be paid to the durability of all moving parts of the equipment supplied.

All equipment shall be constructed to ensure optimum performance. Each piece of equipment must be complete and include every necessary part or accessory. The most durable and desirable materials shall be used to ensure efficient intermittent or continuous operation and easy and convenient maintenance. Structural materials shall be selected according to their specific use.

Equipment shall mean all the material needed for the erection of a part of the process. Equipment components must be complete, i.e. include motors with their base, drive shafts, permanent or temporary stops, all anchor bolts with nuts and washers, etc.

Any device required to achieve results indicated or targeted by the presence of a piece of equipment, even if not shown on the plans and not described in this specification, shall be considered an integral part of the contract and no additional charges may be claimed for its supply and installation.

Materials shall at all times be well suited to use, appropriate for their intended service, and selected and manufactured in accordance with best practice and professional standards.

**3 MANUFACTURING STANDARDS AND REQUIREMENTS**

Mechanical equipment provided shall operate satisfactorily without excessive wear or lubrication or excessive attention required from the operator. All rotating parts must be in rotational balance and must operate without vibrations caused by mechanical failure or improper centering of parts.

Equipment parts must be able to bear all stress encountered during manufacture, assembly, unloading and operation (continuous and intermittent).

All must be performed in a manner to meet the standards provided in these specifications.

Systems must offer excellent durability and be designed to operate in the extreme humidity and corrosiveness of pumping stations.

**GENERAL TECHNICAL SPECIFICATIONS**  
**MANUFACTURE OF EQUIPMENT**

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Where there is vibration or danger of vibration, absorbers or similar must be provided.

**4 SPECIAL TOOLS AND SPARE PARTS**

The Contractor shall ensure that each device includes a complete set of special tools required for the adjustment, operation and maintenance of various pieces of equipment.

Tools whose usage is limited and which are not normally available but which are necessary for certain equipment are considered special tools.

A list of the special tools provided and the spare parts list must be attached to the operating manuals.

**GENERAL TECHNICAL SPECIFICATION**  
**“EQUIPMENT IDENTIFICATION”**





**GENERAL TECHNICAL SPECIFICATIONS  
EQUIPMENT IDENTIFICATION**

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**GENERAL TECHNICAL SPECIFICATIONS**  
**EQUIPMENT IDENTIFICATION**

---

**1. GENERAL**

For the work covered by this section, the Contractor shall refer to all drawings, specifications and tender documents.

**2. DESCRIPTION OF WORK**

The work under this section is described below.

All process system equipment parts as well as piping shall be identified clearly and legibly in the manner described below.

The Contractor shall submit for review by the Consultant a diagram of the equipment with the identification, designation and numbering the Contractor intends to use.

This identification (designation, numbering) must be identical everywhere, including drawings, equipment, instrument and control panels and equipment and operating manuals.

Nameplates, panels, bands, labels and identification tags must be prominently displayed and not be covered with paint or other.

Where insulation is required, the identification shall be affixed to the insulation.

**3. EQUIPMENT IDENTIFICATION**

Manufacturer nameplates shall be affixed to electrical and/or mechanical equipment. These plates must show manufacturer name, model, serial number and, depending on the equipment, engine power, type of power supply, unit capacity and other relevant information.

In addition to manufacturer nameplates, all equipment such as valves, pumps, blowers, tanks, etc. must be identified by labels attached with brass chains. Labels must be fiberglass or laminated, 65 mm x 100 mm in size, and yellow in color with black characters that are at least 12 mm in height. Labels and chains must be such as those manufactured by W.H. Brady Inc. or approved equivalent. Inscriptions must show the type and number of equipment (ex.: P-012 for Pump No. 012) and must match the identification used on drawings and instrumentation and control panels and attached to starters, switches, etc.

**4. PROTECTION OF EXTERNAL SURFACES AND CLEANING**

All surfaces of piping, fittings, elbows, valves, supports and anchors that are not stainless or galvanized steel must be treated against corrosion after installation as specified in the general technical specifications "Sandblasting and Painting" and according to the color code attached to the end of this section and/or as directed by the Consultant.

At the end of the work, the Contractor shall clean the piping and supports to the satisfaction of the Consultant.

**GENERAL TECHNICAL SPECIFICATIONS**  
**EQUIPMENT IDENTIFICATION**

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**5. PIPING IDENTIFICATION**

All piping must be painted in accordance with the color code attached to the end of this section.

In addition to painting, the Contractor shall identify all pipes, including stainless steel and PVC, with yellow self-adhesive labels with black lettering and arrows indicating the nature and flow direction of the transported product.

Identification labels shall be placed at regular intervals along the pipe, without exceeding a distance of 5 meters, so as to successively display complete identification (letters and arrows) alternating with a single arrow.

In particular, at strategic points (valves, faucets, check valves, tees, crosses, bulkhead fittings, cross members, etc.) the aforementioned identification must be supplemented by an indication of the origin and destination of the transported product.

Identification labels must comply with Standard (F) 24-GP-3a-1967 of the Canadian Government Specifications Board (CGSB) entitled "Code for identification and classification of piping systems." The size of the labels shall be appropriate to the outside diameter of the pipe and their positioning shall allow rapid identification by personnel.

**6. VALVE IDENTIFICATION**

The Contractor shall identify all valves using the same tags, labels and corrosion-resistant chains and in the same manner as specified for equipment in the article above.

**GENERAL TECHNICAL SPECIFICATIONS**  
**EQUIPMENT IDENTIFICATION**

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**COLOR CODE**

PIPE - EQUIPMENT	COLOR	PAINT NUMBER	
		C.I.L.	SICO
Drinking water	Light blue	3938-7	3027-41
Non-potable service water	Dark blue with "NON POTABLE"	4848-9	SM-820
Hot service water	Medium blue	3941-9	3028-32
Backwash water for filters	Ocher	4701-9	3100-64
Sand	Rust	4700-9	3084-53
Air from process blowers	Light green	3529-9	SM-986
Compressed air for pneumatic control	Dark green	4788-5	SQ-6741
Chlorine	Light yellow	3117-5	SQ-6245
Chemicals	Orange	2637-5	SM-650
Emergency equipment	Red	4596-4	SM-736
Valves, check valves, etc.	Same color as adjacent pipe	--	--



**GENERAL TECHNICAL SPECIFICATION**  
**“EQUIPMENT INSTALLATION”**





**GENERAL TECHNICAL SPECIFICATIONS  
EQUIPMENT INSTALLATION**

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**GENERAL TECHNICAL SPECIFICATIONS**  
**EQUIPMENT INSTALLATION**

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**1 GENERAL**

For the work covered by this section, the Contractor shall refer to all plans, specifications and tender documents.

**2 DESCRIPTION OF WORK**

This section covers the installation of all equipment.

**3 PROTECTION OF EQUIPMENT AND PREPARATION FOR INSTALLATION**

**3.1 Protection of equipment**

Upon receipt, equipment must be thoroughly inspected for any damage caused during transport. The Contractor shall record in a control log the condition of all received equipment and accessories following their delivery to the site and provide a copy to the Consultant.

Equipment must be stored on a level surface in a dry and sheltered area, according to manufacturer recommendations. Equipment must remain in its original packaging or on its transport medium. Packaging and supports must be repaired if damaged.

Equipment with openings such as pumps, fans, etc. must be plugged to prevent entry of dirt and debris that could damage the inside of the equipment.

Equipment shall be inspected weekly at its storage place and rotating equipment shall be rotated regularly.

Shafts and machined surfaces shall be protected from corrosion with a layer of special oil.

**3.2 Installation instructions**

Prior to fabrication of concrete bases or other structures on which equipment will be placed, the Contractor shall obtain a reproducible certified copy of drawings for each piece of equipment from the equipment supplier and submit the copy to the Consultant. These drawings are necessary for the correct sizing of the bases, for the location of the anchor bolts and for proper pipe routing.

**3.3 Inspection**

Before starting installation, the Contractor shall verify at the storage location that all components have been delivered and that each piece of equipment is in perfect condition. The Contractor shall also at this time submit the updated control log of received equipment and accessories.

**GENERAL TECHNICAL SPECIFICATIONS**  
**EQUIPMENT INSTALLATION**

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**4 GENERAL INSTALLATION REQUIREMENTS**

- 1) Flat washers must be installed under each nut and under each bolt head when these are installed in a slotted hole.
- 2) Wedge washers must be used on inclined surfaces such as the footings of structural profiles.
- 3) When equipment is bolted to a base or structure, the bolt head must be on top of the mounting flanges to prevent the bolt from disengaging if the nut is lost.
- 4) After tightening, a minimum of two thread pitches must extend beyond the top surface of the nut.
- 5) Screws, nuts and keys must be coated with anti-seize before installation.
- 6) Equipment shall not be modified or repaired and no welding or torch cutting of any equipment part shall be permitted without the written authorization of the Consultant.
- 7) Couplings and pulleys shall be installed during Step 1 "Installation." Unless otherwise indicated, couplings must be installed so that the front is level with the end of the shaft. The pulleys and input wheels must be mounted so that the shaft exits the hub by at least 6 mm.
- 8) Service piping connectors must be clearly visible.
- 9) When the requirements of this section and the manufacturer's instructions regarding installation of equipment are in conflict, the more stringent shall apply.

**5 INSTALLATION SEQUENCE**

- 1) To ensure that each installation step has been completed by the Contractor and inspected by the Consultant prior to beginning the next step, the Consultant shall maintain an equipment installation log.

This log shall be signed jointly by the Contractor and the Consultant when each stage has been completed and inspected and the work has been approved.

- 2) The Contractor shall notify the Consultant each time a step is completed.

**6 FIRST STEP / INSTALLATION**

- 1) The Contractor shall carefully inspect each piece of equipment at its storage location to ensure it is in perfect condition before transporting it to its final location.

The Contractor shall report to the Consultant all damage or defects in the equipment.

- 2) If the equipment requires repairs or modifications, these must be executed before transporting the equipment to the installation site.

**GENERAL TECHNICAL SPECIFICATIONS**  
**EQUIPMENT INSTALLATION**

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- 3) Before placing the equipment, the concrete base must be cleaned to remove defective concrete and laitance so as to obtain a rough surface for good grout adhesion. The surface must be free of oil stains, grease, dirt and loose particles.

The anchor bolts placed in the concrete during casting must be cleaned, inspected and repaired if damaged.

Anchor bolts installed in a sleeve must be cleaned and free of any obstructions which may affect the insertion of grout.

## **7 SECOND STEP / LEVELING**

- 1) The leveling of equipment to the elevation shown on the drawings must be done using shims of varying thicknesses. Wedges should not be used. Screw jacks can be used if supplied with the equipment.

The size of the shims must be approved by the Consultant. The shims must be large enough to have adequate bearing surface. Whenever possible, single piece should be used. In no case should shims thinner than 3 mm be stacked on a thickness greater than 5 mm. Shims must be placed on each side of the anchor bolts at 6 mm from the bolt.

For bolts installed in a sleeve, shims must be placed as close as possible to the bolts while keeping sufficient space for the injection of grout into the sleeve.

- 2) For large bases, additional shims must be placed between anchors where specified by the manufacturer or Consultant.
- 3) After tightening of the anchor bolts, the level of the base for each equipment piece must be within the manufacturer's tolerances.
- 4) Screw jacks used to level the base must be released after the anchor bolts have been tightened.
- 5) At this stage, equipment mounted on a base can be aligned approximately.

## **8 THIRD STEP / PLACING GROUT**

- 1) Before placing grout, the Contractor shall ensure that the surface has been properly prepared and is clean and free of loose particles.
- 2) The Contractor shall submit for approval the brand and type of grout the Contractor intends to use.
- 3) When the temperature of the location where the grout is to be placed is lower than 5°C, the location shall be closed off and heated.
- 4) Surfaces on which grout is applied must be saturated with water. Any residual water must be removed before applying the grout.

**GENERAL TECHNICAL SPECIFICATIONS**  
**EQUIPMENT INSTALLATION**

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- 5) The grout must fill all voids in the base plate. The grout must be applied up to the upper surface of the frame at the bottom of an open base.

**9 FOURTH STEP / CONNECTION TO EQUIPMENT**

- 1) At this stage, piping and other accessories shall be installed and temporarily connected to the equipment.
- 2) When installation of piping and accessories is completed, the connection to the equipment shall be undone and the alignment verified. Misalignment shall be corrected on the piping and accessories so as not to transmit any load to the equipment once the permanent connection is made.

**10 FIFTH STEP / ALIGNMENT**

- 1) This step covers the alignment of rotating equipment such as blowers and motors.
- 2) Alignment shall be done using dial gauges.
- 3) During alignment, all piping and fittings shall be detached from the equipment to remove external forces that may be applied to the equipment.
- 4) Angular and parallel alignment must be within manufacturer tolerances and applicable standards.
- 5) When alignment is completed, the Contractor shall notify the Consultant who will read the gauges and record the data in the equipment installation log.
- 6) After the gauges are read, they shall remain in place while the piping and fittings are connected to the equipment. This is to ensure that there are no external forces applied to the equipment that can cause misalignment.
- 7) If the connections cause misalignment, they shall be adjusted to eliminate the forces causing the misalignment.
- 8) Pulleys and input wheels must be aligned in parallel.
- 9) When more than one V-belt is used for a drive, they must be attached to each other.
- 10) Chains and belts shall be installed with a tension according to manufacturer requirements.
- 11) Motors shall not be connected to the load at this stage.

**GENERAL TECHNICAL SPECIFICATIONS**  
**EQUIPMENT INSTALLATION**

---

**11 SIXTH STEP / LUBRICATION**

- 1) The Contractor shall lubricate all bearings, seals and other components that have a grease nipple.

Any drain plugs must be removed prior to lubrication to avoid creating pressure in the grease cavity and to expel any accumulated contaminants.

- 2) The Contractor shall check the level and quality of the oil in all oil pans.
- 3) All couplings must be manually filled with grease.
- 4) All lubricants required for installation and start-up of all equipment shall be provided by the Contractor and shall meet the manufacturer requirements for each piece of equipment.

**12 SEVENTH STEP 7 / ELECTRICAL CHECKS**

- 1) Electrical installation shall be completed and verified in accordance with the requirements of the supplier.
- 2) The rotation direction of each motor shall be verified prior to connection to its load.
- 3) Each motor shall operate for at least fifteen minutes in the presence of the Consultant. During this time, the bearing temperature shall be measured regularly and each reading shall be recorded in the installation log.
- 4) The amperage and voltage of each motor operating in an unloaded condition shall be measured and recorded in the equipment installation log in the presence of the Consultant.

**13 EIGHT STEP / CONNECTION OF MOTORS AND GUARDS**

- 1) At this stage, each motor shall be connected to its load.
- 2) When coupling is completed, the Contractor shall install the guards provided with the equipment. If no guards are provided, the Contractor shall fabricate and install guards in accordance with OSHA standards.

**14 NINTH STEP / INITIAL START-UP**

- 1) Before starting this step, the installation of all instruments necessary for operation of the equipment must be completed.
- 2) Prior to initial start-up of the equipment, the Consultant shall provide the Contractor the procedure to be followed.

**GENERAL TECHNICAL SPECIFICATIONS**  
**EQUIPMENT INSTALLATION**

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- 3) Prior to initial start-up, the tank to which the pumps are connected must be clean and free of any accumulated debris. The suction pipes must be inspected for any debris that can damage the pumps or motors.
- 4) Before start-up, the Contractor shall also inspect the inside of pumps via cleaning openings where possible.
- 5) Before start-up, equipment must be turned manually if possible to ascertain if it turns freely. If not possible to turn the equipment manually, particular attention should be paid to detect any suspicious noise using a mechanic's stethoscope when the equipment is running.
- 6) Before start-up, lubrication must be rechecked.
- 7) The Contractor shall verify that all service pipes are properly connected to the equipment.
- 8) The equipment shall be started and run for one hour in the presence of the Consultant.
- 9) During operation, the bearing temperature must be measured at frequent intervals to detect any overheating. The temperature readings shall be entered in the equipment installation log.
- 10) During operation, voltage and amperage measurements of the motor under load must be taken and recorded in the equipment installation log.

**15 TENTH STEP / RE-VERIFICATION OF ALIGNMENT**

- 1) After initial start-up, the couplings must be undone and the alignment rechecked.
- 2) If necessary, the alignment shall be corrected and the couplings redone and safety guards reinstalled.

**16 EQUIPMENT PROTECTION AFTER INSTALLATION**

After installation, equipment must be turned at least once every two weeks and the lubrication verified.



**GENERAL TECHNICAL SPECIFICATIONS**  
**“HOT DIP GALVANIZATION”**



**GENERAL TECHNICAL SPECIFICATIONS**

**HOT DIP GALVANIZATION**

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## GENERAL TECHNICAL SPECIFICATIONS

### HOT DIP GALVANIZATION

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#### 1 GENERAL

For the work to be performed according to this section, the Supplier must refer to all chapters of the tender documents.

#### 2 DESCRIPTION OF WORK

The work under this section is described in the following text and/or indicated on the plans.

The work described in this section applies to the galvanization of different parts.

#### 3 CODES

Galvanization shall be conducted to ASTM A-123.

#### 4 GALVANIZATION

All necessary precautions must be taken to ensure a high-quality galvanized coating and avoid any distortion or warping due to galvanizing.

The Supplier must notify the Consultant of the place and date of galvanization work. Inspections may be performed at any time during galvanization work. During such inspections, the Supplier must cooperate with the Consultant.

#### 5 ASSEMBLY

Assembly of galvanized parts shall be done properly in order to maintain the integrity of the coating. A minimum of cuts shall be made on galvanized parts. Such cuts shall be made using a grinding wheel. If repairs are unavoidable, the Supplier must provide a repair procedure prior to performing any repairs.

#### 6 STORAGE AND TRANSPORT

The Supplier shall protect galvanized parts against damage during handling and storage. Storage conditions must allow air flow between parts and ensure that water does not accumulate and drains freely and there is no metal to metal contact of the galvanized parts.

Storage and transport of galvanized parts shall be carried out in a manner to avoid formation of "white rust".

Galvanized parts in contact with lifting equipment such as ropes and chains must be adequately protected.

Any damaged parts must be repaired by an appropriate method approved by the Consultant.



**GENERAL TECHNICAL SPECIFICATIONS**  
**“SANDBLASTING AND PAINTING”**





# GENERAL TECHNICAL SPECIFICATIONS

## SANDBLASTING AND PAINTING

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## GENERAL TECHNICAL SPECIFICATIONS

### SANDBLASTING AND PAINTING

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#### 1. GENERAL

This section describes many features of the work to be done and is not intended to be in any way limiting. The Contractor has the obligation to provide related works that need to be undertaken to provide the Owner work consistent with the drawings and specifications. For the work to be performed according to this section, the Contractor shall refer to all drawings and sections of the tender documents.

#### 2. DESCRIPTION OF WORK

The work covered by this section is described in the text hereafter and/or is indicated on the drawings.

The work covered by this section concerns sandblasting and painting of equipment.

Metallic surfaces of equipment exposed to air or water and which are not made of stainless steel, galvanized steel or aluminium shall be treated against corrosion by at least one primer coat and two epoxy coats after having been cleaned by sandblasting. Required retouching shall be done on site.

The painting of motors is specified in articles concerning the equipment.

For carbon steel components, such as structural steel, equipment, piping and other, there must be a cleaning by sandblasting unless otherwise specified elsewhere in the specifications.

This cleaning by sandblasting and primer application shall be as set forth in this section and performed in the manufacturer's workshop, followed by the application of the final paint coats in the workshop.

A gallon of each type of primer paint and finishing coat must be supplied by the manufacturer for retouches. Only retouching of the paint finish of submerged and non-submerged metal parts is provided on site by the Contractor.

Valves, faucets, check valves, clamp couplings and other accessories or fittings of the same type made of ferrous metal must receive factory cleaning by sandblasting and an epoxy primer coat followed by two coats of "high build" epoxy (total minimum 7 mils).

The paint must be compatible at all times with the use and with the materials to which it is applied.

Unless otherwise indicated, metallic surfaces other than those made of stainless steel, aluminium and galvanized steel must be cleaned and painted according to the following.

#### 3. CLEANING BY SANDBLASTING

This specification section applies to the cleaning of metallic surfaces which must be done by sandblasting. This process is used on all surfaces of structural steel and must be performed before the application of protective coatings.

##### 3.1 Definition

Sandblasting is a treatment process for metallic surfaces which uses abrasive materials projected by nozzles or centrifugal turbines.

## GENERAL TECHNICAL SPECIFICATIONS

### SANDBLASTING AND PAINTING

---

#### 3.2 Process description

The preparation of submerged surfaces, unsubmerged or partially submerged surfaces consists in removing dirt, grease, oils, corrosion and any other contaminants by a commercial type of sandblasting.

Sandblasting consists of the following operating phases:

- Oils, grease and any other Les huiles, les graisses et autres substances étrangères nocives doivent être enlevées conformément aux méthodes décrites dans la norme 3700-971 du B.N.Q. « Nettoyage au solvant ».

Excessive amounts of rust and scale must be removed using manual or mechanical percussion tools.

- The actual sandblasting can be carried out using one of the following methods :
  - By dry sandblasting using sand which passes through an 18 gauge (max.) sieve. This step must be followed by brushing or air cleaning;
  - By wet sandblasting using sand which passes through an 18 gauge (max.) sieve. The whole must be followed by washing with water to which has been added an amount of corrosion inhibitor;
  - By the angular grit blasting using a basic cast iron, steel or any other synthetic product. The particles should pass through a sieve of 20 gauge (max.);
  - Sandblasting must be done so as not to damage the metal surface;
  - Dry sandblasting should not be used when treated surfaces may be wet or attacked by moisture before repainting. If rust forms after sandblasting, sandblasting must be done again before applying the base layer.

#### 3.3 Degree of care

Treated surfaces shall be completely free of of scale, rolling, rust, oxides, corrosion, paint and any other foreign substances prior to the application of the base coat.

#### 3.4 Inspection

All treated metallic surfaces can be inspected by the Consultant or his representative. These surfaces must be accessible at all times for inspection.

#### 3.5 Recoat time

Metal surfaces, once sandblasted and cleaned, must be treated immediately to prevent rusting.

Moreover, a metal surface on which there is rust cannot be, under any circumstances, paint, regardless of the time that has elapsed since the sanding.

## GENERAL TECHNICAL SPECIFICATIONS

### SANDBLASTING AND PAINTING

---

#### 4. SURFACE PREPARATION

After blast cleaning, all equipment shall be painted according to the specifications of the following standards:

- Normally submerged surfaces: according to standard SSPC-SP10.
- Partially submerged surfaces and/or subjected to wastewater vapors : according to standard SSPC-SP10.
- Buried surfaces: according to standards SSPC-SP6 (minimum) and SSPC-SP10.
- Surfaces subjected to atmospheric conditions: according to standard SSPC-SP10.
- Interior surfaces: according to standard SSPC-SP6.
- Equipment surfaces which heat up during use: according to standard SSPC-SP10.

#### 5. APPLICATION

Blast cleaned surfaces shall be primed on the same day and before occurrence of any type of rust. Moreover, under no circumstances shall a metallic surface on which there is rust be painted, regardless of the time that has elapsed since the sandblasting.

The number of coats and their thickness must be as recommended by the manufacturer, except for surfaces of types A and B for which a three coat system (primer, intermediate and finishing coat) is required. The total dry thickness of these coats shall be a minimum of 7 mils at all times.

No paint shall be applied if the temperature of the surface to be coated is not at least 9°C above the dewpoint (see table herewith). No paint shall be applied if the temperature is below 7°C (45°F) or above 38°C (100°F), unless otherwise specified by the manufacturer.

No application must be performed if a decrease in temperature greater than 20°C over a period of 4 to 6 hours is foreseeable.

The use of inorganic zinc primer shall be avoided.

All handling and application of paint shall be in accordance with the manufacturer's instructions. Paint containers shall remain closed until required for use. Manufactures requirements shall be strictly adhered to.

Pigmented and catalyzed material shall be thoroughly mixed before being applied.

All re-applications will be done within the manufactures guidelines to avoid improper adhesion between the undercoat and the overcoat.

Continuous agitation spray pots will be used when applying metal pigmented coatings.

Coating reports will be kept by the Consultant upon request.

## GENERAL TECHNICAL SPECIFICATIONS

### SANDBLASTING AND PAINTING

---

Coatings shall be applied uniformly per each coat. Runs, drips and other imperfections in the coating are to be avoided and, if necessary, corrected.

All coats shall be applied as soon as possible after the minimum specified drying time of the preceding coat to reduce the possibility of inter-coat contamination and to ensure proper adhesion between successive coats.

During application, each spray pass shall overlap the previous pass fifty percent. A crosshatched pattern shall be used in a two directional pattern on flat areas.

Overspray shall be kept to a minimum. Any rough surfaces resulting from overspray shall be sanded smooth and top coated again.

**Table : Dewpoint Calculation (° F)  
Ambient temperature ° F**

% RELATIVE HUMIDITY	20	30	40	50	60	70	80	90	100	110	120
90	18	28	37	47	57	67	77	87	97	107	117
85	27	26	36	45	55	65	75	84	95	104	113
80	16	25	34	44	54	63	73	82	93	102	110
75	15	24	33	42	52	62	71	80	91	100	108
70	13	22	31	40	50	60	68	78	88	96	105
65	12	20	29	38	47	57	66	76	85	93	103
60	11	19	27	36	45	55	64	73	83	92	101
55	9	17	25	34	43	53	61	70	80	89	98
50	6	15	23	31	40	50	59	67	77	86	94
45	4	13	21	29	37	47	56	74	73	82	91
40	1	11	18	26	35	43	52	61	69	78	87
35	-2	8	16	23	31	40	48	57	65	74	83
30	-6	4	13	20	28	36	44	52	61	69	77

## GENERAL TECHNICAL SPECIFICATIONS

### SANDBLASTING AND PAINTING

---

#### 6. PAINT TYPE

Types of paint to be used vary depending on the condition of the surfaces to be coated.

If the type of paint for an equipment has not been previously defined in the article concerning this equipment, the paint shall at least meet the following specifications:

##### Submerged surfaces

« High Build » epoxy

##### Unsubmerged or partially submerged surfaces

Catalyzed epoxy enamel

Vinyl

« High Build » epoxy

Polyamide epoxy

##### Surfaces exposed to the Sun or to atmospheric conditions

Vinyl

Polyurethane – aliphatic

Chlorinated rubber

Polyamide epoxy

« High Build » epoxy

##### Dry interior surfaces

Alkyd

Catalyzed epoxy enamel

Matte latex emulsion

Acrylic emulsion

Vinyl

Chlorinated rubber

Polyamide epoxy

## GENERAL TECHNICAL SPECIFICATIONS

### SANDBLASTING AND PAINTING

---

« High Build » epoxy

Paints shall be of the following brands : Carboline, Tremec, Glidden, Mobil, Sico, C.I.L. or approved alternate.

#### 7. INSPECTION PROCEDURE

Prior to any painting work (equipment, piping, etc.), the Contractor shall provide for approval by the Consultant, the specification sheet of the paint he intends to apply. This sheet must indicate the type of paint, and the type of primer and thicknesses recommended by the manufacturer.

At any time during the execution of the coating work, workshop or site inspections can take place, to ensure that work is performed according to the manufacturer's recommendations. During such inspections, the Contractor shall collaborate with the Consultant or his representative.

In addition, the Contractor may be required to demonstrate to the Consultant or his representative that the product(s) comply with the standards listed previously, and to establish that industrial controls were performed during manufacturing, guaranteeing this compliance.

#### 8. COLOUR SELECTION

Colour selection for finishing coats is performed by the Consultant or according to the colour code presented in general technical specifications "Equipment identification".



**GENERAL TECHNICAL SPECIFICATIONS**  
**“EQUIPMENT DISINFECTION”**



**GENERAL TECHNICAL DISINFECTION  
EQUIPMENT DISINFECTION**

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**GENERAL TECHNICAL DISINFECTION  
EQUIPMENT DISINFECTION**

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**1. GENERAL AND SCOPE OF WORK**

The works in the current section include the supply of materials, workforce and all that is required in order to proceed to the disinfection of all pipings, equipment and accessories which are in contact with treated water.

The Contractor shall provide the equipment for dosing sodium hypochlorite and all other required accessories to conduct disinfection works as required by the standards.

Specialized works of this section are part of the contract. It is recalled that all parts of the contract are mutually complementary.

The supplied and installed water treatment equipment must be considered as a water treatment plant.

**2. STANDARDS**

AWWA C652-92 « Disinfection of Water Storage Facilities ».

AWWA C653-87 « Disinfection of Water Treatment Plants ».

AWWA C654-87 « Disinfection of Wells ».

**3. PRODUITS**

Unless otherwise indicated, the use of chlorine gas is prohibited.

Sodium hypochlorite ( $\text{NaClO}$ ) in accordance with ANSI / AWWA B300 standard (use: source of chlorine in liquid form).

Calcium hypochlorite ( $\text{Ca}(\text{ClO})_2$ ) in accordance with ANSI / AWWA B300 standard (use: source of chlorine in granular form).

Sulfur dioxide ( $\text{SO}_2$ ) in accordance with the standard (use: dechlorination).

Sodium bisulfite ( $\text{NaHSO}_3$ ) in accordance with the standard (use: dechlorination).

Sodium sulfite ( $\text{Na}_2\text{SO}_3$ ) in accordance with the standard (use: dechlorination).

Sodium thiosulfate ( $\text{Na}_2 \text{S}_2 \text{O}_3 \cdot 5\text{H}_2\text{O}$ ) in accordance with the to the standard (use: dechlorination).

Dilution water for chlorine: water used for disinfection must meet the quality requirements of the regulation on the quality of drinking water, contain less than 0.3 mg / L of iron, less than 0.05 mg / the Mn and less than 0.05 mg / l of sulphides.

**4. EXECUTION**

**4.1 General**

Refer to the disinfection standard which applies for the equipment that needs to be disinfected.

Clean all the equipment as described in the above standards as well as in the general technical specifications.

**GENERAL TECHNICAL DISINFECTION**  
**EQUIPMENT DISINFECTION**

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**5. DISINFECTION**

**5.1 Disinfection of treated water tank**

The disinfection procedure must conform to AWWA C652-92.

Chlorination methods 1, 2 and 3 are acceptable.

The complete and detailed disinfection procedure must be presented and approved by the Engineer.

It is recommended to use the services of a specialist contractor to disinfect the tank.

**5.2 Disinfection of the water treatment equipment**

The disinfection procedure shall comply to AWWA C653-87.

Disinfection should be performed on all parts in contact with the water as soon as it enters the filtration system (starting at the raw water pumps system) and up to the piping and valves carrying the treated effluent.

**5.3 Bacteriological control**

Simultaneously with the bacteriological sampling, measurement of free chlorine residual must be performed. The minimum acceptable concentration is 2 mg / l. In the case of disinfection of a well, the free chlorine to be measured after one minute of the pump to measure residual chlorine present in the well at the end of the disinfection period.

The sampling and analysis procedures are described in standards which apply to the equipment to be disinfected.

Total coliform bacteria and fecal coliform must be analyzed.

Bacteriological analyzes must be performed by an accredited laboratory on water samples taken by a representative of the laboratory, according to the membrane filtration method in the presence of the Owner. Two (2) sets of samples must be analyzed at the expense of the Contractor:

- At an interval of 24 hours for tanks after the disinfection procedure applied to AWWA C652-92 is completed;
- At an interval of 30 minutes for a treatment plant after the disinfection procedure described in AWWA C653-87 is complete.

Samples must not contain any coliform bacteria. If tests show that the water from the pipes is contaminated, disinfection and laboratory testing must be made again at the expense of the Contractor.