

# SECTION

## SPECIAL 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

Special Technical Specifications

Tetra Tech Project n°: 25288 (60DVC)

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2016-04-20

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**“Issued for tender”**

March 30<sup>th</sup> 2016



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## A. ADMINISTRATIVE CLAUSES

### A.1 Definitions

- |                            |                                                                                                                          |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------|
| a) Owner :                 | Foreign affairs and International Trade Canada (DFATD or DFAIT)<br>125 Sussex Drive, Ottawa,<br>Ontario, Canada, K1A 0G2 |
| b) Contractor :            | Bidder                                                                                                                   |
| c) Consultant or Engineer: | The Consultant is to be determined by the Owner                                                                          |
| d) Main supplier :         | The manufacturer of the water treatment equipments                                                                       |

### A.2 Summary of works

The Contractor shall supply, install and commission all equipment, labour, materials, tools, and provide all necessary supervision and other services as required to execute the work and to achieve the intent of the DFAIT for water system upgrades at the Canadian chancery of Haiti in Port-au-Prince.

The activities include, but are not limited to:

- Decommissioning, dismantling, modification and displacement of the existing water treatment equipment, the existing water heater equipment, electrical panels and wiring and associated equipment including piping and electrical connections;
- Furniture, installation and commissioning of the following water treatment and distribution equipment : Raw water pumps system, sand and anthracite filter, anion exchanger, water softening, UV disinfection system, sodium hypochlorite dosing system, treated water reservoirs, distribution pumps system;
- Supply, installation and commissioning of the car wash pumps system;
- Supply, installation, programming and commissioning of the control panels for all installed equipment;
- Supply, installation and commissioning of mechanical process piping, valves, equipment and associated accessories including electrical works and process automation (instrumentation and control);
- Testing and assembling of the whole process, within the exact assigned area, in Canada, before delivery to Haiti.
- All electrical works, such as supplying, installing, connecting and commissioning of equipments, accessories, cables, and electrical connections, are to be approved by the owner;
- All process control and instrumentation control works, such as supplying, installing, programming, connecting and commissioning of cables, compounds and accessories;
- Protection for existing structures and facilities as necessary for the construction to proceed;
- Temporary water distribution for the building and the car wash, including all required equipment;
- Maintenance and operation by the Main Supplier for one year, starting after the completion and acceptance of the commissioning by the Owner;

- Installation, maintenance and operation manuals;
- Training of Owner's operations and maintenance personnel for all equipment, automation and processes supplied, installed or programmed under this Contract;
- Clean-up of all spillages during performance testing and initial operation.

The Contractor shall provide all equipment, materials, tools, transportation and all services necessary for the proper execution and final completion of the required works.

The Contractor is responsible for locating all interior and exterior utilities prior to any construction and to ensure they are protected at all times.

The owner has the right to modify the scope and the amount of works and to only award a part of the works.

### **A.3 Location of works**

The works are located in Port-au-Prince, Haiti, at the Canadian chancery.

### **A.4 Priority of technical documents :**

All documents are made to complete each other. In case of discrepancies among the technical documents of the water treatment, the priority of the technical documents of the water treatment is as follows:

1. The statement of work (SOW);
2. The drawings;
3. The special technical specifications;
4. The general technical specifications.

### **A.5 Code and Regulation**

Works will be executed in compliance with all laws, regulations and codes which apply.

All equipment, products and materials directly in contact with the treated water are required to comply with NSF/ANSI Standard 61: Drinking Water System Components – Health Effects (NSF-61). All materials are to be certified with Canadian Standards Association (CSA).

The supplied water treatment system must be considered as a drinking water facility when the Contractor must determine which code, standards or regulation apply.

All works and equipment shall comply with the latest version of the codes and standards referred to in the section « Process Requirements » of the general technical specifications.

## A.6 Warranties

The following warranties must be provided in the name of the Owner and the Contractor:

- Warranty of one (1) year for all supplied equipments and all relocated equipment, which include, but is not limited to, mechanical process, electricity, control and instrumentation.

This warranty period starts at the end of the commissioning.

The whole works, including all equipments and instruments, have to be guaranteed against:

- Inadequate or faulty design;
- Improper assembly;
- Faulty materials.

The Contractor is responsible for providing insurance against breakage, theft and vandalism for all supplied and all installed equipments until the end of the commissioning. The Contractor remains responsible for the supplied equipments during the shipping and storage, should the equipments be stored at the worksite, at a supplier site or anywhere.

## A.7 Maintenance and operation by the Main Supplier

The Contractor must include a maintenance contract which will be executed by the Main Supplier.

The maintenance contract only starts after the commissioning and all works are completed.

The maintenance contract must include a total of 4 visits by an experienced technician or engineer employed by the Main supplier, with one visit every three months. The exact date of each visit will have to be coordinated between the Main Manufacturer and the Owner.

Each visit includes 2 days of transportation and 2 days of work at the Canadian chancery of Haiti.

Additional visits required for maintenance will have to be discussed between the Main manufacturer and the Owner.

## A.8 Documents to be delivered

The Contractor must deliver, before the end of the term, the following documents, in « as-built » versions, **in FRENCH**, and is not limited to the following documents:

- The drawings of the layout of the supplied and installed system, including water treatment systems, piping, pumps, valves, check valves, pressure control valves, instrument, accessories, control panel, and including the hot water tank and the hot water tank piping and accessories. They must also include the buildings, the doors and the walls. These drawings must be digitally supplied, using an Autocad version, in a .pdf version and in a .dwg version;
- The drawings and the diagrams (layout, connection, equipment list, etc.) of each control panels;
- List of inputs / outputs of each control panel;
- Programs of the PLC of each control panel;

- SCADA implementation and all other application of each PLC;
- Complete process description of each supplied and installed system;
- Installation, maintenance and operation manual of the supplied and installed systems, including warranties.
- Replacement parts list.

Those documents must be supplied in 3 printed copies and assembled in binders and on CD in a .pdf version and in the original versions (Autocad, Word, Excel, etc.).

#### **A.9 Discrepancies and omissions**

These Specifications shall be considered as an integral part of the Drawings, which accompany them, and neither the Drawings nor Specifications shall be used alone. Any items or subject omitted from one but which is mentioned and/or indicated in the other shall be considered as properly and sufficiently specified and shall therefore be included.

#### **A.10 Installation, maintenance and operation manual**

The installation, maintenance and operation manual must be prepared according to the section « General Technical Specifications – Tests, Training and Manuals ». Moreover, manuals will include, for each system:

- Design criteria, design intents, operating parameters
- Standard operating procedures (including information to assist in troubleshooting system operating problems; each valve position for all manual operation, etc.)
- System operating and maintenance (including regular, preventive and emergency maintenance + inspection and verification forms). A summary with all the required maintenance parts and frequencies at which each equipment must be maintained/ replaced (media, UV lamp, etc.) will be included and identified « Maintenance schedule summary ».

All documents shall be submitted to the Consultant in a first draft version in one (1) copy, format .pdf, **in French**. After review and acceptance of this first version by the Consultant, the Contractor shall produce a final version to be submitted to the Consultant in three (3) copies. The Contractor shall review the manuals until they are approved.

Manuals must be provided within 15 days of commissioning.

#### **A.11 Training of operating personnel**

The training of operating personnel must be prepared, **in French**, according to the section « General Technical Specifications – Tests, Training and Manuals ».

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. Ensure presence of manufacturer representatives who will train personnel. Maintenance manuals shall be provided prior to training.

Training of operating personnel will last at least two (2) days. Manufacturer representatives will have to be on site for at least 2 separated days for the training. The two (2) days do not have to be consecutive. The second day of training will have to be a day on which the operators execute the maintenance and the operation under the supervision of the manufacturer's representative.

#### **A.12 Details, survey and layout**

The Contractor will have to install the equipment relying on the available space inside the water treatment room. Drawings are shown schematically and indicate the approximate location of the equipments. The Contractor is responsible for the specific layout of the equipments. The Contractor shall provide a shop drawing of the piping and accessories which must include and must rely on the specific shop drawings of the suppliers.

#### **A.13 Decommissioning and Dismantling**

The Contractor will have to plan and execute the dismantling works of the existing water equipment. The existing equipments related to the fire pumps must not be dismantled and must be maintained as-is. Some of the existing equipments, such as the sink, the hot water tanks, the valves and the check valves associated with the sink/and or the hot water tanks will have to be moved to fit in the new layout of the room.

The Contractor must provide the Owner a written list of the removed equipments. All removed equipments still belong to the Owner and must be stored at the location designated by the Owner.

The Contractor shall refer to the section in « General Technical Specifications – Decommissioning and dismantling » for requirements for decommissioning and dismantling.

#### **A.14 Coordination and work schedule**

The Contractor is responsible for the coordination between all his suppliers, between the Owner and between the Owner's representatives.

The Contractor's work schedule must be approved by the Owner prior to commencing the works..

#### **A.15 Shop Drawings**

**Along with its bid**, the Contractor must supply shop drawings for the the following equipments:

- Pump systems
  - Car wash pumps system
  - Raw water pumps system
  - Distribution pumps system
- Multi Media filter
- Anion Exchanger
- Cation Exchanger (water softener)
- UV system

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- Sodium hypochlorite injection unit

All equipment will have to be supplied in shop drawings, but only those listed above have to be supplied along with the bid.

The contractor must refer to the section « Shop Drawings » of the General technical specification for the shop drawings requirements.

## **B. TECHNICAL CLAUSES**

### **B.1 Temporary water distribution and water interruption**

The Contractor is responsible during all the time of the works until the end of the commissioning to provide a temporary water distribution to the embassy and to the car wash system. The required pressure and flow of the temporary systems are the same as the required pressure and flow of the supplied systems. A temporary pressure relief valve must be operational during the temporary water distribution for each system. The pressure relief valve must return water to the reservoir it came from and must be set at the same value as the existing pressure relief valve or at the value specified in the article "pressure relief valves".

The Contractor may use existing equipment, supplied equipment or temporary equipment for the temporary water distribution.

The Contractor is allowed to make at most two (2) water interruptions to each the water distribution and the car wash for the whole length of the works. Each water interruption for a single system needs to be of at most four (4) hours and must not be on the same day for the same system.

Each water interruption has to be approved by the Owner at least two (2) days in advance.

The only time available for water interruptions are as follows:

- During the evening or during the night, between 20h00 and 5h00 (any day of the week);
- Sunday or Saturday morning, before 10h00 a.m. (water distribution must be operational at 10h00 a.m.).

The bidder must include the cost of those limited water interruptions in the total cost of his bid.

### **B.2 Equipment Identification**

The Contractor must supply and install the required identification, labeling or signage for each pipe, valve and piece of equipment.

The identification must be made according to the section « General Technical Specifications – Equipment Identification »

In addition, the Contractor must label reservoir filling equipment according to the article « Excavation, reservoir filling piping and road side box » of this section.

In addition, the Contractor must label all car washing and irrigation taps/hose connections as "Non-Potable" in English, French and Haitian Creole.

### **B.3 Water leak tests**

The Contractor shall perform leak tests as specified by this section for the following equipments :

- The sodium hypochlorite retention tank ;
- All piping, valves, accessories and all water treatment equipments.

The Contractor shall refer to the section in « General Technical Specifications – Tests, Training and Manuals » for requirements for leak tests on all equipments piping, valves and accessories.

#### **B.4 Equipments disinfection**

The Contractor shall refer to the section in « General Technical Specifications – Disinfection of water treatment Equipments » for requirements for pipe disinfection, for reservoirs disinfection and for other equipment disinfection.

The water softener tanks and the anion exchanger tanks **must not** be disinfected on site with chlorine, although their piping must be disinfected.

The complete and detailed disinfection procedure must be presented and approved by the Consultant prior to the disinfection.

#### **B.5 Start-up and commissioning**

The contractor is responsible for testing, start-up and commissioning of all supplied and installed equipments and accessoires.

The commissioning must be made according to the section « General Technical Specifications – Tests, Training and Manuals ».

In addition to all detailed required reports, the Contractor must provide an installation summary report verifying that all components are operating in accordance with design and manufacturers' requirements. This report must include, without being limited to, the following details:

- Hardness, turbidity, total organic carbon, true color, UV transmittance, iron and manganese summary of analysis results of raw water as compared with treated water;
- Pressure reading from all gauges when water treatment operates at full capacity;
- Confirmation of no leaks in system;
- Checklist that confirms that all required equipment, testing, training and manuals have been provided.

The end of the commissioning needs to be approved by the Consultant or by the Owner.

#### **B.6 Fire suppression system**

As shown on drawing, a dedicated space inside the treatment room is provided for fire suppression system. If a spacing conflict occurs inside this dedicated space between tendered work and fire suppression system, the Contractor must modify the supplied or installed piping such that the fire suppression system is unaffected.

The Contractor must ensure that the fire suppression system is operational at all times.

#### **B.7 Floor drains**

The capacity of the floor drain in the treatment room might not be sufficient.



If the floor drain capacity is not sufficient, the Contractor will have to modify the drains and/or to install a retention tank for drained water.

The Contractor will have to suggest a work method to the Consultant. This work method must be approved by the Consultant before being executed.

### **B.8 Electricity**

All electricity works will be executed by the Contractor and coordinated with a local electrician. All materials will be supplied by the contractor. The local electrician must be chosen and approved by the Owner.

### **B.9 Excavation, reservoir filling piping and road side box**

The Contractor will have to excavate a trench for the new reservoir filling pipings. The excavation must be made following all laws, rules, standards and regulations which applies. An appropriate warning mesh must be installed over each underground conduit and pipe. Each piping must be filled within at least 300 mm of sand.

The time at which this excavation is made must be coordinated with the Owner and must be approved by the Owner.

The Contractor must design, supply, install and commission a road side box, which will be used for the reservoir filling by the hauled water truck. The design of the roadside box must be approved by the Owner and must be signed and sealed by a professional engineer licensed in Canada. The box will be corrosion resistant, will be lockable and will be large enough for the alarm, for the labels, for the pipe for reservoir filling and for the handling of the hauled water truck's pipe.

The contractor must install an alarm (red flashing light) along with the required cables which is activated only when the raw water reservoirs are full. This alarm must be supplied, installed and commissioned by the Contractor, and must be located inside the roadside box. This alarm must be clearly labeled « Immediately stop filling » in English, French and Creole.

The wiring for the alarm must be within an underground PVC conduit located close to the reservoir filling pipe, using only long radius conduit for elbows.

The Contractor must clearly label the outside reservoir hatches « Domestic Water » and « Non-Potable Water » in English, French and Creole.

### **B.10 Equipment test in Canada before shipping to Haiti**

All water treatment equipment, including piping, pumps and control panel, will be pre-assembled and pre-tested in Canada before being shipped to Haiti. A replica of the room dimensions will be marked on the ground, including marks for the equipment already on site to maintain within the room or to relocate within the room. All equipment will be pre-assembled within this replica of the room, including piping and control panels.

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Once the replica is completed, the site will be visited by the Owner and/or the consultant. The equipment will be pretested at maximum design flow at this site under the supervision of the Owner and/or the consultant. The contractor must demonstrate, using this replica, that all equipment are operational and that they fit within the allocated dimensions. Once this demonstration will be completed and will be approved by the Owner and/or the consultant, the equipment will have to be shipped by the contractor for installation at the work site.

## C. MATERIALS

### C.1 Scope of works and room size

The Contractor must supply, install and commission, and is not limited to, all the equipment specified in this section.

**Warning :** The water treatment room is of a limited size. The equipment specified in this section are of a specific size as shown on the drawing.

If the bidder wishes to submit equipments of a larger size, the bidder must submit another room layout along with its proposal. If the bidder does not submit another room layout or if the proposed room layout does not show there is sufficient space for the maintenance of the equipments, the Owner has the right to reject the bidder's proposal.

The Contractor is responsible for installing all the equipments inside the water treatment room while maintaining sufficient clearance for servicing of equipments, including a clearance of at least 1,0 meter in front of each control panel.

**Warning :** The water treatment room access is also of a limited size. It is a double door, turning from a corridor and a limited spacing between the wall and the existing fire pump system to preserve. The Contractor will have to partially disassemble equipments to pass through the doors, then reassemble the equipments inside the water treatment room. Those costs have to be included in the total cost of the bid.

### C.2 Pump systems

The Contractor must supply, install and commission three pumping systems along with their motors, their starters and/or their variable frequency drives.

The three pumping systems are as follows:

- Car wash pumping system and Raw water pumping system;
- Distribution pumping system.

All pumps and all accessories in contact with water must be NSF-61 certified.

All the components shall be pre-assembled and pre-tested on a galvanised steel base with the individual and the common suction lines, the individual and the common discharge lines, isolating valves for each pump, check valve for each pump, the required pressure gauge, the required pressure transmitter, the required strainer, the required pressure tank and isolating valves for the discharge and suction lines.

The suction and the discharge lines will include the connections for the instrument. Each of those connections must include an isolation valve and must include at least 1 tap at the suction and 1 tap at the discharge.

The pumps will be equipped with automatic air vents to eliminate air in the system.

The Contractor shall refer to the section "Control panel" of the process description (section D of this document) for the starters and the variable frequency drives.

The Contractor shall refer to the section « General Technical Specifications – Electrical Motors » for the pump's motors.

The Contractor shall refer to the appropriate section of the “Materials – Mechanical Process” (Section C of this document) for the piping, the valves, the pressure gauges, the check valves, the pressure transmitters and the strainer specifications.

Each system will be pre-assembled and pre-tested and a commissioning report will be delivered to the Consultant prior to the delivery. Pumping capacity will be tested once again during the on-site commissioning. The following test, at a minimum, must be done by the contractor:

- Verification of rotations;
- Impellers adjustment;
- Pressure readings;
- Motors electric power and current;
- Vibration readings;
- Flow readings.

The contractor must have on site all instrument allowing him to record and execute the required readings.

The Contractor shall refer to the section « General Technical Specifications – Tests, training and manuals » for the requirements.

Room size is limited; each pumping systems must have the smallest footprint possible.

#### C.2.1 Car wash and raw water pumping system

The Contractor must supply four (4) pumps pre-assembled on the same base.

The Car wash pumping system and the raw water pumping system share the same suction line and must be installed on the same base. Those two systems do not share the same discharge line, as shown on the drawings.

The system will include, on the 50mm PVC suction line:

- A strainer;
- A pressure gauge.
- An expansion joint

#### ***Car wash pumps***

The Contractor must supply, install and commission a pumping system with two pumps and two variable frequency drives (VFD), with each pump having the following capacity and efficiency:

- A flow of 10 USGPM (54.5 m<sup>3</sup>/day) at a pressure of 75 psi, with a maximum pump efficiency of at least 40% and a motor of at most 1.5 hp.

Pumps must be such as the Grundfos CRI 1-10, 1.5 hp, or approved equivalent.

The system will include, on the 25 mm PVC discharge line:

- A pressure transmitter;
- A pressure gauge;
- A pressure tank made of 316 stainless steel (18 Litre).
- An expansion joint

### ***Raw water pumps***

The Contractor must supply, install and commission a pumping system with two pumps and two starters for the raw water pumps, with each pump having the following capacity and efficiency:

- A flow of 10 USGPM (54.5 m<sup>3</sup>/day) at a pressure of 65 psi, with a maximum pump efficiency of at least 40% and a motor of at most 1.0 hp.

Pumps must be such as the Grundfos CRI 1-8, 1.0 hp, or approved equivalent.

The system will include, on the 25 mm PVC discharge line:

- A pressure gauge.
- An expansion joint

### **C.2.2 Distribution pumping system**

#### ***Distribution pumps***

The Contractor must supply, install and commission a pumping system with two pumps and two variable frequency drives (VFD), with each pump having the following capacity and efficiency:

- A flow of 35 USGPM (191 m<sup>3</sup>/day) at a pressure of 75 psi, with a maximum pump efficiency of at least 60% and a motor of at most 3.0 hp.

Pumps must be such as the Grundfos CRI 5-9, 3,0 hp, or approved equivalent.

The system will include, on the discharge line:

- A pressure transmitter;
- A pressure gauge;
- A pressure tank made of 316 stainless steel (18 Liter).
- An expansion joint

The system will include, on the suction line:

- A strainer;
- A pressure gauge.
- An expansion joint

### C.3 Water treatment equipments

#### C.3.1 Scope of work

The water treatment system must have a nominal capacity of 0.62 L/s. (10 USGPM). This system will be pre-assembled and pre-tested by the main supplier, in Canada, along with all system components. All treatment units and system must be supplied such as a production of 0.62 L/s needs to be maintained even if one unit of each system is backwashing, being serviced or is offline. Each system must have a second unit which acts as a full redundancy.

All the water treatment equipments must be supplied by the same manufacturer, hereby called the « Main supplier ». The Main supplier may supply additional equipments if the Contractor and the Main supplier wishes to.

The Main supplier must be responsible for the maintenance and operation for one year, starting after the completion and acceptance of the commissioning by the Owner as stated in the administrative clauses of this section.

#### C.3.2 Sand & anthracite filter

Supply one (1) sand & anthracite duplex filter model, operated in parallel including the fiberglass tanks, electronic control valves and independent raw and backwash water inlets. This model allows production of 10 USGPM (0.62 L/s) at a hydraulic loading of 3.98 USGPM/ft<sup>2</sup> (9.7 m/h) when one (1) unit is in operation. The second unit acts as a full redundancy when backwashing or servicing. The filter backwash shall be initiated based on elapsed time controlled by an electronic timer. All the components shall be pre-assembled on a galvanised steel base with all the required valves to allow backwashing with treated water.

The duplex filter shall have the following characteristics:

- Two (2) – Fiberglass Reinforced Plastics (FRP) tanks, 24 inches diameter and 72 inches height designed for 125 PSI maximum operation;
- Tanks media contain 0.14 m<sup>3</sup> (5 ft<sup>3</sup>) of anthracite 0.6-0.8mm for a thickness of 480mm, 0.08 m<sup>3</sup> (3 ft<sup>3</sup>) of filter sand 0.45-0.55mm for a thickness of 300mm and support media;
- Power supply: 120 V, 60 Hz, 15A;
- Maximum operating temperature, 32°C;
- Operating pressure: minimum 22 psi, maximum 100 psi;
- Control valve inlet and outlet diameter: 1 1/2 inches;
- Each cylinder of media shall be capable of treating a flow of 10 USGPM without loss of efficiency when the cylinder is in maintenance mode or washing;
- Automatically controlled backwash;
- Backwash sequence initiation shall be controlled by a programmable electronic timer;
- Controller shall include a relay enclosure for activation of motorised valves complete with a dry contact state indicator (backwash) and an emergency power source (UPS) to maintain programming during long power failures;
- Internal distribution piping and collecting laterals are included and pre-assembled at the plant;

- The filter skid shall be supplied with backwash piping ready to be connected to treated water supply including two (2) motorized valves, isolating valves, sampling port, pressure gauge and flow regulation valve on treated and backwash water;
- Interconnection piping between two skids shall be 1½ inches diameter PVC SCH 80. This piping shall be supplied by the Contractor;
- Operation flow rate shall be as follows:
  - Service flow rate: 5 usgpm (0.31 L / s) per filter for a total of 10 usgpm (0.62 L / s), and 10 usgpm when only one filter is operational;
  - Backwash flow rate: 31 usgpm (1.95 L / s) for a filter bed expansion of 40% at a temperature of wash water at 13° C (55 F) for 10 minutes. The water will come from the water supply treated at a pressure of 25 PSI. The filters are washed one at a time;
  - Fast rinse rate: 31 usgpm (1.95 L / s) per filter for 10 minutes.
- Backwash frequency:
  - Maximum, once per day. Will be set according to the fouling rate and will be adjustable by the operator.

### C.3.3 Anion ion exchanger

Supply one (1) duplex anionic ion exchanger model including the fibreglass tanks, an electronic control valves, independent raw and backwash water inlet and one brine tank. The units will be operated alternately. This model allow to produce 10 USGPM (0.62 L/s) while one (1) unit is in operation. Ion exchanger regeneration shall be initiated based on elapsed time controlled by an electronic timer and treated volume shall be compiled by an integrated water meter. All the components shall be pre-assembled on a galvanized steel base with all the required valves to allow regeneration with treated water.

The duplex anion exchanger shall have the following characteristics:

- Two (2) – FRP tanks, 14 inches diameter and 65 inches height designed for 125 PSI maximum operation;
- The two (2) tanks will be filled with three (3) cubic feet of anionic resin each for organic carbon removal;
- A polyethylene brine tank 24 inches diameter by 41 inches height with a false bottom and a brine valve;
- Power supply: 120 V, 60 Hz, 15A;
- Maximum operating temperature, 32°C;
- Operating pressure: minimum 22 lb / in<sup>2</sup>, maximum 100 lb / in<sup>2</sup>;
- Control valve inlet and outlet diameter: 1½ inches;
- Each ion-exchanger cylinder shall have a nominal capacity of 10 USGPM (0.62 L/s);
- Automatically controlled regeneration;
- Regeneration sequence initiation shall be controlled by a programmable electronic timer;

- Controller shall include a relay enclosure for motorised valves activation, a dry contact state indicator (backwash) and an emergency power source (UPS) to maintain programming during long power failures;
- Internal distribution piping and collecting laterals are included and pre-assembled at the plant;
- The ion-exchanger shall be supplied with backwash piping ready to be connected to treated water supply including two (2) motorized valves, isolating valves, sampling port, pressure gauge and flow regulation valve on treated and backwash water;
- Interconnection piping between two skids shall be 1½ inches diameter PVC SCH 80. This piping shall be supplied by the Contractor;
- Operation flow rate will be as follows:
  - Service flow rate: 10 usgpm (0.62 L/s);
  - Backwash rate: 3 usgpm (0.18 L / s) for a bed expansion of 75% at a temperature of wash water at 13° C (55 F) for 10 minutes;
  - Brining and slow rinse: 1,2 usgpm (0.07 L/s) for 60 minutes;
  - Fast rinse rate: 3 usgpm (0.18 L/s) for 20 minutes.
- Regeneration frequency:
  - One (1) unit regeneration per 3 days, with a regeneration rate adjustable by the operator;
  - Exchangers will be regenerated alternately one on line and one in regeneration or waiting.

#### C.3.4 Cation exchanger (water softener)

Supply one (1) duplex cation exchanger model, including the fiberglass tanks, an electronic control valves, independent raw and backwash water inlet and one brine tank. The units will be operated alternately. This model allow to produce 10 USGPM (0.62 L/s) while one (1) unit is in operation. Ion exchanger regeneration shall be initiated based on treated volume compiled by an integrated water meter. All the components shall be pre-assembled on a galvanized steel base with all the required valves to allow regeneration with treated water. The residual hardness of the outlet of the exchanger shall be +/- 80 mg/L.

The duplex cationic ion exchanger shall have the following characteristics:

- Two (2) – FRP tanks, 18 inches diameter and 65 inches height designed for 125 PSI maximum operation;
- The two (2) tanks will be filled with five (5) cubic feet of anionic resin each for hardness removal;
- A polyethylene brine tank 24 inches diameter by 41 inches height with a false bottom and a brine valve;
- Power supply: 120 V, 60 Hz, 15A;
- Maximum operating temperature, 32°C;
- Operating pressure: minimum 22 lb / in<sup>2</sup>, maximum 100 lb / in<sup>2</sup>;
- Control valve inlet and outlet diameter: 1 ½ inches;



- Each ion-exchanger cylinder shall have a nominal capacity of 10 USGPM (0.62 L/s);
- Automatically controlled regeneration;
- Regeneration shall be initiated based on treated volume compiled by an integrated water meter;
- Controller shall include a relay enclosure for motorised valves activation complete with a dry contact state indicator (backwash) and an emergency power source (UPS) to maintain programming when long duration power failure;
- Internal distribution piping and collecting laterals are included and pre-assembled at the plant;
- The ion-exchanger shall be supplied with backwash piping ready to be connected to treated water supply including two (2) motorized valves, isolating valves, sampling port, pressure gauge and flow regulation valve on treated and backwash water;
- Interconnection piping between two skids shall be 1½ inches diameter PVC SCH 80. This piping shall be supplied by the Contractor;
- Operation flow rate will be as follows:
  - Service flow rate: 8.2 usgpm (0.51 L/s);
  - Backwash rate: 7 usgpm (0.44 L / s) for a bed expansion of 75% at a temperature of wash water at 13° C (55 F) for 10 minutes;
  - Brining and slow rinse: 2 usgpm (0.12 L/s) for 60 minutes;
  - Fast rinse rate: 7 usgpm (0.44 L/s) for 10 minutes.
- Regeneration frequency:
  - Each 19 m<sup>3</sup> treated water;
  - Exchangers will be regenerated alternately one on line and one in regeneration or waiting.

### C.3.5 UV disinfection system

Supply and install one ultraviolet (UV) sterilisation system designed at a dose of 80 mJ/cm<sup>2</sup>. This system, fully factory assembled, allows the continuous disinfection of water. All the components shall be pre-assembled on one (1) galvanized steel base. The system shall have the following characteristics:

- Three (3) UV sterilizers Viqua model PRO-10 (or equivalent), approved NSF55 class A with 316L SS body and each having its own controller;
- The controllers have a display button control to identify the intensity of UV radiation, the operating life of the lamp and generate a fault signal when required (lamp down, probe intensity down, end of the useful life expectancy of the lamp);
- The maximum flow rate of those units will be 21.2 L/min (5.6 usgpm);
- Ultraviolet rays are generated in each reactor by means of a Sterilume lamp (or equivalent), low pressure technology and high intensity, placed inside a quartz sleeve;
- The maximum allowable pressure is 862 kPa (125 psi);
- The maximum operating temperature is 40° C (104 F);

- Sterilizers shall be installed in parallel at a flow limited at half of the lamp design to expose the water to a dose of 80 mJ / cm<sup>2</sup>. Two units will be required for the total flow, the third unit shall provide the required redundancy;
- Three (3) isolation automatic valves (solenoid valves) will be installed upstream or downstream of each sterilizers;
- Two (2) filter housings with 1 micron nominal cartridge (cartridge filters) will be installed upstream of the sterilizers. Each filter will have a capacity of at least 10 USGPM. The filters will be in parallel and valves will be installed such that the treatment can proceed while servicing one of the two filters;
- The interconnecting piping shall be 38 mm (1½") PVC Schedule 80. This piping, factory assembled, will allow the throughput of water continuously through the sterilizer and allow the isolation of any sterilizer for maintenance without stopping any pumps;
- The sterilizers inlet and drain pipe fittings shall be 19 mm (¾") PVC Schedule 80;
- The outlet pipe shall be 25 mm (1") PVC Schedule 80;
- Manual isolation valves shall be ball type True Union PVC with EPDM seals (or equivalent);
- One (1) control cabinet for power supply management system, solenoid valves and relay of alarms.

#### C.3.6 Sodium hypochlorite injection unit

Supply and install one (1) sodium hypochlorite injection unit fully factory assembled. The system must include the following items:

- One (1) 204 liter tank of high density polyethylene graduated with a wall thickness of 5 mm and including a non-metal screw cap;
- One (1) retention tank for the 204 liter tank;
- One (1) polyethylene supporting wall plate for the installation of injection pumps and piping;
- One (1) manual agitator made of polypropylene. The agitator shall be installed on top of the screw cap of the 204L tank;
- Two (2) level switches to prevent dry running of injection pumps at a low level of chemicals (each with low and very-low level), compatible with chlorine;
- One (1) graduated calibration cylinder of 250 ml installed on the supporting wall plate;
- At a low level in the tank, an alarm light shall turn on at the pump and dry-contact shall be activated;

- Two (2) Prominent electromagnetic chemical injection pumps (one in service, one on standby) series Gamma L model GALa 1601 NPB 900UD113100 (or equivalent). The pumps are equipped with auto-degassing head. The pumps adjustment goes from 0-100% stroke length and 0-180 pulses/minute. The maximum operating pressure is 1744 kPa (253psi) Flow rate 0 to 0.59 l / h (0.16 USG / h). The pumps are powered on 120 VAC:
  - Each pump will be supplied with a flow switch and alarm;
  - These pumps are connected to the suction and discharge lines including all necessary fittings such as: isolating valves, foot valves, etc. The pumps are installed on polyethylene support;
  - These pumps will receive a 4-20mA or pulse signal from a control panel, a water meter or from a flow meter;
  - The pumps are supplied with one (1) safety relief valve each and one (1) back pressure valve for two (2) pumps.
- One (1) retractable injection quill model CCS-58-PVC-H with check valve ball and spring made in Hastelloy to inject chemicals directly in the center of the pipe. Injector kit is supplied with 1/2" FNPT ball valve and 3/4" MNPT connector for connection to the drinking water pipe.

#### C.3.7 Static mixer

Supply and install one (1) static mixer Koflo series 328 with the following characteristics:

- Construction PVC;
- Diameter 38mm (1 1 / 2");
- Number of items: 3 ;
- Connections: 1 1 / 2" flange class 150.

#### C.3.8 Water meter

A pulsed water meter is used to control the flow from the metering pumps for chlorine injection.

All supplied water meters must be from the same manufacturer. The Contractor must refer to the section C "water meter" of the current section for the water meters specifications.

Each water meter may or may not be supplied by the main manufacturer, at the choice of the Contractor.

#### C.3.9 pH, Chlorine and turbidity analyser and recorder

Supply and install one (1) in-line analyser system. This system, fully factory assembled, allows the continuous measurement of free chlorine, pH, turbidity and temperature. All analysers must be from the same manufacturer. The system shall include:

- One (1) wall mounting plate polypropylene 25.4 mm thick where the following items shall be attached;
- One (1) flow through chamber PMMA model CCA-250 (Endress & Hauser) with locations for inserting chlorine and pH probes. This chamber shall include a flow indicator, with proximity switch to announce a loss of flow and connecting fittings for PVC pipe of 1/2";
- One (1) free chlorine sensor CCS141-N (Endress & Hauser) with amperometric membrane;

- One (1) pressure reducing valve made of brass ½" model 25AUB-LP-Z3 1/2" by Watts or equivalent;
- Two (2) pressure gauges Winter's LF series with ¼" rear connector stainless steel and glycerine filled dial. The movement and the tube are made of stainless steel. The reading range of the upstream pressure reducing valve shall be 0-160 lb/in<sup>2</sup> and 0-15 lb/in<sup>2</sup> downstream;
- One (1) degasification room and turbidity sensor CUS-31-W-2 (Endress & Hauser). This room eliminates air bubbles potentially present in the water. The turbidity sensor operates under the principle of scattered light 90°. A 7m cable is provided. A wiper with programmable operation keeps the sensor clean. A temperature reading is performed via an integrated NTC sensor;
- One (1) interconnecting Schedule 80 to ½" PVC piping and valves surrounding the chlorine flow through chamber. This piping, factory assembled, will allow the continuous throughput of water through different reading probes. A control valve must be provided to allow adjustment to a flow rate between 30 and 120 L/h;
- The assembly will also allow the isolation and maintenance of the system without stopping the pump. A sampling tap is available for chlorine;
- Isolation valves shall be ball type True Union PVC with EPDM seals;
- One (1) control cabinet including the following items:
  - One (1) NEMA 4 painted steel enclosure complete with mounting plate. The dimensions of the box shall be at most:
    - 508 mm height;
    - Width 406 mm;
    - 300 mm depth.
  - One (1) main switch 15A ;
  - One (1) control lamp power status with self-audit function ;
  - **A visual numerical display to read the current values for each analyser**
  - One (1) Chlorine transmitter model CCM223 -EP3110 (Endress & Hauser). This transmitter is installed in front of the control panel. In addition to free chlorine and chlorine dioxide, it shall be able to measure temperature and pH. The reading range of pH 3.5 to 9.5. The reading range of free chlorine shall be 0.01 to 5 mg Cl<sub>2</sub> / l. It shall have a measurement output for chlorine and pH. A programmable alarm relay shall be available for chlorine and pH;
  - One (1) turbidity transmitter CUM-223 (Endress & Hauser). This transmitter is installed in front of the control panel. It shall possess a measurement output for turbidity, suspended solids and temperature. This transmitter also controls the operation of the mechanical wiper ;
  - One (1) paperless recorder with four analog inputs. It receives the 4-20mA signals from the chlorine transmitter (chlorine and pH) and turbidity transmitter (turbidity and temperature). This recorder will possess the following characteristics:
    - Six (6) universal inputs (U, I, TC, RTD) with integrator;
    - Four (4) digital inputs;
    - Three (3) relay outputs;

- RS232 / RS485 with cable for PC;
- STN color screen 126mm with resolution of 320 X 240 Pixels;
- Communication software ReadWin;
- Power to the control cabinet is 120V / 60Hz / 15A;
- All the required connection terminals for the connection of different devices.

The items listed above are fully assembled at the factory. The system comes ready to connect. The work of the Contractor on site includes:

- Wall installation of the system;
- Connection of the input and the system output, including the alarms relay to other control panels, (see process description);
- Electrical connection to the control cabinet.

The commissioning of the analysers system shall be provided by technicians from the Main manufacturer. The commissioning shall cover the following points:

- Installation of sensors;
- Turning Power ON equipment;
- Programming transmitters;
- Calibration of sensors;
- Training of operating personnel.

#### **C.4 Treated water reservoirs**

The treated water reservoirs are already supplied on site.

The Contractor must supply, install and commission all the equipment linked to the two (2) reservoirs for treated water storage. Each reservoir have a capacity of 800 IMP gallons (3600L; 952 USG), such as the CT-805 from ACO Container systems or approved equivalent by the consultant.

Each reservoir already have the following accessories :

- A manway of 406 mm diameter with a lid and locking strap;
- A threaded connector of 75 mm for the vent (at the top);
- A flanged connection of 37 mm for the water inlet (at the top);
- A flanged connection of 75 mm for the water outlet (at the bottom);
- A flanged connection of 17 mm for the pressure relief valve (at the top);
- A threaded connector of 100 mm for the cables of the 5 level switch (at the top);

The Contractor must supply, install and commission the following equipment for each reservoir :

- A level switch holder for five (5) level switch. The holder will be secured inside the reservoir and will be installed right beside the manway hole. The holder will have multiple section in order to have enough room to remove it from the top of the reservoir. The level of each switch must be easily adjustable.
- A vent, which must be in PVC and must have a diameter of at least (2½ po), a stainless steel grid and an opening which is facing the ground.
- A propriety base.

Each reservoir must be installed according to the manufacturer's instructions.

### **C.5 Water Meters**

The Contractor must install, supply and commission water meters of the following diameters for the following applications :

- 100 mm (4 inch) for raw water reservoir filling from trucks (FI 060);
- 50 mm (2 inch) for raw water reservoir filling from rain (FI 050);
- 25 mm (1 inch) for car wash distribution (FI 020);
- 25 mm (1 inch) for treated water distribution (FI 410);
- 25 mm (1 inch) for water treatment. This must be a pulsed water meter (FIT 310).

All supplied water meters must be of the same brand, such as Neptune or approved equivalent by the consultant. Each water meter must have the following characteristics :

- NSF-61 certified;
- Lead free;
- Maximum operating pressure: 150 PSI;
- Accuracy for the following diameter:
  - 1 inch: at least 95-105% for flow over 0,5 usgpm ;
  - 2 inch: at least 95-105% for flow over 2,0 usgpm ;
  - 4 inch: at least 95-105% for flow over 3,5 usgpm.
- Can be installed in vertical or horizontal position without losing accuracy;
- Unit of measurement: U.S. Gallons;
- Manual reading;
- Register capacity of at least 9 999 999 U.S. gallons.

In addition to the previous characteristics, the pulsed water meter must also have the following characteristics:

- Output pulse: 1 pulse for 10 liters.

Each water meter must be installed according to the manufacturer's instructions and to the drawings.

Each water meter must be installed at a height of at most 1.4 meter from the floor and must be easily accessible so that the operator can easily perform manual readings.

### **C.6 Level switches**

The Contractor must install, supply and commission level regulators (level switches), including accessories for mounting and installation, for the following applications :

- Raw water reservoirs #1 and #2 (3 interruptors for each reservoir as shown on drawings);
- Treated water tanks #1 and #2 (5 interruptors for each tank as shown on drawings);
- The level switches in the sodium hypochlorite tank (LSL 311 and LSLL312) must be supplied by the main manufacturer. Those level switches must have the same characteristics, except that they also need to be safe for immersion in sodium hypochlorite.

All supplied level switches (except LSL 311 and LSLL 312) must be of the same brand, such as model « ENM-10 » from supplier « Xylem (Flygt Canada) », or « Serie K » from supplier « Kelco », or approved equivalent by the consultant. Each level switch must have the following characteristics :

- Lead free;
- CSA certified, for general use;
- Float type, with a regulator casing made of polypropylene or PVC and with a cable sheathed with a PVC or Nitrile/PVC rubber compound;
- Lead free;
- Installation with a sway control ring and with all the necessary hardware (lateral float supports, and all other required components);
- Cable must be of sufficient length to allow connection directly to the control panel without any joints or splices. Selection of cable length is the responsibility of the Contractor;
- Level of installation specified in process description.

Each level switch must be installed according to the manufacturer's instructions (storage conditions, mounting hardware, installation methods, bending radius, pinching/clamping of the cable, etc.).

### **C.7 Strainer (screen)**

The Contractor must install, supply and commission screens (strainers) of the following diameters for the following applications :

- 50 mm (2 inch), or wider, for rain water meter protection;
- 63 mm (2½ inch), or wider, for raw water pumps protection (this screen is already included in the raw water/car wash pumps supply, and this screen has to be of the same brand as the two other screens);
- 100 mm (4 inch), or wider, for raw water reservoir filling meter protection.

All supplied screens must be of the same brand, such as Cal-Val or Singer or approved equivalent by the consultant. Each screen must have the following characteristics :

- Built with NSF-61 certified materials;

- Ductile iron fusion bonded epoxy coated construction with a 316 stainless steel strainer;
- Service must be possible without removal from the line;
- Strainer in 316 stainless steel;
- External fasteners and washers in stainless steel;
- Pressure rated 150 psi;
- Standard 10 mesh size;
- Headloss must be limited to 0.5 psi for a 20 gpm flow for the strainer used for raw water pumps and for rain water meter protection;
- Headloss must be limited to 3 psi for a 1000 gpm flow for the strainer used for raw water reservoir filling meter protection.

Each screen (strainer) must be installed according to the manufacturer's instructions.

### **C.8 Pressure gauges**

The Contractor must install, supply and commission pressure gauges for many applications.

All supplied pressure gauges must have the following characteristics, which also apply to the pressure gauges supplied by the Main supplier and the pressure gauges included in the distribution pumps :

- NSF-61 certified;
- Lead free;
- Gauge must be glycerin filled and must have a diaphragm or a chemical seal;
- Pressure range of the gauges:
  - For pumping systems: as specified by the pump manufacturer, or, if not specified, 0-160 psi;
  - For other equipment: 0-160 psi.
- Reading units: Psi;
- Unless otherwise specified, manometer must be from Ashcroft, Winters, Wika or approved equivalent by the consultant;
- Pressure gauge must be in stainless steel with with a glass cover and with an aluminum dial;
- Gauge size : Dial of a diameter of 100 mm (4 inch).

### **C.9 Air Vents**

The Contractor must supply, install and commission air vents at all high points of the water treatment pipings. A total of 5 air vents will be required.

All supplied air vents must be of the same brand and must be NSF-61 certified.

The contractor must refer to the section « Piping, valve and accessories » of the General technical specification for the installation requirements and the required characteristics of the equipment.



The exact location of each air vent must be suggested by the Contractor on the shop drawings of the piping and must be approved by the Consultant, during the review of this/those shop drawings.

### **C.10 Piping**

The Contractor must supply, install and commission all the required pipings and accessories to produce treated water using the specified equipments, to send the treated water to the treated water reservoirs, to distribute the treated water, to distribute hot water as before the works but from a different hot water tank location, to fill the raw water reservoir, to send overflow water of the raw water reservoirs to the streets and to distribute raw water to the car wash. Location of the connections for the car wash piping and the treated water distribution system are as directed by the Owner.

In addition, the Contractor must supply, install and commission all the required pipings and accessories to send, directly to the drain, the drain water from the equipments and from the air vents, and to send, directly to the reservoirs, the pressure relief valves outflows.

The contractor must refer to the section « Piping, valve and accessories » of the General technical specification for the installation requirements to be met.

All pipings and accessories must withstand a 100 psi pressure and up to a 150 psi surge pressure. Unless otherwise stated, pipings will be in pvc schedule 80.

The Contractor must supply all flanges, bolts, gaskets and other required accessories to connect the supplied piping to existing piping or to piping supplied by others.

In addition, the Contractor shall meet the following requirements for all piping installation :

- The piping must not decrease the clearances between equipment within 0,90 m;
- Slip socket union must be installed between each equipment to facilitate removal or replacement;
- Unless otherwise indicated, the piping must be installed along the walls or must allow a clearance between the invert of the pipes and the floor slab of at least 2,4 metres;
- Do not route piping in locations or at heights that will create tripping hazards or impede the required movement of personnel.

### **C.11 Expansion Joint**

The expansion joints must be NSF-61 certified and much be such as Redflex J1 model or approved equivalent.

### **C.12 Plumbing**

The Contractor must supply, install and commission a standard garden water hose along with a nozzle (with 3 patterns or more) which shall be mounted securely to a wall such as the Suncoast Sidewinder or equivalent. The hose must have a length of 30 meters and a diameter of 5/8 inch and must be rated for 100 psi or more. All steel parts must be in stainless steel, including bolts.

The Contractor shall use an existing connection from the treated water distribution pipings, if available; otherwise, the Contractor will have to install a new connection along with a double check valve.

The Contractor must supply, install and commission a sink inside the water treatment room, along with a cold water and a hot water connection. The Contractor may use the existing sink (not shown on the drawings) but will have to change its location and extend the existing piping and drains. The location of this sink must be approved by the owner before being installed.

### **C.13 Valves**

The Contractor must supply, install and commission valves as shown on the drawings.

The contractor must refer to the section « Piping, valves and accessories » of the General technical specification for the installation requirements and the required characteristics of the equipment.

### **C.14 Pressure relief valve**

The Contractor must install, supply and commission pressure relief valves of the following diameters for the following applications :

- 13 mm (½ inch) for raw water pumps discharge (SRV 010)
  - Relief pressure adjustable between 40 psi and 120 psi (or a wider range), set at 90 psi for installation (setpoint to be confirmed by the consultant)
- 13 mm (½ inch) for car wash pumps discharge (SRV 020)
  - Relief pressure adjustable between 40 psi and 120 psi (or a wider range), set at 90 psi for installation. (setpoint to be confirmed by the consultant)
- 13 mm (½ inch) for treated pumps discharge (SRV 430)
  - Relief pressure adjustable between 40 psi and 120 psi (or a wider range), set at 80 psi for installation. (setpoint to be confirmed by the consultant)

All supplied pressure relief valves must be of the same brand, such as Fisher, Watts, Singer, Cla-Val, Bermad or approved equivalent by the consultant. Each pressure relief valve must have the following characteristics :

- NSF-61 certified;
- Lead free;
- Maximum operating pressure: at least 200 psi;
- Body in cast iron with an epoxy painting or in stainless steel;
- Spring and all nuts, bolts and internal fittings must be in stainless steel;
- Relief pressure easily adjustable on site.

The setting of the relief valves will need to be adjusted by the Contractor during the commissioning.

### **C.15 Pressure transmitter (with integrated display)**

The Contractor must install and supply pressure transmitters, including all assembling accessories. The Pressure Transmitters are included in the pump systems (Section C.2).

Each pressure transmitter must be installed according to the manufacturer's instructions (storage conditions, mounting hardware, installation methods, etc.).

Identification: PT-020 and PT-403.

The pressure transmitters shall comply to the following specifications:

- NSF-61 certified;
- CSA certified for general usage;
- Integrated transmitter, with French display on 4 alphanumeric lines, configurable display, configurations display buttons must be on the front of the pressure transmitter. Configured to display pressure in psi, in French;
- Aluminum box NEMA 4X/6P (IP66/67) and ½" NPT threaded connector cable;
- Operating temperature from 0 to 70 C;
- Process temperature from 0 to 40 C;
- Fed from 4@20mA loop at voltage of 24 Vcc;
- Maximum measurement error of +/- 0.25 % of the measured value on all the measured value range;
- ceramic measuring cell;
- An analog output 4 @ 20mA configured to place the minimum value (3.6 mA) on an alarm;
- Pressure range: as specified by the pump manufacturer, or, if not specified, 0-160 psi.

The pressure transmitters must be supplied by Endress+Hauser, model PMC71, or approved equivalent.

### **C.16 Replacement parts**

The Contractor must supply equipments and replacement parts for the use of the Owner:

- At least twenty (20) 20 kg bags of salt NSF-60 certified;
- One UV lamp for each UV lamp installed in UV reactors;
- Two metering pump spare parts kit, supplied by the manufacturer of the metering pump (for Gala 1601, kit # 10001666), including, and not limited to:
  - 1 Diaphragm
  - 1 Suction Valve
  - 1 Discharge Valve
  - 1 Connector Sets
  - 2 Valve Balls
  - 1 Set O-rings
- Flexible tubing for metering pumps, length as installed
- At least 2% (rounded up) of each model of flanges, gasket, solenoid valves and manually operated valve;
- All replacement parts for 1 year (parts which must be replaced once per year must be supplied);

Those parts must be all available for the Owner at the end of the commissioning.

### C.17 Alarms

The Contractor must supply, install and commission flashing lights alarms panels which are linked to a specific equipment or to the principal control panel.

The alarm locations must be suggested to the Owner by the Contractor and must be approved by the Owner.

The required alarms are as follows:

- Alarm panel inside the water room for raw water reservoirs level, identified “Réserve d’eau de livraison: bas niveau”, which includes:
  - One Solid Yellow light ;
  - One flashing red light.

Activation of these alarms is described in the process description.

- Alarm panel inside the water room for treated water reservoirs level, identified “Réserve d’eau traitée: bas niveau”, which includes:
  - One Flashing yellow light ;
  - One Flashing red light.

Activation of these alarms is described in the process description.

- Alarm panel inside the water room for the pumps and the water treatment system, identified “Systèmes de traitement et pompes”, which includes:
  - One Flashing red light.

This alarm is activated when the principal control panel has an active alarm. The alarm is active if one alarm or more has not been acknowledged and if any of the acknowledged alarms are still active.

- Alarm panel outside, located at the hauled water filling station, for raw water reservoirs, identified “Réserve d’eau de livraison”, which includes:
  - One flashing yellow light.

Activation of this alarm is described in the process description.

### C.18 Eyewash station

The Contractor must supply, install and commission an eyewash station which complies to the ANSI Z358.1-2009 Emergency Eyewash and Shower Equipment standard. The Contractor must supply, install and commission all the required piping to supply the eyewash station with a water temperature ranging from 16°C to 38°C. A check valve and a valve must be installed on each piping which feeds the eyewash station.

The eyewash station must have the following characteristics:

- Be able to deliver fluid to both eyes simultaneously at a volume of no less than 0.4 gallons/minute for 15 minutes;
- Velocity of fluid should not be high enough to cause eye injury;
- Mounted 33 to 45 inches from the floor;

- Mounted a minimum of 6 inches away from the wall or obstructions;
- Activation time of 1 second or less and the unit should remain in operation without the need for continued activation;
- Actuating valve or lever should be in an easily located area and be highly visible;
- Must have nozzle caps to prevent foreign matter from accumulating in the nozzle area;
- Nozzle caps should automatically separate from the nozzles when activated;
- Signs & Lighting - highly visible signs must be posted in the area of emergency eyewash and shower stations. The location should be well lit.

#### **C.19 Manuals**

The Contractor must supply and install wall filing trays with plastic engraved label indicating « Manuels d'opération » and « Résultats d'échantillonnage ».

The trays must be large enough for the manuals.

## D. PROCESS DESCRIPTION, INSTRUMENTATION AND CONTROL

### D.1 Scope of works

**Control panels:** The Contractor must supply, install and connect control panels which meet the specified requirements in this section. The contractor must also supply all wiring and required conduit.

The Contractor must design and supply the connection drawings of each control panel.

The works include, but are not limited to, the design, the labor, the supply, the manufacture, the installation, the adjustments, the configuration, the calibration, the internal electrical connections, the electrical connections, of all systems of command of the control panels.

The Contractor must supply three control panels, as shown in the table of electricity and control equipment (table is shown at the end of this section).

**Signal connections:** The Contractor must also connect all signals (120 Vac, 24Vcc, 4-20mA) to the control panels and to the alarms

**Operator interface (screen) :** The contractor must supply, install, connect, program and configure an operator interface located in front of the panel. A standard display which simplifies the visualization must be supplied in shop drawings and must be based on the process diagram (see drawings). Uniformity is required for displaying the operating states and the measurement units.

### D.2 Process description

#### D.2.1 Raw water pumps and raw water reservoirs

Pumps P011, P012, P021 and P022 are controlled by the principal (main) control panel (PCP) and by the raw water control panel (RCP). The PCP also regroups control devices, alarms and operating display. The RCP regroups starters and variable frequency drive (VFD) of the pumps. Each pump has a control mode "Manual-Off-Auto", which is selectable on the operator interface of the PCP.

In "Off", the pump is stopped and is not available for automatic sequence.

Control signals to the PCP for each pump are as follows:

- Run command;
- Operating fault or alarm.

Each raw water reservoir (2) has an operating mode selector "On - Off", selected on the operator interface. In "On", all controls and alarms will be operational. In "Off", controls and alarms will be suspended.

Very low level switches of the raw water reservoir (LSLL-011 and LSLL-021) produce an alarm at the PCP and stops the raw water pumps (all 4 pumps). If both reservoirs are « on », both level switches need to be activated to stop the pumps. If one reservoir is « off », and the level switch of the raw water reservoir which is « on » is triggered, then the PCP stops the raw water pumps (all 4 pumps).

Low level switches of the raw water reservoir (LSL-012 and LSL-022) produce an alarm at the PCP. The alarm is triggered when one level switch from any of the two reservoirs is activated, if the reservoir from which the alarm is triggered is « on ».

Very high level switches of the raw water reservoir (LSHH-013 and LSHH-023) produce an alarm at the PCP. This alarm is forwarded to both a flashing red light in water room and to an external red flashing light, located at the security fence for the water hauling truck (see drawing H103).

Level switches levels and alarms are specified in this table:

**Table : Raw water reservoirs level switches**

Float	Tank #1	Tank #2	Level	Alarm type	Automatic response for water equipments	Response by the embassy staff
LSHH	013	023	2.85 m	Flashing red light in water room Flashing yellow light outside at security fence	None	Immediately stop filling tank
LSL	012	022	2.2 m	Solid Yellow light in water room at location determined by senior staff employed by the Owner	None	Immediately contact water company to request water hauling truck
LSLL	011	021	1.8 m	Flashing red light in water room	Automatic shutdown of raw water and car wash pumps	Immediately contact water company to request water hauling truck

#### **Manual operation pumps P-011 and P-012**

The "manual" mode allows the starting and stopping of the pumps, bypassing all controls, even the very low level of raw water reservoirs.

#### **Manual operation pumps P-021 and P-022**

The "manual" mode allows the starting and stopping of the pumps, bypassing all controls, even the very low level of raw water reservoirs.

The VFD may be set at any value allowed by the supplier from the PCP at the operator interface.

***Automatic operation pumps P-011 and P-012***

In automatic operation, the starting and stopping of pumps P-011 and P-012 are controlled by the level of treated water reservoirs. The starting of a pump is initiated by one of the following conditions (refer to section D2.4) :

If treated water tank #1 is « On »:

- Low level LSL-412;
- Very low level LSLL-413;
- Extremely low level LSEL-414.

And/Or, if treated water tank #2 is « On »:

- Low level LSL-422;
- Very low level LSLL-423;
- Extremely low level LSEL-424.

Confirmation of whether the pump is working or not will be performed by the signal of the pulsed water meter FIT-310. Following a request for starting a pump, if the water meter does not transmit any signal within a period of 30 seconds (adjustable from 5 to 120 seconds from the PCP display), the pump will be considered faulty, an alarm at the PCP is generated and the pump will be stopped.

The PCP performs alternating sequences of pumps after each start/stop cycle. One pump replaces the other one in case the other pump is “off” or in fault. Each pump is designed to handle the peak flow at the selected pressure.

In automatic operation, the stopping of a pump is initiated by one of the following conditions:

- Very low level in raw water tank (refer to D.2.1);
- Alarm and/or « off » for each of the three UV lamps (refer to section D.2.2).

If treated water tank #1 is « On »:

- High level LSH-411;
- Very high level LSHH-410.

Or, if treated water tank #2 is « On »:

- High level LSH-421;
- Very high level LSHH-420.

***Automatic operation pumps P-021 and P-022***

In automatic operation, the starting and stopping of pumps P-021 and P-022 are controlled by the pressure in the discharge line of the pump, which is recorded by the pressure transmitter PT-020. Pressure must be maintained at 75 psi and may drop to 70 psi. The PCP controls the VFD to maintain this pressure.



The PCP performs alternating sequences of pumps after each start/stop cycle. One pump replaces the other one in case the other pump is « off » or in fault. Each pump is designed to handle the peak flow at the selected pressure.

Confirmation of whether the pump is working or not will be performed by the pressure at the discharge line. Following a request to start a pump, if the pressure in the discharge line is still below 60 psi after a period of 10 seconds (adjustable from 2 to 30 seconds from the PCP display), the pump will be considered faulty, an alarm at the PCP is generated and the pump will be stopped. Those specified values of 60 psi and 10 seconds must be adjusted on site by the Contractor.

In addition, in automatic operation, the stopping of a pump is initiated by the following condition:

- Very low level in raw water tank (refer to D.2.1).

#### D.2.2 UV disinfection system

Each UV lamp (3) is operational at all times with the lamp being on even while the water treatment is stopped. Each UV lamp is equipped with its lamp connector, its UV intensity sensor and its controller. Each lamp (3) has its own solenoid valve (FV-201, FV-202 and FV-203).

A relay box (BJ-203) is supplied with the system. In normal operation mode, the relay box maintains each solenoid valve in the open position.

The following signals will be relayed to the PCP:

- Fault on UV#1 (closure of FV-201 from BJ-203);
- Fault on UV#2 (closure of FV-202 from BJ-203);
- Fault on UV#3 (closure of FV-203 from BJ-203);
- Open command on UV cooling solenoid valve FV-204.

Faults on UV 1, 2 or 3 generate an alarm at the operator interface of the PCP.

In case of a fault from UV #1, #2 and/or #3, BJ-203 will close the solenoid valve from the appropriate UV line and will send a fault signal to the PCP. When the alarm signal from BJ-203 will be suspended, it will open the solenoid valve and abort the fault signal to the PCP.

In case of a simultaneous fault signal from the (3) lamps, PCP will command a continuous stop to the raw water pumps P-011 and P-012. After at least one lamp is back online, raw water pumping from P-011 and P-012 will become possible.

Even when raw water pumping from P-011 et P-012 is stopped, all UV lamps will still be on. If both pumps P-011 and P-012 have been stopped for at least 10 minutes (adjustable between 1 to 360 minutes and can be disabled at the operator interface), the PCP commands the opening of the water cooling solenoid valve (FV-204) to avoid overheating the UV lamps. The PCP commands the closure of the solenoid valve FV-204 when a raw water pump (P-011 or P-012) is confirmed to be working.

#### D.2.3 Sodium hypochlorite injection

The sodium hypochlorite injection system consists of the following control accessories and equipment :

- Low level switch (LSL-311);

- Very low level switch (LSLL-312);
- Two dosing pumps (DP-301 and DP-302);
- A solenoid valve for water carriage of chlorine (FV-303).

The following signals are transmitted to the PCP:

- Hold command for DP-301;
- Fault from DP-301;
- Dosing speed signal for DP-301;
- Hold command for DP-302;
- Fault from DP-302;
- Dosing speed signal for DP-302;
- Opening and closing for the solenoid valve FV-303;
- Low level of the sodium hypochlorite reservoir LSL-311;
- Very Low level of the sodium hypochlorite reservoir LSL-312.

Control of the disinfection system is made from the PCP.

The dosing pump is considered “on” if the hold command is not activated and if there is no fault alarm of the dosing pump. When dosing pump is on, the PCP will order the opening of the solenoid valve FV-303.

When a low level switch is activated (LSL-311 and/or LSLL-312), the PCP generates an alarm at the operator interface, relayed to a red flashing light, but does not stop the dosing pumps nor the raw water pumps.

### ***Operation modes***

Each dosing pump has a control mode "Manual-Off-Auto" which can be selected on the operator interface of the PCP.

When “Off”, the dosing pump is stopped and is unavailable for automatic operation.

### ***Manual operation***

In manual operation, the dosing pump is operated from the operator interface at the PCP with buttons to start and stop, and the speed is manually entered on the operator interface.

### ***Automatic Operation***

In automatic operation, the dosing pump is controlled by the control logic, and the metering speed command from the calculation of automatic dosing is sent to the dosing pump. The dosing pumps are redundant with one in operation and the other one on stand-by.

A dosing pump is considered “available for automatic operation” when the control mode for the dosing pump is selected for automatic mode and no faults are coming from the dosing pump.

If no flow is measured by the pulsed water meter FIT-310, the dosing pump may stay in automatic mode, but the dosing pump must be stopped. It will be started when a flow will be measured from FIT-310.

In automatic operation, the metering speed of the dosing pump is established by the setpoint dosing value, the concentration of chlorine in the solution, the calibration curve of the dosing pump and the water flow (FIT-310).

The following parameters must be entered on the operator interface:

- Sodium hypochlorite concentration of the solution (%);
- Setpoint value of chlorine for treated water (mg/L).

For this metering system, units and range are as follows:

- Sodium Hypochlorite concentration of the solution, in g/L. The range of concentration is from 10 to 200 g/L. Default value is 120 g/L, which corresponds to a concentration of 12%;
- Range for the setpoint value of chlorine for treated water is 0.00 to 10.00 mg/L;
- The calibration curve of each dosing pump, in L/h.

The control system always calculates the metering speed of the dosing pumps, even if the dosing pumps are unavailable in automatic mode. This calculation is made using the setpoint dosing value, the setpoint concentration of chlorine of the solution, the calibration curve of the proper dosing pump and the water flow (FIT-310). The metering speed calculation is performed as follows:

- The setpoint value of chlorine for treated water (mg/L) is multiplied by the water flow rate (L/hr) to obtain the required mass (mg/h);
- The control system must perform conversions of units needed to obtain the required mass in g/h;
- The required mass (g/h) is then divided by the sodium hypochlorite concentration of the solution (g/L) to obtain the volumetric flow (L/h) of the solution to be pumped by the metering pump;
- Finally, the volumetric flow rate is used with the calibration curve to calculate the metering speed of the pump in automatic mode for all the dosing pumps of the dosing system.

Calculation example for the metering speed in automatic operation of the dosing pumps:

Considering the following parameters:

- Setpoint value of chlorine for treated water of 1.5 mg/L;
- Sodium Hypochlorite concentration of the solution : 2%;
- Water flow from FIT-310 : 5680 L/h;
- Dosing pump 1 calibrated from 0 to 1.35 L/h for a metering speed ranging from 0 to 100%;
- Dosing pump 2 calibrated from 0 to 1.30 L/h for a metering speed ranging from 0 to 100%.

Calculation results:

- The 2% concentration is converted in g/L, thus 20 g/L;
- The required mass is 8.52 g/L ;
  - The volumetric flow is 0.426L/h ;

- The calculated speed for each metering pump is:
  - Dosing pump 1 :  $0.426 \text{ L/h} / 1.35 \text{ L/h} = 31.5\%$ ;
  - Dosing pump 2 :  $0.426 \text{ L/h} / 1.30 \text{ L/h} = 32.8\%$ .

#### D.2.4 Distribution pumps and treated water reservoirs

Pumps P401 and P402 are controlled by the principal control panel (PCP) and by the distribution control panel (DCP). The PCP also regroups control devices, alarms and operating display. The DCP regroups starters and variable frequency drive (VFD) of the pumps. Each pump has a control mode "Manual-Off-Auto", which is selectable on the operator interface of the PCP.

Water is distributed by 2 variable frequency drive (VFD) pumps and one pressure transmitter (PT-403). The distributed water volume is measured by a water meter. One pump has the full capacity for the designed flow and pressure, but, if required, both pumps may be operational at the same time.

In "Off", the pump is stopped and is not available for automatic sequence.

Control signals to the PCP for each pump are as follows:

- Run command;
- Operating fault or alarm.

Each raw water reservoir (2) has an operating mode selector "On - Off", selected at the operator interface. In "On", all controls and alarms will be operational. In "Off", controls and alarms will be suspended.

The control signals to the PCP are shown below

Float	Tank #1	Tank #2	Level	Alarm type	Response by the embassy staff
LSHH	410	420	2.18m	At PCP and Flashing red light in water room	Stop raw water pumps
LSH	411	421	2.15m	High level	None
LSL	412	422	1.6m	Low level	None
LSSL	413	423	0.5m	At PCP and Flashing yellow light in water room	1. Make sure water treatment is operational 2. Reduce water consumption in the chancery, if possible, by restricting non-vital usage
LSEL	414	424	0.1m	At PCP and Flashing red light in water room	1. Make sure water treatment is operational

If both treated water reservoirs are "on", both level switches need to be activated to activate an action (alarms are still activated). If one reservoir is "off", only the level switch from the treated water reservoir which is "on" needs to be triggered to execute an action.

**Operation modes**

Each pump has a control mode "Manual-Off-Auto" which can be selected at the operator interface of the PCP.

When "Off", the pump is stopped and is unavailable for automatic operation.

**Manual operation**

The "manual" mode allows the starting and stopping of the pumps, bypassing all controls, even the very low level of treated water reservoirs.

The VFD may be set to any value allowed by the supplier from the PCP at the operator interface.

**Automatic Operation**

The operation of this system at a set pressure is controlled by the PCP:

- When pressure becomes lower than the set pressure, a first pump is started;
- If pressure detected by PT-403 becomes lower than the low pressure setpoint, despite the first pump being already at full capacity, the second pump is started and both pumps are operational simultaneously;
- At each start up, pumps are maintained operational for a minimal time adjustable between 0-60 minutes;
- When pressure becomes over the high pressure setpoint value, the VFD is adjusted to reach the set value;
- An adjustable time of 0-30 seconds allows to validate the value from the transmitter;
- If one pump is stopped due to a breakage or a fault, the other pump takes over;
- Pumps will be alternating at each start/stop cycle;
- Low pressure setpoint, pressure setpoint and high pressure setpoint must be adjustable for each step at the PCP operator interface;
- Pumps will be protected by a low level switch in the water distribution reservoirs (LSEL-414 and/or LSEL-424) and the PCP will command the stopping of the pumps in this condition. Pumps will be automatically restarted when the water tank level reaches the very low level (LSLL-413 and/or LSLL-423);
- In automatic operation or in manual operation, when an overcharge/fault from a motor occurs, the proper pump is stopped by the overload relay/control device and an alarm will be generated. The pumps will have to be restarted manually;
- In automatic operation, in case of a loss of a phase, motors will be stopped by the detector of phase losses. In this case, the restarting of the pumps will be automatic, but an alarm will be initiated and maintained.

The pressure will be displayed at the user interface. An alarm will be initiated if pressure drops below the alarm setpoint, adjusted at 40 psi (adjustable between 5 to 100 psi on the operator interface of the PCP). A high pressure alarm will be initiated when the pressure become higher than the alarm setpoint, set at 90 psi (adjustable between 5 to 120 psi at the operator interface of the PCP).

**D.2.5 Monitoring and alarms**

All alarms must be displayed on the operator interface of the PCP, along with a red flashing light indicating that there is an alarm, located inside the water room.

On the operator interface, for all analog instruments, the following must be configurable and will be adjusted during the commissioning:

- A scale (4-20 mA) converted to engineering units (m, cm, psi, pH, m<sup>3</sup>/h, etc.);
- Four (4) alarm setpoints (LL or very low), (L or low), (H or high) et (HH or very high);
- Four (4) alarm activation selectors;
- Four (4) dead band associated with each alarm setpoint;
- Four (4) alarm activation delays associated with each alarm setpoint;
- Open loop alarm if the signal is below the lower value of the values range (if < 3.9 mA).

From the operator interface of the PCP, for all digital alarm connected to the PCP or programmed inside the PCP (Fault from a pump, fault from a dosing pump, fault from an instrument, fault from UV, Start/stop denial from pumps, fault from any equipment, alarms from level switches, etc.) the following must be configurable and will be adjusted during the commissioning:

- Alarm activation ;
- Alarm activation delay.

Each alarm must be shown on a page entitled « activated alarms » at the operator interface. This page must include the alarm name, its description, date and time of occurrence and acknowledgment status. The page must include, at least, the last 200 occurrences.

Each alarm transition status (Active and unacknowledged, Active and acknowledged, Back to normal and unacknowledged, back to normal and acknowledged) must be listed in an alarm history list. The history must include the name of the alarm, its explicit description, the date and time of occurrence, the alarm status and the acknowledgment status. The history must include, at least, the last 1000 occurrences. The operator interface must offer the possibility to extract the alarm history to a USB stick and by an Ethernet cable in a treatable file format such as a spreadsheet (Excel) as CSV or TXT, using an activatable control from the operator interface. If a special software is required, it must be supplied with the required license and installed on a client computer before training.

**Data filing (archiving)**

The PCP will record the timestamp data which will allow the generation of daily and monthly monitoring reports of the process. The operator interface must register for a minimum period of six months the following data:

Analog equipment

Sampling type		Contin uous <sup>(1)</sup>	Daily minimum	Daily average	Daily maximum	Daily total volume	Total volume
Data	Id						
Flow <sup>(2)</sup>	FIT-310	√	√ <sup>(3)</sup>	√	√	√	√
Pressure	PT-403 PT-020	√	√	√	√		
Turbidity	None		√	√	√		
pH	None		√	√	√		
Residual chlorine	None		√	√	√		

(1) One data every 5 minutes

(2) Flow must be calculated using the pulsed water meter.

(3) When a flow is measured since at least 5 seconds (>0).

A trend page (graph) must present archived analog data.

The operator interface must offer the possibility to extract the archived data to a USB stick and by an ethernet cable in a treatable file format such as a spreadsheet (Excel) as CSV or TXT, using an activatable control from the operator interface. If a special software is required, it must be supplied with the required license and installed on a client computer before training.

Digital equipment

Each motor (pump, dosing pump) must have a page which records and shows the following data:

- Number of starts/stop (daily, monthly and total);
- Total operating hours (daily, monthly and total).

**D.3 Control panels physical characteristics**

Instrument and control equipment will have to be operational without any fault or malfunction under the following environmental conditions:

Inside of a building

- Temperature : 0° C to +40° C
- Temperature (inside panels) : 0° C to +50° C (inside of a panel)
- Humidity : 5% to 95%

**D.3.1 Size**

The maximum size of the control panel must be appropriately selected by the Contractor taking into account the available size inside the water room.

**D.3.2 Box type**

The control panels will be NEMA 4 in painted steel and will regroup the PLC, the relays, the protection devices and all other required accessories to execute the control sequence as described in this document.

The control panels will include one (1) master switch with fuse-links installed with a handle in the front door of the lockable panel in "OFF" position using a padlock.

**D.3.3 Static uninterruptible power supply (UPS)**

All devices in the control system and PLC must be powered from a filtered seamless power source.

The power for control shall be taken from the available chancery's UPS panel.

The Contractor must supply, install and commission all necessary connections to this panel, connections which will have to be coordinated with a local electrician who is approved by the Owner.

**D.3.4 Programmable logical control (PLC)**

The Contractor shall provide a programmable controller capable of managing the points of I / O and perform all logical functions of command to ensure a reliable and independent control.

The PLC must be of industrial grade. It must have the following characteristics:

- One (1) processor (CPU) with memory, timers, counters;
- The I / O modules;
- At least one (1) Ethernet communication port;
- Mathematical integers to 32-bit signed functions;
- Integrated PID functions;
- Timers, counters and internal sequencers;
- Records of data maintained in the event of power loss;
- Programming should be done according to IEC 1131-3 with the five following languages: Function block diagram, structured text, ladder diagram, instruction list and Sequential function chart;
- A speed of 0.4 ms/K or better;



- The processor must include a real-time clock module to establish a time base for the controller functions that require coordination with events in real time.

#### D.3.5 Input and output modules

The I / O extensions must have the following characteristics:

- Plug-in modular format into the common structure of the PLC;
- Each input / output module shall be provided with an identification plate;
- The Contractor must provide an addition of 20% (rounded up) of the needs of I / O system, and for each type of I / O used;
- Contractor is responsible for spinning all inputs and outputs of the controller and maps terminals images, including the 20% additional inputs and outputs.

#### D.3.6 Operator interface (display)

The operator interface must have the following characteristics:

- In color and tactile;
- With Ethernet and USB port;
- Eight (8) inch minimum;
- Include all communication cables, all programming cables and all the required mounting accessories;
- Include a 2 GB minimum SD card for data recording.

#### D.3.7 Codes, standards and regulations

All electricity and control equipment covered by this specification shall be designed, manufactured and tested in accordance with the latest version of the standards.

All materials, structures and working methods must comply with security and construction codes which apply and must comply with the codes and standards listed below. In case of conflict between the regulations, the most stringent requirements prevail.

**Table: Codes, standards and regulations for electricity and control**

Codes	Description
ANSI	American National Standards Institute
ANSI 250	Enclosure for Electrical (1000 volts maximum)
ASTM	American Society for Testing of Materials
CEI 61131	International standard for programmable logic controllers
CEMA	Canadian Electrical Manufacturers Association

Codes	Description
NBCC	National Building Code of Canada
C22.2 n° 0	Canadian Electrical Code Part II-General Requirements
CSA C22.1	Canadian Electrical Code Part I
CSA C22.2 no14	Industrial control equipment
CSA C22.2	Bonding of Electrical Equipment
CSA C22.2 no45	Rigid Metal Conduit
CSA C22.2 n° 56	Flexible Metal Conduit & Liquid Tight Flexible Metal Conduit
CSA Z462	Workplace electrical safety
EIA	Electronics Industries Association
EIA RS-232-C- 69	Interface between Data Terminal Equipment Employing Serial Binary Data Interchange
EN 61800-3	Adjustable Speed Electrical Power Drive Systems – Part 3: EMC Product Standard Including Specific Test Methods and Amendments A11
EEMAC	Electrical & Electronic Manufacturer's Association of Canada
FM	Factory Mutual
IEC 529	Specification for Degree of Protection Provided by Enclosure (IP Code)
IEEE	Institute of Electrical and Electronic Engineers
IEE 472-74	Guide for Surge Withstand Capability (SWC) tests
ISA	Instrument Society of America
ISA RP55.1	Hardware Testing of Digital Process Computers
ISA S5.1	Instrument Symbols and Identification
ISA S5.2	Binary Logic Diagrams for Process Operations
ISA S5.3	Graphic Symbols for distributed Control/Shared Display Instrumentation,

Codes	Description
	Logic and Computer Systems
ISA S5.4	Instrument Loop Diagrams
ISA S5.5	Graphic Symbols for Process Displays
NEC	National Electrical Council
NEMA IS1.1	Enclosures
NEMA ICS 1	General Standards for Industrial Control Devices and Systems
NEMA ICS 2	Industrial Control Devices, Controllers and Assemblies
NEMA ICS 3.1	Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems
NEMA ICT6-78	Enclosures for industrial controls and systems.
NFPA-70E	National Fire Protection Association
SAMA	Scientific Apparatus Makers Association
UL	Underwriter Laboratories

**Identification**

All internal components must be identified by photomechanical indelible labels.

All external components must be identified by photomechanical indelible labels.

DFAIT

Water treatment – Canadian Chancery Section

N/Ref. : 25288

**SPECIAL TECHNICAL SPECIFICATIONS**

**Table: Electricity and control equipment supply**

Equipment Name	Function	Tetra Tech Identification		Function description and note	HP	Type	Volt/ ph	Supply by <sup>1</sup>
Principal control panel	Control	PCP		Principal control pannel (alarms, display, etc.)				Contractor
Raw water control panel	Control / Electricity	RCP		Car wash pumps and raw water pumps				Contractor
Distribution control panel	Control / Electricity	DCP		Treated water pumps				Contractor
Alarms	Control / Electricity	Not identified		see specifications and process description		Red and Yellow lights		Contractor
<b>RAW WATER</b>								
Level regulator	Level of raw water reservoir #1	LSLL	011	Micro-switch contact to PCP Alarm		Float	24V	Contractor
Level regulator	Level of raw water reservoir #1	LSL	012	Micro-switch contact to PCP Alarm+ pump protection level		Float	24V	Contractor
Level regulator	Level of raw water reservoir #1	LSHH	013	Micro-switch contact to PCP Alarm for filling		Float	24V	Contractor
Level regulator	Level of raw water reservoir #2	LSLL	021	Micro-switch contact to PCP Alarm		Float	24V	Contractor
Level regulator	Level of raw water reservoir #2	LSL	022	Micro-switch contact to PCP Alarm+ pump protection level		Float	24V	Contractor
Level regulator	Level of raw water reservoir #2	LSHH	023	Micro-switch contact to PCP Alarm for filling		Float	24V	Contractor

**DFAIT****Water treatment – Canadian Chancery Section****N/Ref. : 25288****SPECIAL TECHNICAL SPECIFICATIONS**

Pulsed water meter	Water to treatment	FIT	310	signal transmission to PCP		Electromagnetic		Contractor
In-line vertical centrifugal pump	Raw water to treatment	P	011	Command by PCP with treated water tank level	1	fixed speed		Contractor
In-line vertical centrifugal pump	Raw water to treatment	P	012	Command by PCP with treated water tank level	1	fixed speed		Contractor
In line pump	Raw water to car wash	P	021	Command by PCP with PT-020 signals	1.5	Variable frequency drive		Contractor
In line pump	Raw water to car wash	P	022	Command by PCP with PT-020 signals	1.5	Variable frequency drive		Contractor
Pressure transmitter	car wash pressure	PT	020	4-20 mA signal transmission to PCP			24V	Contractor
<b>FILTERS AND EXCHANGERS</b>								
Relay box for multimedia filters	Electric supply and control	BJ	110	Backwash motorized valve+ filters top mounted valve			120/1	Main Supplier
Relay box for anion exchangers	Electric supply and control	BJ	120	Backwash motorized valve+ filters top mounted valve			120/1	Main Supplier
Relay box for water softeners	Electric supply and control	BJ	130	Backwash motorized valve+ filters top mounted valve			120/1	Main Supplier
<b>UV DISINFECTION</b>								
Relay box for UV disinfection	Electric supply and control	BJ	203	Alarm signal from FV-201, FV-202 and FV-203 to PCP			120/1	Main Supplier
Solenoid valve for cooling water	Cooling of UV reactors	FV	204	Open to recirculate treated water through UV reactors		ON-OFF (NC)	120/1	Contractor

**DFAIT****Water treatment – Canadian Chancery Section**

N/Ref. : 25288

**SPECIAL TECHNICAL SPECIFICATIONS**

<b>SODIUM HYPOCHLORITE INJECTION</b>								
Metering pump	Sodium hypochlorite	DP	301	Control via signal 0/4 - 20 mA from PCP		electromagnetic diaphragm	120/1	Main Supplier
Metering pump	Sodium hypochlorite	DP	302	Control via signal 0/4 - 20 mA from PCP		electromagnetic diaphragm	120/1	Main Supplier
Solenoid valve	Carry NaOCl to injection point	FV	303	Open to allow water flow		ON-OFF (NC)	120/1	Contractor
Level regulator	Low level in NaOCl tank	LSL	311	Micro-switch contact to PCP		Float	24V	Main Supplier
Level regulator	Very Low level in NaOCl tank	LSLL	312	Micro-switch contact to PCP		Float	24V	Main Supplier
<b>TREATED WATER TANK AND DISTRIBUTION</b>								
In-line vertical centrifugal pump	Distribution	P	401	Command by PCP with PT-403 signals	3	Variable frequency drive		Contractor
In-line vertical centrifugal pump	Distribution	P	402	Command by PCP with PT-403 signals	3	Variable frequency drive		Contractor
Pressure transmitter	Distribution	PT	403	4-20 mA signal transmission to PCP			24V	Contractor
Level regulator	Treated water tank #1	LSHH	410	Micro-switch contact to PCP Overflow alarm		Float	24V	Contractor
Level regulator	Treated water tank #1	LSH	411	Micro-switch contact to PCP Full tank level		Float	24V	Contractor
Level regulator	Treated water tank #1	LSL	412	Micro-switch contact to PCP Filling tank level		Float	24V	Contractor
Level regulator	Treated water tank #1	LSLL	413	Micro-switch contact to PCP Alarm+ pump rearming level		Float	24V	Contractor

**DFAIT****Water treatment – Canadian Chancery Section****N/Ref. : 25288****SPECIAL TECHNICAL SPECIFICATIONS**

Level regulator	Treated water tank #1	LSEL	414	Micro-switch contact to PCP Alarm+ pump protection level		Float	24V	Contractor
Level regulator	Treated water tank #2	LSHH	420	Micro-switch contact to PCP Overflow alarm		Float	24V	Contractor
Level regulator	Treated water tank #2	LSH	421	Micro-switch contact to PCP Full tank level		Float	24V	Contractor
Level regulator	Treated water tank #2	LSL	422	Micro-switch contact to PCP Filling tank level		Float	24V	Contractor
Level regulator	Treated water tank #2	LSLL	423	Micro-switch contact to PCP Alarm+ pump rearming level		Float	24V	Contractor
Level regulator	Treated water tank #2	LSEL	424	Micro-switch contact to PCP Alarm+ pump protection level		Float	24V	Contractor

**THIS ELECTRICITY AND CONTROL LIST IS NOT LIMITED**

## Notes:

1-Supply by the Contractor might be by the Main Supplier, as chosen by the Contractor. Supply by the Main Supplier must be by the Main supplier

## General notes

2- Unless otherwise specified, all cables must be Teck or PVC pipe

3- The cable trays must be used in priority for routing cables

4- Cables must be supported on the walls and between the walls and each equipment

5 - The #16 pairs must be shielded and lay, for a 4-20 mA signal type