

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1        This section includes the specific technical clauses for the execution of the cathodic protection system elements.

**1.2            RELATED SECTIONS**

- .1        Section 01 11 00 – Description of Work
- .2        Section 01 61 00 – Common Products Requirements
- .3        Section 05 12 23 – Steel

**1.3            REFERENCES**

- .1        Contractor must comply with the codes, standards and regulations, as well as with the good practice rules as recommended by the following associations, related to the Work to be executed. The federal laws and regulations prevail on the other codes and standards.
  - .1        ANSI, American National Standards Institute
  - .2        API, American Petroleum Institute
  - .3        ASME, American Society of Mechanical Engineers
  - .4        ASM, American Society for Metals
  - .5        ASTM, American Society for Testing and Materials
  - .6        AWS, American Welding Society
  - .7        AWWA, American Water Works Association
  - .8        BNQ, Bureau de Normalisation du Québec
  - .9        CEMA, Canadian Electrical Manufacturers Association
  - .10       CEQ, Quebec Electrical Code
  - .11       CGSB, Canadian Government Standard Board
  - .12       CPQ, Quebec Plumbing Code
  - .13       CSA, Canadian Standards Association
  - .14       CSST, Code de sécurité pour les travaux en construction
  - .15       MDDEP, Ministère du développement durable, de l'environnement et des parcs du Québec
  - .16       NACE, National Association of Corrosion Engineers
  - .17       NBC, National Building Code
  - .18       NFPA, National Fire Protection Association
  - .19       SSPC, Steel Structures Painting Council
  - .20       ULC, Underwriters Laboratory of Canada

- .2 The edition prevailing for the above-mentioned standards, laws and regulations is the one in force at the time of the Call for Tenders. However, the Contractor must not restrict himself to the application of the above-mentioned standards only, but he must rather comply with all the standards to which his work could be related to.

#### **1.4 CONTRACTOR'S COMPETENCE**

- .1 Contractor should have personnel being qualified for the cathodic protection system installation and in electricity. He should submit a report written by a competent professional authorized to work in the province of Quebec, certifying that the equipment and its installation comply with the regulations in force. There must be in his team engineers specialized in electricity and in cathodic protection to seal plans and to take in charge work done in their own field.

#### **1.5 GUARANTEE**

- .1 Regardless the Contract general clauses, during the guarantee period, if the cathodic protection system stops due to the total or partial failure of the system, the duration of this failure will be added to the guarantee period, so that finally, the owner gets a total of two (2) years of good operating condition for his system.
- .2 After notification to Contractor, the department's representatives will repair the cathodic protection system during the guarantee period, without affecting the guarantee conditions.

#### **1.6 VERIFICATION OF BASIC DATA FOR THE PROJECT REALIZATION**

- .1 Contractor must verify himself the basic data required for the project whole realization. He must ensure he has on hand all the information required for the installation and good operation of the system. The Departmental Representative will supply him all the data available. If they are required, all additional tests, site visits or other actions necessary to the project realization will be at the Contractor's charge.
- .2 The approximate bathymetry is indicated on the plans. Before starting the anodes fabrication process, Contractor should verify the bathymetry to have the precise measurements of the equipment location and check if any obstacles prevent any work execution on the worksite. Afterwards, the bathymetry results will be submitted for approval to department's representative, with the shop drawings showing the anodes assembly and the cables connections.

#### **1.7 SHOP DRAWINGS**

- .1 Three (3) days after the reception of acceptance of Offer notice, the Contractor must give to the Departmental Representative the list of shop works he intends to make before beginning the work in situ.
- .2 The Departmental Representative will proceed to various inspections of these shop works. The Contractor should give all the facilities to the Departmental Representative so they have access and can properly examine the components and assemblies at various stages upon the Departmental Representative request.
- .3 The inspections do not reduce in any way the Contractor's responsibility regarding the quality of his materials and workmanship.

## **1.8 WORK DESCRIPTION**

Without being restricted, the works are as follows:

- .1 The cathodic protection has one anodes circuit. The anodes must be installed on the sheet piles as indicated on the plans. The anodes cables must be attached on the main cable in the pulling-box.
- .2 The Contractor must install the conduits and pulling-box in the slab in order to protect the anodes positive and negative cables. The details are indicated on the plans.  
  
Then, the Contractor must connect the main cable of the anodes circuit and the negative cable of the structure to the rectifier, and the rectifier cables to the electrical system.
- .3 The quality control of the Cathodic Protection system is made as follows:
  - .1 With an remote control system (RMU); the Contractor must installed in the electrical room, the RMU with 8 acquisition channels. The phone line is supplied by others.
  - .2 With corrosion samples and reference electrodes installed on the sheet piles.
- .4 The Contractor must install reference electrodes and corrosion samples on the sheet piles, as indicated on the plans. For the reference electrodes, the Contractor must install a negative cable attached to the electrode support, as indicated on the plans. The reference electrodes cables and their negative cable will be routed towards the pulling-box and connected to the data acquisition system. Also, the instruments cables will be installed between the rectifier and the data acquisition system for voltage and ampere measurements.  
  
Concerning the corrosion samples, their installation will be made only upon the rectifier connection, and the samples surfaces will be cleaned with an oxide before immersion.
- .5 The connection of the data acquisition system is the Contractor's responsibility. The electrical installation of the data acquisition system is also the Contractor's responsibility.

## **1.9 MINIMUM REQUIREMENTS**

- .1 The specifications and plans give the minimum requirements for the Work execution. The Work should be executed in accordance with the other regulations and codes in force in the province of Quebec.  
  
Contractor must make sure his personnel is qualified for the work execution, particularly concerning the Quebec Electrical Code and cathodic protection specialty.
- .2 The electrical plans are schematic and the Contractor must make sure that the installation complies with the codes in force. Then, the works must be executed by competent personnel.
- .3 Before proceeding with the electrical connection, a document signed by an authorized engineer must be provided to the Departmental Representative, certifying that the installation complies with the codes and standards in force in the province of Quebec.

## **1.10 OPERATION AND MAINTENANCE DATA**

- .1 At the most 15 days after the completion of work, provide six (6) copies of a maintenance manual written in French.
- .2 Include the following information in the document

- .1 The description and the operating and maintenance instructions of the various equipment, including the complete list of the equipment and of its components.
- .2 The names, addresses and phone numbers of the sub-traders and professionals.
- .3 The guarantees and their duration.
- .4 The manufacturer identification and the origin of the products used in the present project.
- .5 The action to take in the case of an emergency.
- .6 The procedure to take upon ships arrival and while the ships are docking at the wharf.
- .7 The electrical components verification in order to prevent any accidents and particularly electrical shocks.

#### **1.11 FORMATION MEETINGS**

- .1 Give the wharf maintenance personnel the necessary formation regarding the operation and maintenance of the new system. Allow a minimum of 8 hours formation period on the site of the wharf.

### **Part 2 Products**

#### **2.1 GENERAL**

- .1 All the materials used for the installation of the wharf cathodic protection system should be designed for a 20-year minimum duration.

#### **2.2 PLATINIZED NIOBIUM ANODES**

- .1 The anodes characteristics for the impressed current cathodic protection system are indicated on plans.
- .2 The anodes will be Anomet 40 type or the equivalent, of 3,17 mm (0,125 in) in diameter with a platinum film of 5 microns (200 micro-inches) thick. The effective length of the anodes is indicated on plans. Anode's rods must be installing in the assembly as show on plans.

The junction anodes – electrical conductors is made with a mechanical connection and with a silver weld. The connection is protected with a thermo retractable sleeve and with epoxy. The Contractor must submit the connection's protection mode for approval.

#### **2.3 REFERENCE ELECTRODES**

- .1 Reference electrodes are Borin Stelth type, model SRE-004-SFB, specifically designed for sea-water utilization (silver - silver chloride electrodes).
- .2 Reference electrodes are protected by a PVC conduit, as indicated on plans.

#### **2.4 CORROSION SAMPLES**

- .1 The corrosion samples will be made out of 350 W steel. The samples supports must be in electrical contact with the corrosion samples via connection bolts. The electrical continuity must be checked.
- .2 The corrosion samples surfaces must be polished and the oxide removed.

- .3 The corrosion samples will be installed only upon the rectifier start-up.

## **2.5 RECTIFIER**

- .1 The rectifier must be specifically designed for cathodic protection in marine environment.
- .2 The general characteristics of the rectifier are as follows:
  - .1 Primary power supply in tri-phased 600 VAC
  - .2 Air cooling rectifier
  - .3 Rectifier is constant voltage type with 25 adjustment steps
  - .4 The casing of the rectifier is made out of painted steel.
  - .5 Rectifier made stainless steel supports anchored to the slab made out of stainless steel
  - .6 Thermal protection and automatic starter
  - .7 Lightning protection
  - .8 Voltage and amperage measurements terminals
  - .9 Local ON/OFF terminal
  - .10 Circuit for a remote ON/OFF
  - .11 High limit amperage protection system
  - .12 Ampere-meter and voltmeter.
- .3 At the secondary, the rectifier should supply 200 A at 18 VDC. Rectifier must be protected at maximum power.

## **2.6 ELECTRICAL CABLES AND CONNECTIONS**

- .1 All the AC cables fabrication and dimensions must comply with the Electrical Code in force.
- .2 All the immersed DC cables must be specifically designed to permanently resist to sea-water. Contractor must supply a certification of such. The anodes immersed cables must be double insulated, Hallar type and H.M.W.P.E., and protected by a flexible conduit in the sections that are not protected by a metallic channel.
- .3 The other DC cables must be designed for sea-water utilization.
- .4 The cables splices must be designed for sea-water utilization. Contractor must provide, for approval, a sample and the technical data sheets of the materials taken for the splices execution. As a guide for the splices fabrication, the Contractor must take the following requirements into account:
  - .1 The cables connection will be double: mechanical and by a weld.
  - .2 It is the Contractor's responsibility to design and make the splices according to the preceding requirements or otherwise. the Contractor can propose other types of splices or improve the ones described above. In all cases, the Contractor must provide a shop drawing and a sample of his design at least one week before the splices fabrication.
  - .3 It is specifically indicated that the epoxy layer must be shop made in controlled temperature and moisture conditions, according to the product technical data sheet.

- .5 The electrical cables and the surface splices on the wharf will have to be protected with metallic sheaths in the zones where the public can have direct access to the cables.
- .6 The minimum dimension (No. AWG) of the cables is as follows:
  - .1 All anodes cables are Hallar and HMWPE, no 8 type.
  - .2 The anodes main cables and the structure negative cables are RU 90 type, No 2/0.
- .7 The rectifier negative cables are double as indicated on the drawing.
- .8 The reference electrodes cables and the negative cables are double insulated, Hallar type, and HMWPE, no AWG 8.

## **2.7 GROUND**

- .1 2 grounding stations will be installed by Contractor for connection with the ships docking at the wharf. The location of the grounds connectors is indicated on the drawing. 3 cables, 100 A cables each, must be provided by Contractor.
- .2 Each grounding cable is made as follows:
  - .1 A electrical cut-off of 100 A.
  - .2 A flexible electrical cable of 100 A, similar to the one used for the welding machine of a minimum length of 30 m.
  - .3 Cable Alligator insulator clips on the ship structure.

## **2.8 OTHER ELECTRICAL COMPONENTS**

- .1 The Contractor must install the electrical components on the AC power circuit, according to indications on the plans.
- .2 All the equipment must comply with the requirements of the Electrical Code in force. It is the Contractor's responsibility to make sure the equipment and installation are in accordance with the electrical codes in force.

## **2.9 OTHER EQUIPEMENT**

- .1 The other equipment will be made in accordance with the standards currently in force and protected against public access.

## **2.10 MATÉRIALS USED**

- .1 It is not allowed to use materials other than those CSA approved. The electrical equipment selection must be approved by an electrical engineer retained by the Contractor.
- .2 All the materials should be selected so they can resist to the marine environment conditions.

## **2.11 RMU**

- .1 The long-term performance assessment will be made with a data acquisition system and by a communication system. This system will be installed in the existing service station.
- .2 The system should perform the following operations:

- .1 Data saving to pre-determined cycles. The data to be collected are the potential indicated by all the reference electrodes, the voltage, the power supplied by the rectifier and the rectifier cabinet temperature.
- .2 Allow simultaneous saving in real time of the data collected by the data acquisition system.
- .3 Save the software parameters in non volatile memory.
- .4 Save at regular intervals the above-mentioned data.
- .5 Read or save the data in ON/OFF mode according to data acquisition system predetermined cycles.
- .6 Allow the remote ON/OFF interruption of each one of the rectifiers.
- .3 The data acquisition software characteristics are as follows:
  - .1 Allow reading in real time of the data collected by the data acquisition system.
  - .2 Allow ON/OFF interruption and examine the data collected previously.
  - .3 Allow to predetermine the system control data collection cycles and the components ON/OFF interruption.
  - .4 Allow to save on disk and print the data collected.

## **Part 3 Execution**

### **3.1 ANODES PREPARATION**

- .1 The anodes will be shop made. Anodes should be carefully inspected by Contractor before commencing assembly. No platinum film damage will be tolerated.
- .2 Contractor must assemble anodes as indicated on plans. The anodes active length must be strictly respected.
- .3 The anodes fixation to the electrical conductor will first be made with a mechanical connector followed by a weld silver joint.
- .4 At the other end, Contractor must protect the copper core and the niobium casing with a weld so that they cannot get into contact with sea-water. This weld will be made by the anodes manufacturer.
- .5 The dead part of the anodes and the cable fixation to the anode will be sealed with epoxy. The Contractor should take all the necessary precautions to avoid that these can get into contact with sea-water.
- .6 The anode cable must be protected by a PVC flexible conduit. The end of this conduit must also be sealed with epoxy.
- .7 The PVC conduit threaded connections, caps and sleeves composing the anode assembly must also be sealed with epoxy.

### **3.2 REFERENCE ELECTRODES PREPARATION**

- .1 The reference electrodes will be installed in PVC conduits in the same manner as the anodes.

- .2 The live part of the reference electrodes should be cleared off to allow the reading of the structure potential.
- .3 The reference electrodes should be properly calibrated before installation in the presence of Departmental Representative.

### **3.3 RECTIFIERS PREPARATION**

- .1 Rectifiers should be inspected by Contractor upon delivery in order to check whether they comply or not with the requirements.
- .2 If changes are made by Contractor, the work must be made by qualified personnel. These modifications should be approved by the rectifiers manufacturer.
- .3 The rectifiers should be CSA approved.

### **3.4 ANODES INSTALLATION**

- .1 The anodes will be installed in the concave part of the sheet piles.
- .2 The anode will be fixed on a steel plate, as indicated on the plans.
- .3 Contractor must check if bolted connections are sufficiently screwed in.
- .4 Above the anode, Contractor must install an anode protective angle-iron to avoid any damages due to ice forces.

### **3.5 CABLES INSTALLATION**

- .1 The anodes cables will be welded to the sheet piles with steel channels indicated on the plans.

### **3.6 RECTIFIERS INSTALLATION**

- .1 Rectifier no 1 will be installed in the existing electrical building.
- .2 The fixations of the rectifiers supports will be made out of stainless steel anchored into the floor.
- .3 Contractor must connect the anodes main cable to the positive terminal of the rectifier.
- .4 Contractor must connect the cable coming from the structure to be protected to the negative terminals of the rectifier.
- .5 The rectifier will be locked with stainless steel padlock.

### **3.7 NEGATIVE CABLES CONNECTIONS**

- .1 The rectifiers negative electrical cables will be fixed where indicated on plans.
- .2 The fixation metallic angle-iron will be welded with a continuous weld. Afterwards, the angle-iron, the sheet pile and the negative cable bolted fixation will be protected with Petroleum Petro-40. The area around the fixation will be filled with a good water straining material.
- .3 Contractor must verify the electrical continuity of the sheet piles along the wharf. He must ensure the whole structure will be protected by the cathodic protection circuit. The way to ensure the electrical continuity is indicated on the plans.



### **3.8 PULLING BOX AND PIPE IN THE SLAB**

- .1 The pulling box and the piping in the slab are already installed. The Contractor must use the existing pulling box and pipe.

### **3.9 INSTALLATION OF OTHER EQUIPMENT**

- .1 The other components and equipment will be installed according to the rules of good practice and to the standards and codes in force.

### **3.10 PROTECTION OF THE PUBLIC**

- .1 During the Work, Contractor must ensure that the public does not have any direct access to the hazardous areas. He must create protected working zones.
- .2 All the electrical components must be installed so that the public cannot have access to any of them.
- .3 Contractor must install the necessary posters, French and English, warning the public of the electrocution hazard.

### **3.11 OTHER INSTALLATIONS**

- .1 The other installations should be made according to the actual standards in force.

### **3.12 VERIFICATION OF THE ELECTRICAL INSTALLATION**

- .1 Before the beginning of the Work, Contractor must verify by his engineer that all the materials and the whole installation of the cathodic protection system comply with the Electrical Code requirements and with the good practice rules. The Work should be approved by a competent authority recognized in the province of Quebec. His recommendations will prevail on all documents supplied to Contractor.
- .2 Once the system is installed, the electrical system inspection will be made by a competent authority in the province of Quebec. A certification will be given to Departmental Representative before the tests are made. It is specifically forbidden to connect the system before the certification is obtained and submitted to Departmental Representative. In case of rejection, the appropriate adjustments will be made by Contractor and the costs of such will be paid for by Contractor.

### **3.13 START-UP OF THE CATHODIC PROTECTION SYSTEMS**

- .1 Once all the components of the impressed current cathodic protection system are installed, the Contractor must proceed with the system start-up.
- .2 The Contractor must give technical assistance to the Departmental Representative for the start-up testing and allow the required time accordingly, to the utmost satisfaction of the Departmental Representative.

**END OF SECTION**