

Technical Specifications Mechanical & Electrical

For tenders

N/Ref: F2202105

Correctional Service Canada

June 2023

Archambault Establishment

244 Gibson Road, Sainte-Anne-des-Plaines



For tenders

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244 Chemin Gibson, Sainte-Anne-des-Plaines

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Log book of emissions and revisions		
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**CORRECTIONAL SERVICE CANADA
ARCHAMBAULT ESTABLISHMENT**

**MECHANICAL AND ELECTRICAL
LIST OF SECTIONS**

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ANNEXES LIST

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 22.
- .2 Section 26.

1.2 WORK COVERED BY THE CONTRACT DOCUMENTS

- .1 The Work covered by this contract includes the replacement of existing chlorination systems as well as related control and electrical equipment.
- .2 The existing chlorination systems must be disconnected and dismantled. As well as a portion of piping.
- .3 Two new chlorination systems must be supplied, installed and connected.
- .4 A flowmeter must be supplied, installed and connected.

1.3 SUBMITTALS/SAMPLES

- .1 Submit documents and samples required in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit a preliminary Work schedule following award, then an execution schedule once the equipment delivery times have been determined.

1.4 WORK EXECUTION ORDER

- .1 Execute Work in stages in order for the Contracting Authority to use the premises continuously during the Work.
- .2 Coordinate the Work progress schedule so that chlorine dosing is done continuously during the Work, either with one of the two existing systems, or one of the two proposed systems.

1.5 PREMISES OCCUPATION BY THE CONTRACTING AUTHORITY

- .1 The Contracting Authority will occupy and continue its normal activities into the premises during the construction Work.
- .2 The premises usage is restricted to the areas necessary for the execution of the Work in order to allow the operation of the equipment on the premises by the Contracting Authority;

- .3 Collaborate with the Contracting Authority in the Work establishment, so as to reduce conflicts and facilitate the use of the premises.

1.6 REQUIRED DOCUMENTS

- .1 Each of those following documents has to have a copy on site at all times:
- .1 Contract drawings;
 - .2 Technical Specifications;
 - .3 Addendum;
 - .4 Revised shop drawings;
 - .5 List of unreviewed shop drawings;
 - .6 Modification orders;
 - .7 Other contract modifications;
 - .8 Field test reports;
 - .9 Copy of approved construction schedule;
 - .10 Health and Safety Plan and other safety documents;
 - .11 Other indicated documents.

2 PRODUCTS

2.1 NO OBJECT

- .1 No object.

3 EXECUTION

3.1 NO OBJECT

- .1 No object.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 22
- .2 Section 26

1.2 ADMINISTRATIVE MODALITIES

- .1 Submit required documents and samples to Consultant for review promptly and in pre-determined order not to delay Work schedule. A delay in this respect cannot constitute a sufficient reason to obtain an extension of the deadline for the execution of the Work and no request to this effect will be accepted.
- .2 Do not undertake Work for which the deposit of documents and samples is required before the examination of all the parts submitted is completely finished.
- .3 The characteristics indicated on shop drawings, data sheets as well as products' samples and Works must be expressed in metric units (SI).
- .4 When items are not produced or manufactured in metric (SI) units or when characteristics are not given in metric (SI) units, converted values may be accepted.
- .5 Examine documents and samples before submitting them to the Consultant. By this due diligence, the Contractor confirms that the requirements applicable to the Work have been or will be determined and verified, and that each of the documents and samples submitted has been examined and found to comply with the requirements of the Work and the Contract Documents. Documents and samples that are not stamped, signed, dated and identified in connection with the particular project will be returned without being examined and will be considered rejected.
- .6 Notify the Consultant in writing when it is the time for submission of documents and samples as well of deviations from requirements of Contract Documents while stating the reasons why.
- .7 Ensure the accuracy of measurements taken on site in relation to adjacent structures affected by the Work.
- .8 The fact that the documents and samples submitted are examined by the Consultant does not relieve the Contractor of his responsibility to submit complete and accurate documents.
- .9 The fact that the documents and samples submitted are examined by the Consultant does not relieve the Contractor of his responsibility to submit documents that comply with the requirements of the Contract Documents.

- .10 Maintain on site a verified copy of each submitted document.

1.3 SHOP DRAWINGS AND SPECIFICATIONS

- .1 The Contractor must prepare and submit a copy of the shop drawings of the equipment, preferably in French, to the supervisor. A copy of the Autocad drawings (latest version) must be given to the client, if available.
- .2 Devices, accessories or instruments submitted for approval in the form of data sheets, catalog pages or any other printed form must meet the following requirements:
- .1 Trademark, model number, capacity and any other technical information pertinent to the contract must be circled in red pencil or indicated by an arrow on each data sheet in such a way that it indicates in detail what is offered;
- .3 For review, the Contractor must also provide manufacturing drawings as well as technical documentation specific to the model and type of equipment and systems proposed, which includes the general description of each and their operation, the nature of the performance and schematic diagrams (including diagrams of mechanical, electrical and other easement connections with their characteristics), critical design characteristics such as temperature, pressure, flow, load, power, current, capacity and others, as well as wiring, control diagrams and remote couplings.
- .4 Please allow 14 days for the Consultant to review each lot of submitted documents.
- .5 Changes made to shop drawings by Consultant are not intended to change the official contract price. If so, notify the Contracting Authority and the Consultant in writing before undertaking the changes.
- .6 Make changes to shop drawings as requested by Consultant in accordance with requirements of Contract Documents. When resubmitting drawings, please notify Consultant in writing of changes made in addition to those that have been required.
- .7 The Contractor should not proceed with the execution of these Works until the drawings have first been reviewed by the Engineer. This is really important. The Engineer reserves the right to have removed all materials or equipment that have not been officially accepted by shop and installation drawings at the expense of the Contractor.
- .8 The review of these drawings by the Engineer constitutes only an approval in principle and in no way engages his responsibility. It is not intended to serve as a final correction and in no way exempts the Contractor from his responsibility to check the plans himself or to provide the materials and Work required by the contract specifications and/or by these new corrections. The Contractor is solely responsible for the execution of the Work.

1.4 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit one (1) copy of high-resolution color digital photograph package in an electronical presentation.
- .2 Frequency of photo submission: as directed by Contracting Authority and Consultant.
- .3 Project identification: project designation, number and date of photos.
- .4 Number of viewpoints: four (4).
 - .1 The point of views and their location will be determined by the Contracting Authority and the Consultant.

2 PRODUCTS

2.1 NO OBJECT

- .1 No object.

3 EXECUTION

3.1 NO OBJECT

- .1 No object.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 22.
- .2 Section 26.

1.2 ADMINISTRATIVE MODALITIES

- .1 Procedure for receipt of inspection Work executed by the Contractor: The Contractor must inspect the Work, identify defects, wears and failures and make the necessary repairs so that everything complies with the requirements of the Contract Documents.
 - .1 Notify Consultant in writing of completion of Contractor's inspection and submit a document mentioning that corrections have been made.
 - .1 Submit request for inspection by Contracting Authority and Consultant.
 - .2 Inspection made by Contracting Authority and Consultant:
 - .1 The Contracting Authority and the Consultant will execute an inspection of the Work with the Contractor to identify defects and failures.
 - .2 The Contractor shall make the requested corrections.
 - .3 Completion of tasks: submit a document in English and French certifying that the tasks indicated below have been completed.
 - .1 Work is complete and has been inspected and found to conform to requirements of Contract Documents.
 - .2 Failures and defects found during inspections have been corrected.
 - .3 Devices, materials and systems have been tested and are fully operational.
 - .4 The necessary training in the operation of devices, materials and systems has been given to the Contracting Authority's personnel.
 - .5 The commissioning of mechanical devices, materials and systems has been carried out, and a copy of the final commissioning report has been submitted to the Consultant.
 - .6 Work is complete and ready for final inspection
 - .4 Final inspection:
 - .1 When all the mentioned tasks above have been completed, submit a request for the Work for final inspection, which will be carried out jointly by the Contracting Authority, the Consultant and the Contractor.
 - .2 Complete the items of Work and reapply for inspection if Work deemed incomplete by Contracting Authority and/or Consultant.

1.3 FINAL CLEANING

- .1 Execute cleaning Work in conformity with the requirements of sections 22 et 26.
- .2 Dispose of the extra materials, the garbage, the tools and the unnecessary equipment from site.
- .3 Waste management: sort waste for re-use and recycling where possible.

2 PRODUCTS

2.1 NO OBJECT

- .1 No object.

3 EXECUTION

3.1 NO OBJECT

- .1 No object.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 22
- .2 Section 26

1.2 ADMINISTRATIVE MODALITIES

- .1 Two (2) weeks before the date of the provisional completion of the Work, carry out, for the Contracting Authority's employees, demonstrations of the operation and maintenance operations of the devices, materials and systems installed.
- .2 The Contracting Authority provides the list of personnel who must take this training and will ensure, at agreed times, their participation in sessions organized for this purpose.
- .3 Preparatory Work
 - .1 Ensure that the conditions for performing demonstrations of the operation of devices, equipment and systems as well as training sessions does indeed comply with requirements.
 - .2 Ensure that designated persons are present.
 - .3 Ensure that devices, materials and systems have been inspected and put into operation in accordance with Sections 22 and 26.
 - .4 Ensure that testing, adjustment and balancing have been carried out and that devices, equipment and systems are fully operational.
- .4 Demonstration and training:
 - .1 Show how the start-up, operation, control, adjustment, fault diagnosis, upkeep and maintenance of each device, equipment and system must be ensured, at the agreed time, at the place where are these items.
 - .2 Instruct personnel in all stages of operation and maintenance of equipment, materials and systems using the provided operation and maintenance manuals.
 - .3 Perform a detailed review of the contents of these manuals so as to explain all aspects of operation and maintenance.
 - .4 If required, collect additional data necessary for training and insert them into the operation and maintenance manuals.

1.3 SUBMITTALS/SAMPLES FOR APPROVAL/INFORMATION

- .1 Submit documents and samples required in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Two (2) weeks prior to dates specified, submit schedule to Contracting Authority and Consultant for approval for demonstration of operation of each device, equipment and system.
- .3 Within one following week of the demonstrations, submit documents confirming that they have been carried out and that the appropriate training has been satisfactorily given.
- .4 Specify the date and time of each demonstration as well as the list of people present.
- .5 Provide complete copies of operation and maintenance manuals for use in demonstration of operation of devices, equipment and systems as well as the related training sessions.

1.4 QUALITY INSURANCE

- .1 When it is prescribed in certain sections that an authorized representative of the manufacturer must demonstrate the operation of the devices, equipment and systems installed,
 - .1 ensure that the Contracting Authority's staff is trained;
 - .2 provide written confirmation that such demonstration has been completed and that the related training has been given.

2 PRODUCTS

2.1 NO OBJECT

- .1 No object.

3 EXECUTION

3.1 NO OBJECT

- .1 No object.

END OF SECTION

1 GENERAL

1.1 REFERENCES

- .1 The Works must meet the requirements of plans and specifications, local regulations and the most recent version of the National Building Code. Standard norms and other quality references complete the specification in order to govern the choice and requirements relating to materials and labour. The Contractor must refer to the latest edition of the standard norms at the time of bid closing.
- .2 The materials and equipment supplied and installed under this contract must comply with the standards specifically mentioned in this division and in general manner without being limited to the following standards:
 - .1 ACI : Allow Casting Institute;
 - .2 CSA : Canadian Standards Association;
 - .3 AFBMA : Anti-Friction Bearing Manufacturer Association;
 - .4 AGMA : American Gear Manufacturer Association;
 - .5 AISI : American Institute of Steel Construction;
 - .6 CEMA : Canadian Electrical Manufacturers Association;
 - .7 ANSI : American National Standard Institute;
 - .8 API : American Petroleum Institute;
 - .9 ASA : American Standard Association;
 - .10 ASME : American Society of Mechanical Engineers;
 - .11 ASTM : American Society for Testing and Materials;
 - .12 AWA : American Welding Association;
 - .13 AWS : American Welding Society;
 - .14 AWWA : American Water Works Association;
 - .15 BNQ : Bureau de normalisation du Québec;
 - .16 CAGI : Compressed Air and Gas Institute;
 - .17 NBC : National Building Code (Québec);
 - .18 NBCC : National Building Code of Canada;
 - .19 IEEE : Institute of Electrical and Electronics Engineers;
 - .20 ISA : Instrument Society of America;
 - .21 ISO : International Standardization Organization;
 - .22 NEMA : National Electrical Manufacturers Association;
 - .23 NSF : National Sanitation Foundation;

- .24 SHI : Standards of Hydraulic Institute;
- .25 ULC : Underwriters Laboratories of Canada.
- .3 Structural parts must conform to ASTM specifications. Gears must conform to AGMA specifications. The noise level of any piece of equipment must meet ANSI SI-4 standards.
- .4 All parts in contact with drinking water must be NSF-61 certified unless otherwise specified.

1.2 RELATED REQUIREMENTS

- .1 Section 22.

1.3 SUBMITTALS/SAMPLES FOR APPROVAL/INFORMATION

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

1.4 SUBMITTALS/ITEMS TO PROVIDE WHEN COMPLETION OF WORK

- .1 As a condition of provisional acceptance of the Work, the Contractor must provide the Professional with a final version digital copy of the operation and maintenance manual both in French and in English. The Contractor must provide the translation costs if applicable. Manuals in a language other than French and English will be automatically refused. The manual should contain the following information:
 - .1 Table of contents;
 - .2 List and contact information of stakeholders, Contractors, subcontractors and others;
 - .3 Identification of equipment as installed on the project;
 - .4 List of all approved shop and assembly drawings;
 - .5 Reduced copy of all shop and assembly drawings “as approved”;
 - .6 List of parts and equipment as well as the names, addresses and telephone numbers of the Suppliers of all appliances, motors, accessories, etc that were supplied and installed with a reference to the specification items that describe them, including serial numbers;
 - .7 Description of the exact operation, step by step, of each system installed;
 - .8 Description of the procedure to follow, point by point, for starting and shutting down equipment, in order to have a reliable and safe operation;
 - .9 List of possible operating problems and how to remedy each of these problems;
 - .10 Information sheet and a maintenance schedule for the various parts of the equipment, giving the replacement interval;

- .11 Instructions relating to lubrication as well as a table summarizing the points to be lubricated, the type of lubricant and the frequency of lubrication;
 - .12 List of spare parts to be kept in reserve by the Contracting Authority;
 - .13 Plans as built (paper, CAD and PDF format);
 - .14 Equipment warranty.
- .2 A digital copy (directory with individual PDFs for each piece of equipment) will first be presented to the Professional for approval and corrections; an annotated digital copy (PDF) will then be returned to the Contractor for the preparation of a fully corrected and finalised digital copy.

1.5 MATERIALS/REPLACEMENT/MAINTENANCE MATERIALS TO BE PROVIDED

- .1 The Contractor must provide all the spare parts requested in the plans and specifications that are necessary for the routine maintenance of the equipment that is subject to replacement during the first year of operation. The Contractor must provide the Engineer with a detailed list of the spare parts recommended by the various Suppliers before the provisional acceptance of the Work.
- .2 Spare parts to include lubricants and filters. They must be delivered at the same time as the equipment and they must be placed in individual sealed boxes to protect them against damage and corrosion due to long periods of storage.
- .3 Provide a kit of all the special tools necessary for the assembly, operation and maintenance of all equipment and accessories in accordance to the manufacturers' recommendations.

1.6 TRANSPORT, STORAGE AND HANDLING

- .1 The Contractor is responsible for inspecting equipment arriving on site, storing it, setting it up and connecting it. Uninstalled equipment must be stored away from destruction or theft.
- .2 The lifting equipment required for the handling of the equipment, the delivery point and the installation are at the expense of the Contractor.
- .3 The Contractor must ensure with the manufacturers that the openings provided in the building for the entry of large equipment are sufficient.
- .4 If the finish of the devices or equipment has been damaged during transport or installation, the Contractor must restore the equipment to the original state before the breakage or damage.

2 PRODUCTS

2.1 REQUIREMENTS OF THE MANUFACTURERS

- .1 The Contractor must obtain from the manufacturer or the Supplier the diagrams, drawings, all the written instructions necessary for the proper installation of the equipment as well as any other information which, in the opinion of the Director, will facilitate the Work. A copy of these instructions must be given to the supervisor before installation for the supervision of the Work.

2.2 EQUIPMENT DIMENSION

- .1 The equipment must have the characteristics and dimensions suitable for the places where they are to be installed. The Contractor must notify the Engineer before proceeding with the installation of equipment that does not comply with these conditions.

2.3 ROTATING MECHANISMS

- .1 All equipment equipped with rotating mechanisms, such as belts, pulleys, chains, gears, couplings, etc., must be designed to operate under all load conditions without jolts or vibrations. Mechanisms that cannot be physically housed in enclosures must be equipped with protective devices to ensure the safety of operating and maintenance personnel. The selection of these rotary mechanisms must be made according to the standards defined by the AGMA.

2.4 INDICATING DEVICES

- .1 The Contractor must place the direct reading instruments so that they can be read from the factory operating floor. If it is not possible to place the instruments in such a way that they can be easily read, the Contractor must provide these instruments with the devices and accessories required to make easy reading from a distance.

2.5 VIBRATION

- .1 All rotating parts supplied must be machined and balanced so that no excessive vibration occurs during commissioning of the equipment. Any excessive vibrations related to the supply of equipment may result in the rejection of the equipment.
- .2 Equipment subject to transmitting vibrations to the structure or buildings must be provided with shock absorbers capable of absorbing said vibrations.

2.6 BEARINGS

- .1 The L 10 life of any bearing, calculated according to AFBMA standards, must not be less than one hundred thousand (100 000) hours.

2.7 LUBRICATION OF EQUIPMENT AND BEARINGS

- .1 All equipment requiring lubrication must be designed in such a way that it can operate continuously without additional lubricant for at least seven (7) days continuously, or one hundred and sixty-eight (168) hours. The Contractor must provide all the lubricants required for commissioning and testing until the provisional acceptance of the Work.
- .2 The Contractor, or the Supplier if applicable, must provide, with its equipment, a list of suggested lubricants and their replacement frequency. All lubricants are Quebec or Canadian products and available immediately from suggested Suppliers. All lubricants in contact with drinking water as well as motor-pump unit lubricants must be food grade.
- .3 Oil lubricated bearings to be fitted with covers and level indicators. Grease lubricated bearings should be supplied with grease nipples and should be fitted with extensions, if required. All equipment should have adequate guards against oil or grease splashes during normal operation.

2.8 NOISE

- .1 Unless otherwise specified in other sections, the noise level produced during normal operation by a piece of equipment and measured at 1 meter from it, must not exceed 85 dBA under expected operating conditions. according to the measurement standards defined by the "International Standard Organization (ISO), recommendation R 495". In the event that the noise level generated by the equipment exceeds this value of 85 dBA, the Contractor or its Supplier must, at its expense, make the necessary correction.

2.9 SCREWS, BOLTS AND NUTS

- .1 Fasteners, such as screws, bolts, nuts, must comply with the requirements of ACNOR standards. All fasteners in contact with or near water or chemicals must be 316L grade stainless steel. If the fixing parts are not in contact with water or chemical products, the material must be according to the Supplier's recommendations, or identical to the element to be bound or retained. In all cases, the fasteners must be corrosion resistant.
- .2 The screws and bolts used must be manufactured according to metric measurement standards. The protrusion of the bolts beyond the nuts, after being tightened, must be at least two (2) exposed threads without exceeding the value of a diameter. Unless otherwise specified, hex nuts should be used. Washers of the same material must be installed under all nuts and bolt heads in the case of tapped holes.

- .3 The installation of fasteners is such as to prevent corrosion of the bolts resulting from the galvanic effect between different metals. The Contractor must provide for the installation of dielectric between materials of different natures. In addition, the threads of all bolts must be coated just before installation with a "Never-seez - Pure nickel special grade" type coating.
- .4 The Contractor must supply and install all bolts and anchor bolts required for the proper installation of all equipment, piping, valves, accessories, supports and other elements to be installed for the installation and operation of the system.
- .5 The anchor bolts to the concrete slabs must be "HILTI" type and entirely of the same material. Fastener bolts must be of high strength and of the best quality.

3 EXECUTION

3.1 DEMOLITION AND DISMANTLING

- .1 The Contractor must, unless otherwise specified, demolish and dispose of materials and equipment according to the regulations in force of the Contracting Authority, the MELCC and in accordance with the Laws in force. He must also remove all surplus materials, tools, equipment and debris and leave the site clean and in good order. All costs directly or indirectly related to the dismantling Work, such as demolition, repair, off-site transportation, disposal or others, are the responsibility of the Contractor.
- .2 The Contractor shall keep, protect and pack the equipment indicated on the process demolition plans. He must deliver the stored equipment to the site designated by the Contracting Authority when the latter wishes to keep it.

3.2 CLEANLINESS AND PROTECTION OF EQUIPMENT

- .1 The Contractor must take all necessary precautions to protect the equipment and keep it clean.
- .2 At the end of his Work, he must ensure that the interior and exterior of the systems are permanently clean and, if necessary, carry out the required cleaning. He must also remove all surplus materials, tools, equipment and debris and leave the site clean and in good order.

3.3 TESTS AT THE SUPPLIER'S OR MANUFACTURER'S WORKSHOP

- .1 All mechanical equipment driven by an electric motor can be checked at the Supplier's or Manufacturer's Workshop to demonstrate its proper functioning. The tests specific to each piece of equipment are described in the respective sections of these specifications.

3.4 EQUIPMENT INSTALLATION

- .1 The Contractor installs all the mechanical equipment and accessories it provides in accordance with the Suppliers' and manufacturers' specifications. He must ensure, beforehand, that he has obtained from the various Suppliers or manufacturers all the specific instructions on the installation, verification and start-up of the equipment.

3.5 COMMISSIONING

- .1 After completion of installation of equipment, the Contractor shall commission the equipment in whole or in part, only after approval has been given by the Engineer as to the manner of proceeding.
- .2 During the commissioning period, the Contractor must provide, at his own expense, skilled labor for the operation of the equipment, as well as all the elements required to operate the equipment correctly.
- .3 During this period, the equipment is operated under different operating conditions, as requested by the Engineer, to ensure that all systems are able to operate as intended. Any defect found during this period of operation is corrected to meet the requirements of this document and the equipment retested to the satisfaction of the Contracting Authority.
- .4 The Contractor is fully responsible for the equipment and its operation during this period. If there is equipment damaged during start-up, the Contractor will make repairs or replace this equipment to the satisfaction of the Contracting Authority at no additional cost.
- .5 The commissioning of the equipment must be coordinated by the Contractor and targets all stakeholders from other disciplines who must also commission their respective equipment.
- .6 During the commissioning period, the Contractor makes all changes and adjustments to the equipment at his own expense and demonstrates to the Engineer that the equipment is capable of operating properly, under all the conditions provided for in the specifications.
- .7 Competent representatives of the equipment Suppliers must be available on request to carry out the detection of deficiencies for the entire duration of the commissioning.

3.6 PROVISIONAL ACCEPTANCE TESTS

- .1 After the commissioning of the equipment and when all the equipment has been installed to the satisfaction of the Engineer, the Contractor must assist the Engineer for the provisional acceptance tests which aim to demonstrate that all equipment and accessories included in this contract comply with the warranties and other

- requirements of this document and the Contract Documents and that the assembly is in a condition to provide the expected performance.
- .2 Prior to the provisional acceptance tests, the Contractor must provide the complete operating manual. In the absence of this document, the Contractor will not be authorized to proceed.
 - .3 During the provisional acceptance tests and until the moment of the provisional acceptance of the Work, the Contractor provides, at his own expense, competent personnel to assist the Contracting Authority's operating personnel in the operation of the entire system and qualified representatives of Suppliers of equipment as well as measuring and control equipment for all process equipment.
 - .4 Without limiting the content of this section, the Contractor is referred to the other sections of the document for the specific requirements concerning the particular tests of the equipment supplied under this contract.
 - .5 For all equipment, the Contractor must demonstrate that their efficiency corresponds to the forecasts established using the curves and characteristic graphs provided with the operating manual, unit by unit first, and then, by combining the operation of devices to operate simultaneously. These tests are carried out by the Contractor according to a test protocol that he must prepare and present to the Engineer for approval. This protocol must describe the objectives and methodology of the trials.
 - .6 For each test, a complete report containing the results obtained must be submitted. The report, in three (3) copies, summarizes:
 - .1 The test protocol used;
 - .2 The conditions during the tests;
 - .3 The interpretation and discussion of results;
 - .4 The conclusions and the recommendations.
 - .7 After the first test, if it is not satisfactory, the Contractor is responsible for all costs incurred for the resumption of said test and the resulting consequences.
 - .8 If in the opinion of the Engineer, the acceptance test shows that the equipment or a portion of the equipment or accessories fails to comply in all respects with the warranties and other requirements of the technical specifications, the Contractor shall modify, replace or rebuild, at his own expense, if requested by the Engineer, any defective part of the equipment and accessories until such time as the entire equipment and accessories meet the requirements of the contract.
 - .9 Competent representatives of the equipment Suppliers must be available on request to carry out the detection of deficiencies during the provisional acceptance tests.

3.7 TRAINING OF THE OPERATORS

- .1 The Contractor must explain to the operating personnel, through its various Suppliers or subcontractors, how to operate and maintain the equipment provided. He must review, with the operating personnel, the maintenance guides and the operation of the equipment for each piece of equipment provided by the latter. These explanations must be included in the service manuals.
- .2 The Contractor must consider the Work schedules of the operating personnel when establishing the training schedule.
- .3 Prior to training, the Contractor must have submitted the operating manuals. If special instructions govern the operation of certain equipment, the Contractor should provide indication plates near the said equipment.
- .4 Unless otherwise specified, representatives of each equipment Supplier must plan to give one (1) session of each training session to ensure that all operation and maintenance personnel can attend. These sessions will take place during business hours, from 9:00 a.m. to 3:00 p.m., in a location to be determined by the Contracting Authority.
- .5 For each piece of equipment and system, the Contractor shall submit to the Engineer:
 - .1 A complete training program at least ten (10) days before training. The program will identify the trainer, their experience, the topics covered and their duration;
 - .2 A training certificate signed by the City superintendent no later than ten (10) days after the training.
- .6 The training will take place in French and the Contractor must provide computer support (PowerPoint presentation).
- .7 The Professional may require modifications or additions to the training program at no extra cost.
- .8 The Contractor must submit a training schedule for approval. These will necessarily take place from Tuesday to Thursday inclusively between 9 a.m. and 3 p.m.
- .9 The Contractor must consider that commissioning and training will not take place on the same day.

3.8 EQUIPMENT MAINTENANCE

- .1 The Contractor must carry out periodic maintenance Work on equipment and accessories according to the manufacturers' recommendations until the date of provisional acceptance.
- .2 All maintenance fluids, oil, grease and detergent, must be provided by the Contractor, as well as the labor, and the Contractor must prepare the maintenance forms attesting

that this Work has been carried out. been carried out, according to the recommendations of the manufacturers.

3.9 COORDINATION

- .1 Before the Work, the Contractor must check and correct, if necessary, the dimensions and location of the mechanical process equipment shown on the plans. He must ensure that all the required fittings are properly located and sized.
- .2 The Contractor, or his subcontractor, must submit, for approval, a scaled plan with location dimensions showing all the equipment described in the specifications of this division and shown on the plans.
- .3 The Contractor is responsible for coordinating the Work of all disciplines involved in the construction of the Works described in these documents. The Contractor must check the plans of the different disciplines and consider the characteristics of the materials and equipment to ensure that there will be no conflict between the different disciplines.
- .4 The Contractor must coordinate the Work so that all mechanical and electrical equipment is installed and connected properly so that it is functional, accessible and properly adjusted to the surrounding structures.

END OF SECTION

1 GENERAL

1.1 REFERENCES

- .1 The Work must meet the requirements of plans and specifications, local regulations and the most recent version of the National Building Code. Standard norms and other quality references complete the specification in order to govern the choice and requirements relating to materials and labour. The Contractor must refer to the latest edition of the standard norms at the time of bid closing.
- .2 The materials and equipment supplied and installed under this contract must comply with the standards specifically mentioned in this division and in general manner without being limited to the following standards:
 - .1 ACI : Allow Casting Institute;
 - .2 CSA : Canadian Standards Association;
 - .3 AFBMA : Anti-Friction Bearing Manufacturer Association;
 - .4 AGMA : American Gear Manufacturer Association;
 - .5 AISC : American Institute of Steel Construction;
 - .6 CEMA : Canadian Electrical Manufacturers Association;
 - .7 ANSI : American National Standard Institute;
 - .8 API : American Petroleum Institute;
 - .9 ASA : American Standard Association;
 - .10 ASME : American Society of Mechanical Engineers;
 - .11 ASTM : American Society for Testing and Materials;
 - .12 AWA : American Welding Association;
 - .13 AWS : American Welding Society;
 - .14 AWWA : American Water Works Association;
 - .15 BNQ : Bureau de normalisation du Québec;
 - .16 CAGI : Compressed Air and Gas Institute;
 - .17 NBC : National Building Code (Québec);
 - .18 NBCC : National Building Code of Canada;
 - .19 IEEE : Institute of Electrical and Electronics Engineers;
 - .20 ISA : Instrument Society of America;
 - .21 ISO : International Standardization Organization;
 - .22 NEMA : National Electrical Manufacturers Association;
 - .23 NSF : National Sanitation Foundation;

- .24 SHI : Standards of Hydraulic Institute;
- .25 ULC : Underwriters Laboratories of Canada.
- .3 Structural parts must conform to ASTM specifications. Gears must conform to AGMA specifications. The noise level of any piece of equipment must meet ANSI SI-4 standards.
- .4 All parts in contact with drinking water must be NSF-61 certified unless otherwise specified.

1.2 RELATED REQUIREMENTS

- .1 Section 22.
- .2 Section 26.

1.3 ADMINISTRATIVE MODALITIES

- .1 Pre-Installation Meetings
 - .1 One (1) week prior to the beginning of execution of Work, meet with Contractor's Representative, the Consultant and the Contracting Authority, which shall cover the following.
 - .1 Work requirements;
 - .2 The conditions of execution and the state of the support;
 - .3 Coordination of Work with Work carried out with other finishing trades;
 - .4 Manufacturer's written instructions concerning installation as well as the terms of the warranty offered by the latter.

1.4 SUBMITTALS/SAMPLES FOR APPROVAL/INFORMATION

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

2 PRODUCTS

2.1 PVC PIPING

- .1 All PVC piping and fittings will be schedule 80, in accordance with ACNOR B137.3, ASTM D 1784 for type 1 class 1 and ASTM D 1785 standards. The pipes and fittings are assembled by cold welding. solvent-based cement aid manufactured in accordance with ASTM D 2564.

- .2 When the piping is intended for the transport of chemical products, the Contractor must ensure that the appropriate cements are used in the joints to resist the fluids transported.
- .3 All pipes are cylindrical and straight with ends cut square. The finish is smooth and free of imperfections such as grooves or ripples.
- .4 The Contractor must install enough "union fittings" to allow flexibility when dismantling the piping. Unions must be installed for the connection of equipment and for each straight length over 7.5 m.

2.2 SUPPORTS FOR PIPING AND ACCESSORIES

- .1 All piping and its accessories will be supported on concrete bases and/or by means of metal structural elements.
- .2 The supports are not all indicated on the plans. The Contractor must determine the location and/or the maximum spacing of supports not indicated. The Contractor must provide for approval the drawing of the supports he proposes.
- .3 The wall anchoring systems for the various pipes to be supported will be compatible with the type of pipe to be fixed (i.e. stainless steel, galvanized steel, CPVC, etc.). The sizing (i.e. size of collars and/or metal structures, as well as their spacing) of the supports and anchors will be adequate to support the weight of the piping and its accessories (i.e. valves, fittings, etc.), as well as the liquid transported and the forces due to pressure and water hammer.
- .4 Any pipe support, rod or clamp will carry its portion of the load. The supports shall be adjustable so that the alignment of the piping can be maintained.
- .5 The Contractor will provide all anchor bolts and other required fasteners.
- .6 The metal elements for the supports, the rods, the fasteners will be in hot-dip galvanized steel with application of a layer of zinc of at least 600 g/m², in accordance with the ACNOR G164-M1981 standard.
- .7 Unless otherwise specified, secure equipment supports, hangers, spacers, etc. to structural steel with type-approved clamps. No drilling of the structural steel will be authorized.
- .8 Unless otherwise indicated on the drawings, do not make any fasteners by welding or drilling without the written approval of the Engineer. In concrete, use "HILTI" type fasteners.
- .9 Prevent contact between dissimilar metals with dielectric insulation to prevent galvanic corrosion. The Contractor must ensure that the piping is well supported and must pay particular attention to establishing the slope necessary for good drainage.

- .10 Support piping on each side of valves, flowmeters, etc., so as to allow removal and within 300 mm of each horizontal bend. The vertical pipes will be supported at the base and on all floors, or as presented on the plans.

2.3 PIPE INSULATION AND LINER

- .1 When indicated on the plans, the insulation will be AP/Armaflex with a thickness of 25 mm. The insulation will be covered with a 0.5 mm (0.020 in) thick Zeston 2000 PVC sheath in the straight ends and Armaflex WB Finish paint in the elbows and at the pump outlets.

2.4 MAGNETIC FLOW METER

- .1 The flow meters must be installed in strict accordance with the manufacturer's recommendations. The inlet and outlet straight sections should be greater than or equal to the manufacturer's recommendations.
- .2 The flowmeter must have at least the following specifications:
- .1 Integrated transmitter/indicator with display in GPM, PSI and °F;
 - .2 Measuring range: 0.1 gpm to 26 gpm;
 - .3 Stainless steel frame, stainless steel probes;
 - .4 PEEK/VITON insulation parts;
 - .5 24VDC power supply, 2 configurable outputs (4-20mA, etc.);
 - .6 Adapter G1 Male to 1"FNPT;
 - .7 Bidirectional reading;
 - .8 Connection cable of appropriate length with M12 (4 pin) Micro-DC type connector.
- .3 The wall mounting box must be installed so that the cable entries are oriented downwards.
- .4 The installer must ensure that the measurement system is correctly connected, in accordance with the electrical diagrams. In addition, the transmitter must be grounded, except in the case of galvanically isolated auxiliary power.
- .5 It is recommended to connect the two flanges with the corresponding flange of the pipe by means of a grounding cable in order to avoid parasitic effects on the measurement. If the nominal diameter is less than or equal to 300 mm, the earthing cable is mounted with the flange screws directly on the conductive flange coating. If the nominal diameter is greater than or equal to 350 mm, the earthing cable is mounted directly on the metal transport bracket.

2.5 DOSAGE EQUIPMENT

- .1 Production of chlorine solution
 - .1 The chlorination unit must produce automatically and continuously, in “batch” mode, the chlorine solution in order to facilitate supply to the network.
 - .2 A maximum concentration of chlorine solution of 0.05% (500 ppm) must be maintained in order to prevent scale deposits in the various components of the system. Systems producing chlorine solutions at concentrations greater than 0.05% are not acceptable.
 - .3 The addition of chlorine to the water must be done through the supply system by erosion of calcium hypochlorite tablets in solid form. This system provides precise and consistent control of the required concentrations in the chlorine solution. Spray or vortex systems are not acceptable.
 - .4 To ensure redundancy, two independent systems are required.
- .2 Dosage of chlorine solution
 - .1 A centrifugal pump will dose the freshly obtained chlorine solution into the chlorine solution tank in just enough quantity for maximum efficiency. Multi-stage centrifugal pumps, such as those of the Grundfos brand, will be acceptable. Systems using a metering pump(s) to meter the solution are not acceptable.
 - .2 Pumps will be equipped with variable frequency drives. The pump speed will be manually adjustable by an operator at the local control panel.
- .3 Interconnecting piping
 - .1 All interconnecting piping of the chlorination unit must be PVC schedule 80 for greater durability. Systems using flexible tubing are not acceptable.
- .4 The system components supplied will include the following:
 - .1 Pressure reducing valve;
 - .2 Water inlet connection with 1.5” (38 mm FNPT) filter adjusted for 25 mm piping;
 - .3 Inlet solenoid valve;
 - .4 Manual guillotine type control valve, for flow control;
 - .5 Tablet chlorinator;
 - .6 Scale with Low Level Tablet Alarm;
 - .7 Manual control valve and manual flow meter on solution tank supply line for regulation of solution tank concentration;
 - .8 70 US gallon minimum capacity high density polyethylene solution tank;
 - .9 High level (LSH), low level (LSL) and very low level (LSLL) switch;
 - .10 A chlorine solution supply pump;

- .11 Isolation valves (ball valves) and check valves on “priming line” of pumps to tank;
- .12 Ball check valve type check valves to protect the system against reverse flow returns;
- .13 Relief valves for pumps;
- .14 Pressure sustaining valve on pump outlet;
- .15 NEMA 4X type local electrical control panel;
- .16 Type 6061-T aluminum structural frame.

2.6 LOCAL CONTROL PANNELS

- .1 Local control panel
 - .1 A main controller fixed on the platform is factory fitted by the manufacturer of the chlorination system in order to allow the automatic control of the quantity of residual chlorine in the network. The pump and system instruments will be wired at the manufacturer's factory to this controller.
 - .2 The "NEMA 4X" control box includes "microprocessor" type controls, an alpha-numeric display, available in French and English, allowing the various control parameters to be viewed, alarm messages, etc.
 - .3 A programming keyboard gives access to operation, configuration, calibration and diagnostic menus. An output is also available, if required, for data acquisition of free residual chlorine values, alarm messages, etc. A security code can be inserted to limit access to operating parameters.
- .2 All electrical and control connections and all plumbing between the various elements of the chlorinator will be made at the factory before shipment to the site.
- .3 The electrical supply connection is made at a single location in a junction box. The circuit for the pumps must be designed for the following characteristics: 575 V, 3 Ph, 60 Hz and 3/4 HP.

2.7 DOSAGE CONTROL

- .1 Dosage is manually controlled by an operator. The speed of the feed pump is adjusted according to the reading of the flow meter installed on the distribution line.
- .2 Dosing systems operate alternately to provide system redundancy.
- .3 Dosing systems are started and stopped manually by an operator.

3 EXECUTION

3.1 INSPECTION

.1 Verification of conditions: before proceeding with the installation of special devices, ensure that the condition of the surfaces/supports previously implemented under the terms of other sections or contracts is acceptable and allows the Work to be carried out in accordance with the manufacturer's written instructions.

.1 Visually inspect surfaces/supports.

.2 Immediately notify Consultant of any unacceptable condition discovered.

.3 Begin installation Work only after unacceptable conditions have been corrected and written approval has been received from Consultant.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written requirements, recommendations and specifications, including any available technical bulletins, instructions for handling, storage and installation of products and data sheets.

3.3 INSTALLATION

.1 Install the chlorination system and accessories in accordance with the manufacturer's instructions, the prescriptions made and the details shown on the plans.

.2 The systems must be installed alternately so that there is always a system, either existing or new, in operation to ensure the dosage of chlorine.

3.4 START-UP

.1 A representative of the dosing platform supplier must be present for the duration of the start-up of the chlorine dosing system. It must be available to the Contractor during the start-up of the entire plant.

.2 The Contractor is responsible for the entire coordination of the tests and the start-up of the systems. The testing and start-up methodology must be proposed by the Contractor and approved by the Consultant and the Contracting Authority.

3.5 TEST AND ADJUSTMENT

.1 Dosage system

.1 The Contractor must carry out all the tests required to demonstrate the proper functioning of this equipment. The requirements of the estimate must be met

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before said equipment is approved by the Consultant and the Contracting Authority.

- .2 Any defective equipment will be repaired or replaced by the Contractor; any system failure will be corrected to the satisfaction of the Contracting Authority.
- .3 The Contractor shall ensure that the tank is perfectly sealed. Ducts (vents and others), access hatches, non-watertight threaded plugs and any other opening in communication with outside areas must be hermetically sealed if there is a possibility of the release of odors or products.
- .4 The Contractor shall carry out the tests of the dosing systems, as required by the supplier of the pumps.
- .5 The Contractor must carry out the control system tests, as required in section 26.
- .2 Flow meter
 - .1 Verify location and accessibility
 - .2 Verify Accuracy of Flow Meter Readings.

3.6 ACTIVITIES RELATED TO THE COMPLETION OF WORK

- .1 Commissioning reports: as specified in Section 01 91 13 – General Commissioning Requirements, for reports, and as specified in this section.
- .2 Training: provide training as specified in Section 01 91 13 – General Commissioning Requirements, for O&M personnel training, and as specified in this section.

3.7 CLEANING

- .1 Cleaning during Work: carry out cleaning Work and leave the premises clean at the end of each Working day.
- .2 Final clean-up: remove surplus materials/equipment, rubbish, tools and equipment from site.
- .3 Waste management: sort waste for reuse/re-use and recycling where possible. Remove recycling bins and dumpsters from the site and dispose of materials at the appropriate facilities.

3.8 PROTECTION

- .1 Protect installed equipment and components from damage during construction.
- .2 Repair damage to adjacent materials and equipment caused by installation of special fixtures.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 This section is an integral part of Section 22 05 00 – Common Work Results for Plumbing.

1.2 REFERENCES

- .1 Definitions
 - .1 Electrical and electronic terms: unless otherwise indicated, the terminology used in this section and on the drawings is based on that defined in IEEE SP1122.
- .2 References
 - .1 CSA C22.1-F21, Canadian Electrical Code, Part I (25th Edition), Safety Standards for Electrical Installations.
 - .2 CSA C22.10-F18
 - .3 CAN/CSA-C22.3 issue 1-F10, Aerial networks.
 - .4 CAN3-C235-F83 (C2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
 - .5 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .6 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.3 SUBMITTALS/SAMPLES FOR APPROVAL/INFORMATION

- .1 Samples
 - .1 Where required, submit, for Engineer's approval, two copies of manufacturers' standard samples requested in these specifications, or as Engineer may reasonably require. The samples must bear a label indicating their origin and the use for which they are intended in the Work, and must comply with the requirements of the specifications.
 - .2 Include cost of samples in bid price.
 - .3 Keep one copy of each sample on site until all Work is completed. The other copy is kept by the Engineer
- .2 Shop Drawings
 - .1 The expression "shop drawings" means drawings, diagrams, illustrations, tables, execution graphs, brochures and other data that the Contractor must provide to show in detail a part of the Work.
 - .2 Submit shop drawings for Engineer's review by e-mail within reasonable time and in logical sequence so as not to delay Work. If

requested by either the Contractor or the Engineer, both shall jointly prepare a table setting out the dates for submission and return of drawings.

- .3 The Engineer's review is limited to verifying the compliance of shop drawings with Contract Documents for the purpose of recommendation to the Contracting Authority. The Engineer assumes no responsibility for the accuracy of dimensions or details or quantities.
- .4 Shop drawings relating to products, systems or installations of special design, bespoke or of a similar nature, not forming part of standard cataloged products or services, will be considered as Engineering documents, and consequently, must be authenticated by their Author Engineer. Authentication must be in accordance with the laws and regulations in force in the province of Quebec. As an indication, and without limitation, shop drawings of custom-made modular air handlers are included in this category, and constitute Engineering documents that must bear such compliant authentication.
- .5 When shop drawings are resubmitted, notify Engineer in writing of revisions, other than revisions requested by Engineer.
- .6 Within three (3) weeks of contract award, submit to Engineer, for approval, one (1) reproducible or electronic copy of all shop drawings requested in this Division. Shop drawings sent by fax are not accepted.
- .7 Shop drawings must meet the following conditions:
 - .1 The cover page mentioned below, in the appendix, must be present;
 - .2 Only one file in PDF format per shop drawing per equipment must be submitted. If several documents constitute the drawing, these must be incorporated within a single file;
 - .3 If it is required to approve several drawings for the same equipment, for example a shop drawing for a lighting equipment and a second drawing for its finishing frame, the Contractor must submit a group of drawing of shop and describe in detail what the additional shop drawings are for;
 - .4 For each shop drawing provided, the Contractor must enter the quantity required for the project;
 - .5 The drawing printing parameters must be integrated into the file in such a way as to ensure scale printing on a commercial type printer;
 - .6 The file must be of excellent graphic quality;
 - .7 The transmission of drawings must respect the communication channels established for the project;
 - .8 A transmission slip must accompany the drawing(s) submitted.

- .9 The Contractor must make the selections corresponding to the requirements if selections must be made in the shop drawings.
- .10 Shop drawings that do not comply with these directives will be returned to the Contractor with the mention rejected.
- .11 Provide each drawing or group of drawings with a cover page. Include on the cover page at least the following information:
 - .1 The Contracting Authority's name;;
 - .2 The project's name;
 - .3 The Engineer's name;
 - .4 The Contractor's name;
 - .5 The subcontractor's name;
 - .6 The Supplier's name;
 - .7 The manufacturer's name;
 - .8 The discipline;
 - .9 The description;
 - .10 Specification section number and specification item number;
 - .11 The revision number;
 - .12 Sufficient free space for the affixing of the verification seal.
- .12 Provide drawings in French, certified for construction by the manufacturer.
- .13 Drawings for unlisted items or materials must be made specifically for this project.
- .14 Shop drawings must include the following:
 - .1 Construction details, dimensions, weights, and characteristics of equipment or materials along with additional information such as bulletins, illustrations, and exploded views of component parts. Advertising leaflets or advertising brochures are not accepted.
 - .2 Graphs, curves, capacities, efficiencies and other technical data, supplied by manufacturers or requested by the Engineer relating to the operation of the equipment,
 - .3 Wiring diagrams, single-line diagrams, block diagrams, control diagrams, sequences of operation and all interconnections with other systems, when required.
- .15 Drawings will be returned with one of the following: "No correction to report", "Make corrections as indicated", "Resubmit", "Refused".

- .16 Drawings marked “No correction to report” will not be subject to further action. The drawings are in accordance with the contractual documents.
- .17 Drawings marked "Refuse" must be redone and resubmitted for verification. The drawings do not conform to the contractual documents.
- .18 Drawings marked “Make corrections as indicated” should not be resubmitted. Subject to the corrections indicated, the drawings comply with the contractual documents.
- .19 Drawings marked "Resubmit" shall be resubmitted, in whole or in part, as indicated, for verification. These drawings do not conform to the contractual documents.
- .20 The drawings marked "Correct according to the annotations" and "Resubmit", must be resubmitted in part or in whole, according to the indications on the drawings, for verification. Subject to the corrections indicated, the drawings comply with the contractual documents.
- .21 Verification of shop drawings by the Engineer does not release the responsibility for supplying equipment that complies with the standards and regulations in force and with the requirements of this specification.
- .22 When equipment is manufactured without prior verification of the shop drawings by the Engineer, the latter may refuse the equipment. The Contractor must assume all costs resulting from this refusal.
- .23 The Engineer reserves a period of ten (10) Working days from the receipt of the shop drawings for their verification.

.3 Certificates

- .1 Provide CSA certified equipment and materials.
- .2 Where CSA certified equipment or equipment cannot be obtained, submit proposed equipment or equipment to authority having jurisdiction for approval before delivering to site.
- .3 Submit test results of installed electrical systems and instruments.
- .4 Permits and rights: according to the general conditions of the contract.
- .5 Upon completion of Work, submit acceptance certificate issued by authority having jurisdiction to the Contracting Authority.

1.4 SUBMITTALS/ITEMS TO PROVIDE WHEN COMPLETION OF WORK

- .1 Submit required submittals/items.
- .2 Operation and Maintenance Manuals:

- .1 Provide three (3) copies of operation and maintenance manuals, in French and English, describing the operation and maintenance of the systems. Submit these copies to the Engineer at the same time as the request for certification of substantial performance of the Work.
- .2 Divide each manual into sections by a blank sheet, with colored lights bearing the necessary identification. Insert a table of contents at the beginning of the manual with title of each section and identification of the corresponding light.
- .3 Include in each instruction manual the following:
 - .1 Instructions for regular maintenance (greasing, adjustment, calibration, lubrication, etc.). Start-up and shutdown procedures with periodic checks.
 - .2 Detailed instructions with respect to constituent elements, construction features, function of various components, to facilitate the operation, repair, alteration, extension and expansion of any part or feature of the facility.
 - .3 List of all numbered parts and components.
 - .4 List of all replacement parts.
 - .5 Names and addresses of local Suppliers of all items listed in Operation and Maintenance Manuals.
 - .6 A copy of all approved shop drawings.

1.5 DELIVERY AND STORAGE OF MATERIALS

- .1 Deliver materials and store in accordance with manufacturer's instructions with seals and labels intact.
- .2 Ship and store equipment to be mounted on the floor in an upright position.
- .3 Close equipment doors and keep them locked. Protect equipment from damage and dust.
- .4 If necessary, chock moving parts to prevent damage when moving or shipping equipment. Remove the shims according to the manufacturer's instructions.
- .5 Store indoors or sheltered from the weather, equipment intended for indoor installation.

1.6 CUSTODY OF MATERIALS AND TOOLS

- .1 The Contractor is responsible for the custody of the materials and tools that he brings to the Work site; it pays for loss or damage due to theft, vandalism and other depredations where its equipment and/or tools are involved.
- .2 Coordinate with the Contracting Authority appropriate storage locations and Work locations.

2 PRODUCTS

2.1 DESIGN REQUIREMENTS

- .1 Operating voltages to CAN3-C235.
- .2 Motors, electric heaters, command/control/regulation and distribution devices must operate satisfactorily at the frequency of 60 Hz and within the limits established in the above-mentioned standard.
 - .1 The devices must be able to operate without suffering damage under the extreme conditions defined in this standard.
- .3 Operating and display language: provide, for identification and display purposes, nameplates in French for the command/control devices.

2.2 MATERIALS/EQUIPMENT

- .1 Equipment and devices must be CSA certified. In cases where CSA certified materials or devices cannot be obtained, submit replacement materials and equipment to the authority having jurisdiction prior to delivery to the job site, in accordance with SUBMITTALS/SAMPLES FOR APPROVAL/INFORMATION, of PART 1.
- .2 Command/control panels and component assemblies to be factory assembled.

2.3 ELECTRIC MOTORS, DEVICES AND COMMANDS/CONTROLS

- .1 Verify installation and coordination responsibilities for motors, equipment, devices and commands/controls as indicated.

2.4 WIRING TERMINATIONS

- .1 Ensure that pods, terminals and wiring termination screws are suitable for both copper conductors and aluminum conductors.

2.5 MATERIAL IDENTIFICATION

- .1 All panels, transformers, safety switches, junction and pull boxes, starters, contactors, each circuit of the main panels and any other equipment supplied by this Division must all bear an identification plate. See the detail of the plate on the drawings.
- .2 On this plate, put three (3) identifications corresponding to those appearing on the drawings as follows:
 - .1 Top: equipment identification "T-0011"
 - .2 In the center: technical information "120/208V – 3PH – D.225A – (F.300A)"
 - .3 Bottom: power source "Source: PD-01; CTC:24; L-A004»
- .3 Use screw-on nameplates of laminated phenolic plastic with machine-engraved black letters on white background. Use white letters on a red background for emergency powered equipment.
- .4 Provide sufficient space to write approximately twenty-five (25) characters.

- .5 Submit list of identifications for approval.
- .6 Format as indicated in the table below.

Equipment	Lines	Lettering Height	Font size
Pannel	Line 1	7 mm	28
	Line 2 and 3	3 mm	12
Transformer	Line 1	7 mm	28
	Line 2 and 3	3 mm	12
Safety Switch (Distribution)	Line 1	7 mm	28
	Line 2 and 3	3 mm	12
Trough	Line 1	7 mm	28
	Line 2 and 3	3 mm	12
Distribution Centre	Line 1	7 mm	28
	Line 2 and 3	3 mm	12
Motor Control Centre	Line 1	7 mm	28
	Line 2 and 3	3 mm	12
Safety Switch (Mechanical Equipment)	Line 1	5 mm	20
	Line 2 and 3	3 mm	12
Starter	Line 1	5 mm	20
	Line 2 and 3	3 mm	12
Contactor	Line 1	5 mm	20
	Line 2 and 3	3 mm	12

2.6 CABLE IDENTIFICATION

- .1 Both ends of phase conductors of each feeder and each branch circuit must be permanently and indelibly marked with colored plastic tape.
- .2 Maintain phase sequence and same color code throughout installation.
- .3 Color code has to be conformed to CSA C22.1.
- .4 Use communication cables made of conductors with uniform color identification throughout the network.

2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Color-code conduits, boxes and metal-sheathed cables.
- .2 Apply plastic tape or paint, as a means of identification, on cables or conduits every 15 m and at wall, ceiling and floor crossings.
- .3 Base color bands to be 25 mm wide and complementary color bands to be 20 mm wide.

Network	Base colour	Complementary colour
Until 250 V	yellow	-
Until 250 V - Emergency	orange	red

Until 600 V - Normal	yellow	green
Until 600 V - Emergency	purple	red
Until 5 kV	yellow	blue
Until 15 kV	yellow	red
Telephone	green	-
Other communication networks	green	blue
Fire alarm	red	-
Emergency communication	red	blue
Other security systems	red	yellow

2.8 JUNCTION AND PULL BOX IDENTIFICATION

- .1 Identify, with a black marker pen, the panel number and the circuit numbers or its function on the covers of the junction and pull boxes. Identifications will be such as the following:

C1 : for the circuit number;

C.1 (P-100) : for circuit and pannel numbers.

2.9 FINITION

- .1 The surfaces of the metal envelopes must be finished in the Workshop and be coated with a rust-proof primer, inside and outside, and with at least two (2) coats of finish enamel paint.
 - .1 Enclosures/cabinets for switchgear and distribution equipment installed indoors shall be painted light gray.

3 EXECUTION

3.1 INSTALLATION

- .1 Unless otherwise indicated, complete installation in accordance with CSA C22.1.
- .2 Unless otherwise indicated, install overhead and underground networks in accordance with CAN/CSA-C22.3 number 1.

3.2 LABELS, INDICATOR PLATES AND NAMEPLATES

- .1 Ensure CSA labels, indicator plates and nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduits and sleeves before pouring concrete.
 - .1 Crossing sleeves for concrete structures: plastic pipe, diameter allowing the free passage of the conduit and exceeding the concrete surface by 50 mm on each side.

- .2 When using plastic sleeves for penetrations of walls or floors with a fire resistance rating, remove them before installing the conduits.
- .3 Install cables, conduits and fittings which must be embedded or covered with plaster, placing them neatly against the structure of the building, so as to minimize the thickness of the furring strips.

3.4 COORDINATION OF PROTECTION DEVICES

- .1 Ensure that circuit protection devices such as overcurrent tripping devices, relays and fuses are installed, that they are of the correct rating and that they are set to the required values.

3.5 ON-SITE QUALITY CONTROL

- .1 Test the following items:
 - .1 Motors, heaters and related control/regulation devices, including controls for sequential operation of systems where applicable.
 - .2 Measurement of insulation resistance.
 - .1 Measure, using a 500 V megohmmeter, the insulation value of circuits, distribution cables and devices with a nominal voltage of not more than 350 V.
 - .2 Measure, using a 1000 V megohmmeter, the insulation value of circuits, feeders and appliances with a nominal voltage between 350 and 600 V.
 - .3 Check resistance to ground before energizing.
- .2 Provide measuring devices, indicators, devices and personnel required for the execution of tests during the execution of the Work and at the completion of the latter.

3.6 START-UP OF THE INSTALLATION

- .1 Instruct operating personnel in the mode of operation and maintenance methods of the installation, its equipment and its components.
- .2 Retain and pay for the services of an Engineer detached from the manufacturer's factory to supervise the start-up of the installation, to check, adjust, balance and calibrate the various elements and to instruct the operating personnel.
- .3 Provide these services for a sufficient period of time, allowing for the number of visits necessary to put the devices into operation and to ensure that operating personnel are familiar with all aspects of their maintenance and operation.

3.7 CLEANING

- .1 Upon substantial performance of Work, remove surplus materials, tools, construction equipment and materials no longer required for performance of remainder of Work.

- .2 Prior to final inspection, remove surplus materials, tools, equipment and construction materials.
- .3 Remove debris and waste materials, including those generated by the Contracting Authority or other Contractors.
- .4 Clean and polish glazing, mirrors, hardware, wall tiles, chrome or enamel surfaces, laminate surfaces, stainless steel or porcelain enamel elements as well as mechanical and electrical devices.
- .5 Remove dust, stains, marks, mechanical and electrical devices, furniture items, etc.
- .6 Clean reflectors, diffusers and other lighting surfaces.
- .7 Dust and vacuum interior building surfaces, remembering to clean behind grilles, registers and screens.
- .8 Examine finishes, accessories and materials to ensure they meet specified requirements for function and Workmanship.
- .9 Remove dirt and other elements that spoil the ventilation system.
- .10 Thoroughly clean materials and equipment, and replace mechanical system filters.
- .11 Clean roofs, drains and evacuations.

3.8 ARCHIVE DRAWINGS

- .1 Additional copies of drawings will be provided by the Engineer for execution of record drawings.
- .2 Carefully indicate, on a copy of the drawings, in red and as the Work progresses, all the changes and deviations made to the construction drawings of the Engineer. Keep this copy on site for consultation by the Engineer or any other representative of the Contracting Authority.
- .3 On this copy of drawings, indicate in particular, without limitation:
 - .1 Location of all main and secondary service feeds and branches for each system.
 - .2 New locations of all relocated equipment and power.
 - .3 Changes in layout of circuits, areas, etc.
 - .4 The diameter of the conduits as well as the number and the gauge of the conductors which are installed there.
 - .5 The exact location of underground or concealed services using elevations taken from landmarks.
 - .6 Submit to the Engineer, at the same time as the request for certification of substantial completion of the Work, the complete copy of the archive drawings. These drawings will reflect the final state of the installations with the exact location of all the equipment and all the power supplies.

3.9 TRAINING OF OPERATING PERSONNEL

- .1 Provide competent instructors to train operating personnel in maintenance, adjustment and operation of equipment and in all changes and modifications to equipment under the warranty.
- .2 Instructions to be given during normal Working hours, before systems have been accepted and turned over to the Contracting Authority.
- .3 Operation and maintenance manual to be used for personnel training.

3.10 RECEIPT

- .1 Provide the following articles to the Contracting Authority:
 - .1 Maintenance products and portable equipment specified in this estimate.
 - .2 Replacement materials specified in these specifications.
 - .3 Keys to all equipment provided with lock.
- .2 Obtain the receipts from the Contracting Authority for each of the items mentioned above and give them to the Engineer.

3.11 CERTIFICATE OF COMPLIANCE

- .1 At the end of the Work, each subcontractor must submit to the Engineer the certificate of conformity at the end of this section, which certifies that all the Work has been carried out according to the drawings and specifications and according to the codes applicable in vigor.
- .2 Send this certificate to the Engineer at the same time as the request for certificate of completion of the Work.
- .3 Have this form signed by a Company Administrator/Director, and affix the company seal.

3.12 WARRANTY

- .1 All Work (materials and labour) performed under this contract will be guaranteed for one (1) year, except for longer periods indicated in other sections or below:
 - .1 None.
- .2 During this one-year period, the Contractor shall, upon receipt of a written request from the Contracting Authority, correct at his own expense any defects that may occur.
- .3 In the event that the Contractor refuses or neglects to correct the defects, losses or damages, the Contracting Authority may hire other persons to correct all those and the Contractor and/or the guarantor will be called upon to pay the costs.

END OF SECTION

1 BELONGING

- .1 This Section belongs to Section 26 05 00.

2 SPECIAL REQUIREMENTS

2.1 INTERPRETATION OF DOCUMENTS

- .1 All equipment, devices, appliances, ducts and others, the paths illustrated in the plans, drawings, extracts are a schematic representation and have an approximate location; their exact locations will be determined on site according to site conditions and in coordination with the equipment of other trades.
- .2 All the details of the existing installations are not all described and/or identified in the documents. The Contractor must take the necessary means by carrying out visits, surveys, inspections, measurements, etc. in order to validate these installations.

2.2 SECURITY MEASURES

- .1 The Contractor must take the necessary precautions and coordinate with federal, provincial and/or municipal authorities for the transportation of equipment containing toxic products that could harm the environment.
- .2 Throughout the duration of the project, the Contractor has the obligation to protect his Work against bad weather, breakage, fire and theft.

2.3 PRECAUTIONS TO TAKE

- .1 The Contractor shall verify the availability and delivery times of the specified and/or approved equipment, and notify the Engineer and the Contracting Authority of any delay that may affect the Work schedule due to the non-availability of such equipment. He must then propose an alternative or equivalence to the product in question and submit an appropriate credit to the client if applicable. No product substitution is accepted without the approval of the Engineer and/or the Contracting Authority.
- .2 The Contractor must take all necessary precautions during the installation of the equipment, in order to avoid damaging or soiling the finishing parts of the equipment or the surfaces, before the completion of the Work. Any equipment deemed unclean by the Engineer or the client must be properly cleaned by the Contractor to their full satisfaction.

2.4 DEMOLITION AND MODIFICATION

- .1 Unless otherwise indicated, all electrical equipment to be removed or replaced remains the property of the Contracting Authority. These elements are promptly given to him

when he wishes to keep them. The equipment that he does not wish to recover must be transported off site and properly disposed of by the Contractor, at no additional cost.

- .2 In the case of equipment to be removed, the Contractor must proceed with the removal of all equipment, wiring, conduits, pipes and accessories up to the supply point of the equipment concerned. Keep the remaining equipment operational (unaffected by the Works) and connected to the same circuit or Network at no additional cost to the Contracting Authority.
- .3 Any relocated or reinstalled equipment or device must be cleaned and repaired if necessary, and this, before being finally installed and connected.

2.5 COORDINATION WORK

- .1 The Contractor must coordinate closely with the process mechanics contractor, in order to adequately plan the connection of process mechanics equipment.
- .2 The Contractor must coordinate with the equipment manufacturers and refer to the product installation guides in order to supply and install the conduits, boxes and all accessories as well as connections required for complete equipment installations, functional according to the recommendations of the manufacturers.
- .3 During the Work, if certain devices and/or equipment (existing or new) cause an obstacle or interference and/or must be kept for the purpose of continuity of operation of a mechanical, electrical or other system, the Contractor must permanently or temporarily relocate the devices or equipment to a suitable location and make the respective connections that are required at no additional cost to the client.

2.6 ELECTRIC EQUIPMENT INSTALLATION

- .1 The Contractor must supply and install appropriate steel profiles for the surface installation of electrical distribution Network equipment (panels, disconnectors, starters, boxes, etc.).
- .2 Unless otherwise specified, the Contractor must install gray fireproof plywood panels, mounted on appropriate supports, in all electrical rooms and in places where there will be a grouping of electrical equipment, such as in electrical, mechanical and control rooms.
- .3 The Contractor must plan to install flexible expansion joints for all conduit Networks crossing the area where there are expansion joints in the concrete slabs.

END OF SECTION

1 BELONGING

- .1 This Section belongs to Section 26 05 00.

2 SCOPE OF WORK

2.1 GENERAL

- .1 Electrical Work includes the supply, delivery, transportation, labor, handling, materials, equipment and tools necessary for the installation and electrical connection of all that is shown in the plans and specifications, with all the elements, even those which are not mentioned in the plans and specifications, but which are nevertheless required to carry out a complete, clean, safe and perfectly functional installation corresponding to the rules of the art and/or to the compliance with applicable standards and codes.

2.2 INCLUDED WORK

- .1 All Work below must be included.

2.3 ELECTRIC DISTRIBUTION

- .1 Dismantling of existing chlorination systems;
- .2 Supply and installation of a power panel for the flowmeter;
- .3 Connection of mechanical process equipment, including but not limited to:
 - .1 Flow meter connection;
 - .2 Connection of chlorinator control panels;
- .4 Network of electrical conduits including connectors, adaptors, supports, anchors, profiles, etc.;
- .5 Outlet, junction, distribution and pull boxes;
- .6 Electrical conductors, control cables and related accessories;
- .7 Equipment grounding.

2.4 OTHER INCLUDED WORK

- .1 Drilling Work (opening of less than 125mm dia.) and patching Work for the passage of electrical piping, sleeves, power cables and others, in slabs and walls;
- .2 Sealing and fireproofing Work in all openings used for the passage of conduits or cables, through concrete slabs, block and concrete walls;
- .3 Supply of shop drawings, operating manuals, documents {"As Built" (AB)/ "As Annotated" (AA)}, etc.;

- .4 Training sessions for maintenance personnel;
- .5 Commissioning and start-up of systems;
- .6 All other electrical Work, not mentioned and/or described in the plans and specifications, but required for a complete, compliant and functional installation.

2.5 EXCLUDED WORK

- .1 Drilling Work (openings of more than 125mm dia.) for the passage of electrical piping, armored bar;
- .2 Groove Work, sawing in the concrete slab for the passage of electrical piping;
- .3 Painting Work except for the identification of conduits and conductors.

3 LOCKOUT

3.1 GENERAL

- .1 The Contractor and the building operator staff must respect the procedures for locking out electrical and other equipment before any intervention, handling of equipment in the mechanical / electrical room and elsewhere in the building. They must, among other things, carry out the following activities:
 - .1 Take the necessary measures to protect his health, safety or physical integrity;
 - .2 Take care not to endanger the health, safety or physical well-being of other people in the workplace or near the workplace;
 - .3 Participate in the identification and elimination of risks of industrial accidents and occupational diseases in the workplace;
 - .4 Participation in a lockout training session with authorized personnel;
 - .5 Collaborate with all stakeholders in the implementation;
 - .6 Validate the lockout procedures at the start of the mandate;
 - .7 Maintain in good order and in adequate quantity the mechanisms, accessories and lockout devices made available to him.
- .2 The Contractor and the building operator staff and electricians must apply the rules for locking electrical and other equipment before any intervention, handling of equipment in the mechanical / electrical room and elsewhere in the building.
- .3 The Contractor must prepare a lockout plan for each electrical equipment on the project. They should coordinate with building operating personnel to identify a method of identifying equipment. The summary list, without limitation, of affected electrical equipment is as follows:
 - .1 Low voltage switch cabinet and circuit breakers;
 - .2 All electrical distribution panels;
 - .3 All motor, starter and VFD control centers;

- .4 All fused and non-fused disconnect switches;
- .5 Power factor correction system and capacitors;
- .6 Automatic load switching equipment;
- .7 Any other equipment or apparatus deemed relevant.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 DATA SHEETS

- .1 Submit the technical data sheets required in accordance with Section 26 05 00 - Common Work Results for Electrical.

2 PRODUCTS

2.1 BUILDING WIRING

- .1 Conductors: stranded if 10 AWG and larger; minimum size: 12 AWG.
- .2 Copper conductors: of the size indicated with under cross-linked thermosetting polyethylene insulation for voltage of 1000 V and type RW90 XLPE.
- .3 Copper conductors: of the size indicated with under thermoplastic insulation type TW75 for nominal voltage of 600 V.

2.2 TECK 90 CABLES

- .1 Cables: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductors
 - .1 Grounding conductor: copper, size indicated;
 - .2 Supply conductors: copper, size indicated.
- .3 Insulation
 - .1 Cross-linked polyethylene (XLPE);
 - .2 Nominal voltage: 1000 V.
- .4 Sheath: polyvinyl chloride.
- .5 Metallic armour: aluminum foil.
- .6 Outer jacket: thermoplastic polyvinyl chloride.
- .7 Fasteners
 - .1 One-hole clamps, zinc, for exposed cables 50 mm or less. Two (2) hole fixing clamps, in steel, for cables longer than 50 mm.
 - .2 U-shaped supports for groups of two (2) or more cables, placed at 100 mm centres.
 - .3 Threaded hanger rods: 6 mm diameter, for “U” brackets.

- .8 Connectors
 - .1 Waterproof models approved and suitable for TECK cables.

3 EXECUTION

3.1 ON-SITE QUALITY CONTROL

- .1 Test in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Carry out tests before energizing the electrical installation.

3.2 GENERAL – INSTALLATION OF CABLES

- .1 Use cable color coding in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Parallel feeders to be the same length.
- .3 Tie or “clip” feeder cables to distribution centers, pull boxes and terminations.
- .4 Route wiring hidden in walls down or in vertical loops to facilitate subsequent work. Unless otherwise specified, avoid running wiring bottom-up or horizontally in walls.
- .5 Use only two-wire circuits for branches to outlets with surge suppression as well as for permanently connected electronic and computer equipment. Common neutral circuits are prohibited.
- .6 The control wiring must be identified by collars with numbering corresponding to the legend of the shop drawings.

3.3 INSTALLATION OF BUILDING WIRING

- .1 Install wiring:
 - .1 In conduits, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings;

3.4 INSTALLATION OF TECK 90 CABLES (0 - 1000 V)

- .1 As much as possible, group the cables on "U" supports.
- .2 Lay the exposed cables by fixing them firmly by means of fixing clamps.

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Section 26 05 00 - Common Work Results for Electrical applies.

1.2 SECTION CONTENT

- .1 The Work of this section includes, but is not limited to, the supply, handling, transport and installation of all systems and accessories described in this section or on the drawings, which all must be functional:

- .1 Grounding and bonding.

1.3 SHOP DRAWINGS AND DATA SHEETS

- .1 Submit shop drawings and technical data sheets in accordance with the requirements of Section 26 05 00 - Common Work Results for Electrical.
- .2 Submit shop drawings and data sheets for the following equipment and materials:
 - .1 Grounding equipment;
 - .2 Earthing equipment.

1.4 FACTORY TESTS

- .1 The Engineer must attend the final factory tests of the following equipment:
 - .1 None.

1.5 SAMPLES

- .1 Submit samples as prescribed in Section 26 05 00 - Common Work Results for Electrical.
- .2 Samples of the following items must be submitted for approval:
 - .1 None.

2 PRODUCTS

2.1 GROUNDING AND BONDING

.1 References

- .1 Bonding of electrical equipment to CSA C22.2 no 0.4.
- .2 Grounding and bonding equipment CSA C22.2 no 41.
- .3 Unless otherwise specified, materials will comply with CSA C22.3 No. 2.
- .4 ANSI/IEEE 837 1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.

.2 Conductors

- .1 Bare: stranded copper 98% conductivity.
- .2 Insulated: type TW75 or RW90, color green.
- .3 Caliber: as indicated.

.3 Fittings

- .1 Aluminothermic welding are not accepted.
- .2 Bolt type: "Servit" model, Burndy KS series or approved equivalent.
- .3 Compression: Burndy Hyground system or approved equivalent.
- .4 The tightening torques recommended by the manufacturer as well as those required by the Electricity Code in force must be respected for any connection made with bolts.

.4 Related Accessories

- .1 Grounding and bonding terminals.
- .2 Protective flanges.
- .3 Bolted connectors.
- .4 Connectors to be welded by aluminothermy, if explicitly requested.
- .5 Jumpers, braids and link bars.
- .6 Wire clamp connectors.

2.2 ACCEPTABLES MANUFACTURERS

- .1 Burndy, Cadweld.

3 EXECUTION

3.1 GROUNDING AND BONDING

.1 General

- .1 Unless otherwise indicated, a grounding and bonding wire is required in all electrical supply conduits (lighting, outlets, electrical distribution, motors, etc.).
- .2 When metallic electrical tubes (EMT type) are used, install an insulated grounding conductor in the tubes, of appropriate size even if not explicitly indicated.
- .3 Install connectors in accordance with Manufacturer's instructions.
- .4 Use mechanical connectors to make grounding connections for equipment equipped with grounding terminals.
- .5 On flexible conduits, provide a bonding wire, securely attached to the conduit and connected at each end to a grounding tip, a solderless terminal, a wire clamp or a screw with Belleville washer.

.2 Equipment grounding

- .1 Make required grounding connections for all equipment including: service equipment, transformers, switchgear, raceways, motor racks, motor control centers, starters, control panels, structural steel, metal cladding, generators, alternators, power generators, soundproof shelter, elevators and escalators, switchboards, outdoor lighting network, overhead cranes, cranes, hoists, ventilation system, conveyors, fuel line, equipment roof, and others.
- .2 Make grounding connections for networks and secondary network circuits of 347/600V and 120/250V.

.3 Tests

- .1 Tests in accordance with General Requirements of Section 26 05 02.
- .2 Check continuity and measure resistance of grounding system by methods appropriate to site conditions and to satisfaction of Engineer and local authorities having jurisdiction.
- .3 Carry out tests before energizing the electrical installation.
- .4 During the tests, disconnect the earth leakage indicator.

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 Section 26 05 00 - Common Work Results for Electrical applies.

1.2 REFERENCES

- .1 Junction boxes, pull boxes and hinged lid boxes to CSA C22.2 No. 40.

1.3 SECTION CONTENT

- .1 The Work of this section includes, but is not limited to, the supply, handling, transport, installation and installation of all systems and accessories described in this section or on the drawings, all must be functional:
 - .i Distribution boxes;
 - .ii Cabinets;
 - .iii Junction boxes.

1.4 SHOP DRAWINGS AND DATA SHEETS

- .1 Submit shop drawings and technical data sheets in accordance with the requirements of Section 26 05 00 - Common Work Results for Electrical.
- .2 Submit shop drawings and data sheets for the following equipment and materials:
 - .i Distribution boxes;
 - .ii Cabinets;
 - .iii Junction boxes.

1.5 SAMPLES

- .1 Submit samples as prescribed in Section 26 05 00 - Common Work Results for Electrical.
- .2 Samples of the following items must be submitted for approval:
 - .i None.

2 PRODUCTS

2.1 JUNCTION AND PULL BOXES

- .1 Junction and Pull Boxes:
 - .2 Construction: steel boxes, welded.
 - .3 Covers, for flush mounting: covers with edge protruding at least 25 mm.
 - .4 Covers, for surface mounting: flat covers, screw-on.

2.2 ACCEPTABLE MANUFACTURERS

- .1 Junction and Pull Boxes:
 - .i Iberville;
 - .ii Thomas & Betts;
 - .iii Roger Girard;
 - .iv Bel;
 - .v Crouse Hinds;

3 EXECUTION

3.1 JUNCTION AND PULL BOXES

- .1 Support boxes so that they are supported independently of the conduits connected to them.
- .2 Install recessed units flush with finished wall where applicable, use plaster rings and ensure that edges of wall covering terminate 6 mm ($\frac{1}{4}$ ") near opening.
- .3 Fill boxes with paper or foam to prevent building materials from entering.
- .4 Provide openings of suitable size in the boxes for the connection of conduits and armored cables. It is forbidden to use reduction washers.
- .5 The wall outlets must be installed at the mounting level given in the legend to the drawings.
- .6 Boxes to be recessed in masonry must be aligned with symmetry in relation to the masonry.
- .7 The required pull or junction boxes must be accessible after the Work of the other Divisions has been completed.
- .8 Supply and install the quantity of junction and pull boxes necessary for the installation.

3.2 PULL WIRES

- .1 All empty conduits must be fitted with stranded nylon pull wires of at least 3 mm diameter.
- .2 All pull wires must be fitted at their ends with metal rings large enough to prevent their accidental removal.

END OF SECTION

1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 The Section 26 05 00 - Common Work Results for Electrical applies.

1.2 SECTION CONTENT

- .1 The Work of this section includes, but is not limited to, the supply, handling, transport and installation of all systems and accessories described in this section or on the drawings, which all must be functional:

- .1 Electrical Conduits and Accessories;

1.3 SHOP DRAWINGS AND DATA SHEETS

- .1 Submit shop drawings and technical data sheets in accordance with the requirements of Section 26 05 00 - Common Work Results for Electrical.

- .2 Submit shop drawings and data sheets for the following equipment and materials:

- .1 Electrical Conduits and Accessories;

1.4 SAMPLES

- .1 Submit samples in accordance with the requirements of Section 26 05 00 - Common Work Results for Electrical.

- .2 Samples of the following items must be submitted for approval:

- .1 None.

2 PRODUCTS

2.1 PIPES

.1 Reference

- .1 Rigid metal conduit in threaded galvanized steel to CSA C22.2 No. 45.
- .2 Electrical Metallic Tubing (EMT) to CSA C22.2 No. 83.
- .3 PVC conduits to CSA C22.2 No. 211.2.
- .4 Flexible metal conduits and flexible and waterproof metal conduits with PVC covering in accordance with CSA C22.2 no. 56.
- .5 Conduits in epoxy resin reinforced with fiberglass type FRE in accordance with CSA C22.2 no 2515 standard.
- .6 Flexible non-metallic tubing to CSA C22.2 No. 227.3.

2.2 USE OF ELECTRICAL CONDUITS

.1 Threaded galvanized steel rigid metal conduits

- .1 For indoor and outdoor medium voltage (three-phase circuit in the same conduit);
- .2 For all installations in hazardous locations;
- .3 For outdoor installation;
- .4 For equipotential systems.

.2 Aluminum conduits

- .1 For indoor medium voltage (three-phase and single-phase circuit in same conduit);
- .2 For outdoor installation;
- .3 For all installations in hazardous locations;

.3 Electrical Metallic Tubing (EMT)

- .1 For the arteries of the use and distribution panels;
- .2 For branch circuits and auxiliary systems;
- .3 In suspended ceilings, masonry walls and drywall;
- .4 When buried in concrete (except for a connection).

.4 CPV conduits

- .1 For outdoor installation on roofs;
- .2 For underground installations and in corrosive environments;
- .3 Type EB1, when buried in concrete;
- .4 Type DB2, when buried directly in the ground;
- .5 For the part below ground of the underground connection.

.5 Flexible metal conduits

- .1 For connecting transformers in dry locations;
- .2 For the connection of lighting devices (maximum length = 3 meters).

.6 Flexible and sealed metal conduits with PVC covering

- .1 For connecting motors and devices whose operation causes vibration.

2.3 CONDUIT AND CABLE SUPPORTS AND CLIPS

- .1 One (1) hole clamps in malleable iron to secure exposed conduits up to 53 mm (2"). Two (2) hole clamps for conduits larger than 53 mm (2").
- .2 Clamps to secure conduits to exposed metal Work.
- .3 "U" sections to support several TECK conduits or cables and spaced according to the Electrical Code in force.

- .4 Steel threaded rods to support suspended pipes having a diameter sufficient for the load, 6.3 mm (¼") minimum.
- .5 Ty-Rap type nylon ties are not accepted except for conductors inside panels.
- .6 The catalog numbers given here refer to 16 mm (½") conduit. For any other size, the fittings will be of the same series.
 - .1 Galvanized steel flange tie, Routleco U814 series.
 - .2 Malleable iron angle clamp for series no. 1276 rigid conduit and for electrical metallic conduit, series no. 4159, 16 mm (½"), by Thomas & Betts.
 - .3 Expanding clamp for poured concrete, Star Co. 3435 0000 series.
 - .4 Expanding fastener for brick walls and masonry, Star Co. 1835 00300 series.
 - .5 Clip on channel, Routleco M 5026 series.
 - .6 PVC coated steel clamp for PVC conduit, Scepter CS series.
- .7 TECK cable ties
 - .1 Thomas & Betts series CH118 cable tie straps for cables installed in vertical cable trays or on U-profiles.

2.4 CONDUIT FITTINGS

.1 Reference

- .1 Fittings to CSA C22.2 No. 18.
- .2 PVC fittings to CSA C22.2 No. 85.
- .3 FRE fittings to CSA C22.2 No. 2515.
- .4 Fittings specially designed for the conduits used.
- .5 Prefabricated "L" fittings, where 90° elbows are required on conduits 27 mm (1") in diameter and over.
- .6 Watertight expansion joints.
- .7 The catalog numbers given below refer to 16 mm (½") conduit. For any other size, the fittings will be of the same series.

.2 Rigid metal conduit in threaded galvanized steel

- .1 Thomas & Betts lock nut No. 141;
- .2 Thomas & Betts plastic metal end caps No. 122.

.3 Electrical Metallic Tubing (EMT)

- .1 Iberville No. 5004 fittings;
- .2 Iberville No. 5104 screw couplings.

.4 CPV conduits

- .1 Scepter couplings, EC Series;
- .2 Scepter adapters, TA or FA series.

.5 Type FRE type fiberglass reinforced epoxy resin conduits

- .1 GEC 6540 series fittings;
- .2 GEC 6540 series couplings.

.6 Flexible and sealed metal conduits with PVC covering

- .1 Thomas & Betts fittings No. 5332.

.7 Flexible conduits

- .1 Thomas & Betts fittings No. 302.

.8 Flexible non-metallic tubing

- .1 Scepter fitting no. KTC, KC or KTA depending on application.
- .2 Watertight expansion fittings.

2.5 ACCEPTABLES MANUFACTURERS

.1 Communications cable shelf

- .1 Thomas & Betts Corporation;
- .2 Cooper B-Line;
- .3 T.J.Cope Inc. / Tyco;
- .4 Canadian Electrical Raceways;
- .5 Chalfant Manufacturing Co.

.2 Conduits and fittings

- .1 Columbia-MBF;
- .2 Scepter (CPV);
- .3 IPEX (CPV);
- .4 General Electric Canada (FRE Composites);
- .5 Thomas&Betts;
- .6 Iberville.

3 EXECUTION

3.1 INSTALLATION OF CABLE SHELVES

.1 Installer Qualifications

- .1 Only subcontractors experienced in communication will be accepted. Subcontractors must submit references for Work similar to that specified in this document. Subcontractors must have undergone training and be authorized manufacturers. All bidders must include in their offer the certification documents and references of the installations carried out.

.2 Installation

- .1 Before and during installation, please refer to the approved shop drawings.
- .2 Install cable trays as indicated. Installations will be carried out according to the manufacturer's instructions and accepted industry practices to ensure that they comply with OESC requirements and applicable CSA standards. Refer to NEMA VE2 as a general installation guide.
- .3 Cable routes are shown in a diagram on the drawings. The Installer must check the exact location and routing of the components on site. The Installer must coordinate the communication infrastructures with the other electrical and mechanical Works.
- .4 All cable runs will be bonded to the grounding bar of the attached telecommunications room or telecommunications closet, with a minimum 6 AWG copper conductor (as required by applicable local legislation). The grounding cable will be connected to each section of the cable tray to ensure the continuity of the masses.
- .5 Provide the necessary clearance to ensure access to the cable trays in order to ensure the installation and maintenance of the cables. Ensure a minimum clearance of 305 mm above the cable tray.
- .6 The cable tray supports will be located in such a way as to respect the mechanical constraints of the sections of the cable tray. The supports will be installed according to the indications in the NEMA VE2 installation guide, and in accordance with the manufacturer's instructions.

.3 Tests

- .1 The tests will focus on the continuity of the masses and the grounding of the cable trays. The maximum resistance must comply with the specified maximum ground resistance.
- .2 The manufacturer shall submit test reports verified by an independent test laboratory, presenting maximum load conditions carried out in accordance with the NEMA VE1 latest edition standard. This includes test reports on the verification of the load capacities of the rungs in compliance with NEMA VE1 standard.

3.2 CABLE ROUTES

.1 General

- .1 Install entire network of cable trays as indicated.
- .2 Install cable tray supports on both sides.
- .3 When the cable trays cross the floor, pour a concrete coping around the opening.
- .4 Remove sharp edges and protrusions to prevent damage to cables or injury to personnel.
- .5 Laying cables in cable trays
 - .1 Lay cables one at a time.

- .2 Lay the cables in the cable trays. If cables must be pulled, use rollers.
- .3 Secure cables with nylon ties, and this, every 6 m (18'-0") in horizontally mounted cable trays.
- .6 Ground the cable trays, as described in the "Grounding and Continuity of the Masses" article.
- .7 Sealing barriers
 - .1 In the walls and floors rated for their fire resistance, make an opening of the width and thickness necessary to pass the cable tray.
 - .2 After laying the cables, insulate the walls and floors so as to restore their fire protection to its original level. Refer to the "Conductors" and "Cables" articles for the method to use.
- .8 Add movable joints to sections of rigid cable trays when they cross a structural expansion joint.

3.3 PIPING

.1 General

- .1 Not all conduits are shown on drawings. Those listed are shown in schematic form only. When a conduit size is given, do not install one of a lower size.
- .2 Conceal conduits except those laid in mechanical rooms and electrical equipment rooms.
- .3 Exposed conduits will be installed so as not to reduce the free height of the room and using as little space as possible.
- .4 All conduits used to supply panel feeders, motor control centers, etc., as well as conduits used to supply motors, starters, VFDs, etc., must include a green ground conductor calculated according to the appropriate Table 16 of the current Electrical Code.

.2 Bending and cutting of conduits

- .1 Bend the conduits cold, so that the crushing does not cause a reduction greater than 1/10 of the original diameter of the conduit. Consider as defective and replace all conduits whose hangers are twisted or have a crush greater than 1/10.
- .2 Mechanically bend all steel tubes over 21 mm (3/4") in diameter.
- .3 The radius of curvature must not be less than the radius of the manufactured elbows.
- .4 The threads of the rigid conduits executed on the site must have a sufficient length to allow the conduits to be properly tightened.
- .5 The end of the conduits must be reamed to remove metal particles which could damage the conductors.

.3 Installation of conduits

- .1 All electrical conduits must be secured with the appropriate fasteners. Never use suspended ceilings, plumbing pipes, ventilation or air conditioning ducts or any other device as a means of securing electrical conduit. Steel wire and perforated metal strips will not be tolerated.
- .2 Unless otherwise indicated, the conduits must not pass through the structural members.
- .3 Secure all metallic conduits and flexible conduits installed on the surface with malleable iron straps, bolts and anchors. Space them, according to the requirements of the Electrical Code in force.
- .4 Where there is a concentration of conduits, group and support the conduits on "U" profiles in galvanized steel suspended or applied.
- .5 Secure individually mounted overhead conduits with steel clamps.
- .6 The diameter of the rods and the spacing of the supports must be determined according to the conduits forming a group.
- .7 Lay conduits parallel to steam or hot water lines leaving a lateral clearance of at least 150 mm (6") and a vertical clearance of at least 75 mm (3") between the conduits and the intersecting lines.
- .8 Conduit runs shall not have more than three 90° bends or a length of 30 m (100'). In addition, in vertical rises, provide boxes equipped with cable ties as manufactured by O-Z/Gedney, or the equivalent, according to the spacing provided in Table 21 of the Electrical Code in force. Each end of the conduit runs shall terminate in a box.
- .9 Expansion sleeves will be installed in large straight runs of conduit and at building expansion joints. The electrical continuity of the grounding must be maintained by means of a flexible bond suitable for the materials used and in accordance with the requirements of the Electricity Code in force.
- .10 All conduits must be closed with plugs to prevent the entry of foreign bodies during construction.
- .11 It is forbidden to use a corrosive product to unclog the conduits. Remove and replace clogged portion of conduit.
- .12 Thoroughly dry the conduits before passing the wires through them.
- .13 Supply and install polypropylene fish tape in empty conduits to facilitate eventual pulling of conductors.
- .14 Each of the motors will be connected with a piece of waterproof flexible metal conduit.
- .15 The conduits must be installed to ensure the electrical continuity of the grounding.
- .16 A sufficient number of pull boxes will be installed on the run of the conduits to facilitate the pulling of conductors.

.4 Apparent conduits

- .1 Place conduits parallel or perpendicular to building layout lines.

- .2 Leave a clearance of 1500 mm (60") in the case of conduits installed behind infrared or gas heaters.
- .3 If applicable, conduits must be installed on the flange of the structural steel members.

.5 Hidden conduits

- .1 It is forbidden to install conduits horizontally in masonry walls.
- .2 It is forbidden to lay conduits in terrazzo and concrete screeds unless otherwise indicated.

.6 Conduits buried directly underground

- .1 Pipes buried underground will be buried to the depth indicated.
- .2 Construct groups of pipes on undisturbed soil or on well-compacted granular fill at least 150 mm (6") thick and compacted to 95% of the maximum Proctor dry density.
- .3 Before starting to lay the conduits, dig the trench over the entire distance to be covered and ensure that there are no obstacles that could cause a change in the level of the conduits.
- .4 Install conduits to elevations and grades indicated, with minimum grade ratio of 1:400 to ensure water drainage.
- .5 Lay out and support the conduits, as indicated, with interlocking spacers and preformed rigid plastic used to space the conduits at least 50 mm (2") horizontally and vertically. Install the spacers of spaced at maximum 1500 mm (60") intervals and place them at the levels shown for the bottom row of conduits. Stagger the joints of adjacent rows by at least 750 mm (30").
- .6 Thoroughly waterproof joints (except joints on PVC conduits) by applying a thick coat of bituminous paint.
- .7 Use galvanized steel conduit for pipes extending above finished grade.
- .8 Perform transpositions and changes of direction using five (5) degrees elbows.
- .9 Use flared ends for conduit connections to manholes and buildings.
- .10 Use adapter sleeves to connect metallic conduit to non-metallic conduit.
- .11 Cut, edge and ream the end of the conduits on site, following the manufacturer's instructions, so that the ends thus finished are in all respects similar to the ends finished at the factory.
- .12 Protect the group of conduits with a thin layer of 150 mm (6") of sand above the row of conduits.
- .13 When backfilling, install identification tape indicating that cables are buried. This tape will be similar to Brady's "Identoline Tape" and the inscription will be "Buried Power Line".

.7 Conduits buried underground in a conduit duct bank

- .1 Pipes buried underground will be to the depth indicated.

- .2 Construct groups of pipes on undisturbed soil or on well-compacted granular fill at least 150 mm (6") thick and compacted to 95% of the maximum Proctor dry density.
- .3 Before starting to lay the conduits, dig the trench over the entire distance to be covered and ensure that there are no obstacles that could cause a change in the level of the conduits. The bottom of the excavation must be leveled to ensure a minimum thickness of 75 mm (3") of concrete under the conduits.
- .4 Install conduits to elevations and grades indicated with minimum grade ratio of 1:400 to ensure water drainage.
- .5 Lay out and support the conduits, as indicated, with interlocking spacers and preformed rigid plastic used to space the conduits at least 50 mm (2") horizontally and vertically. Install the spacers of spaced at maximum 1200 mm (48") intervals and place them at the levels shown for the bottom row of conduits. Stagger the joints of adjacent rows by 600 mm (24"). Install formwork on each side of the conduits to ensure a minimum thickness of 50 mm (2") outside the conduits and give a rectangular, regular and uniform shape to the conduit duct bank. Install the reinforcing rods where indicated.
- .6 Use galvanized steel conduit for pipes extending above finished grade.
- .7 Make variations in direction using 5 degrees elbows. Unless otherwise specified, make changes of direction using bends with a minimum radius of 1500mm. The number of bent parts should be kept to a minimum.
- .8 Use flared ends for conduit connections to manholes and buildings.
- .9 Use adapter sleeves to connect metallic conduit to non-metallic conduit.
- .10 Cut, edge and ream on site the end of the conduits, following the manufacturer's instructions, so that the ends thus finished are in all respects similar to the ends finished at the factory.
- .11 Immediately after pouring the concrete, drive a rigid mandrel at least 300 mm long and 6 mm less than the inside diameter of the conduit through the conduit. Use a stiff bristle brush to remove sand, soil or other foreign matter. Avoid moving or damaging the conduits where the concrete has not fully set. Run the stiff bristle brush through each conduit immediately before pulling the cables.
- .12 Install 19 mm thick wood panels between electrical conduits and communication conduits.
- .13 Concrete placement must be continuous along the entire length or up to a construction joint. The concrete must be compacted by hand using wooden strips or equivalent to avoid empty spaces between the conduits or along the forms. The use of concrete vibrators is not permitted.
- .14 During backfilling, install an identification tape halfway between the top of the concrete and the ground level indicating that cables are buried. This tape will be similar to Brady's "Identoline Tape" and the inscription will be "Buried Power Line".

.8 Conduits embedded in concrete slabs and walls

- .1 Lay them so that they adapt well to the reinforcing steel. Arrange the conduits to reduce the number of crossings to a strict minimum.
- .2 Do not install conduits in a concrete slab whose diameter is greater than 25% of the thickness of the slab. Embed the conduits under a concrete thickness of at least 25 mm (1").
- .3 Protect conduits exiting outside of concrete.
- .4 Before pouring the concrete, install sleeves where the conduits cross the slab or the wall.
- .5 Before installing the waterproof membrane, install oversized sleeves where the conduits must cross it. Place a cold applied sealant between the sleeve and the conduit.
- .6 Compact the concrete well all around the conduits.

.9 Conduits under floor slabs

- .1 Conduits 27 mm (1") in diameter and over must pass under the slabs and be enclosed in a concrete envelope 75 mm (3") thick. Place a layer of sand 50 mm (2") thick over the concrete envelope, which is under the floor slab.

.10 Flexible non-metallic conduits

- .1 Non-metallic flexible conduits in concrete slabs must not be installed at low temperatures in order to avoid conduit breakage. Any broken conduit must be replaced with another non-metallic flexible conduit before pouring concrete or with metallic electrical tubes on the surface after pouring concrete.

.11 Risers

- .1 In the risers, install a pull box according to the minimum spacing required in Table 21 of the Electrical Code in force, and secure the conductors using type R brackets from O-Z/Gedney at high voltage and Q in the other cases.

.12 Conduits in ventilation systems

- .1 Conduits entering ventilation systems to supply equipment must be sealed to prevent air leaks through the ventilation ducts.

.13 Conduit fittings

- .1 Fittings for threaded rigid conduits must be coated with lead red before being screwed.
- .2 Screw-type couplings shall be used for metal tube connections.
- .3 Weatherproof fittings shall be used for installations outdoors or in damp locations.

END OF SECTION