Part 1 General

1.1 SITE WORK

.1 After project completion, return the outside site conditions back to the original conditions. Photos of the Site will be taken before Work begins on Site to assist in confirming that after all Work is completed, the Site is returned to its original condition in accordance with the City of Winnipeg Standard Specifications.

1.2 USE OF SITE AND FACILITIES

.1 Contractor may at his discretion place a construction trailer on the Site and store materials in designated areas.

.2 Potable water is not available on the Site. Make arrangements to provide drinking water for workers as required.

.3 Contractor to provide portable washroom facilities outside the flood pumping station.

1.3 REGULATIONS

.1 All Work shall be in full accordance with all applicable Codes, Regulations, By-laws and Ordinances.

1.4 PERMITS, FEES AND INSPECTIONS

.1 Apply for all permits, supply all test certificates and pay all fees to Authorities Having Jurisdiction regarding the installation and inspection of the systems installed under this Contract.

.2 Review drawings with authorities having jurisdiction to ensure compliance with all applicable codes and by-laws.

.3 In case of conflict, codes and regulations take precedence over the contract documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein. Any discrepancies must be brought to the Contract Administrator's attention in writing.

.4 Before starting any work submit the required number of copies of drawings and specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the contract, but notify the Contract Administrator immediately of such changes. Prepare and submit any additional drawings, details or information as may be required.

1.5 EXISTING CONDITIONS AND OTHER TRADES

.1 Visit the Site to determine existing conditions affecting the Work.

.2 Examine all drawings and become fully familiar with the Work of other trades in all Divisions under this Contract.

.3 Cooperate with all other trades. Pay particular attention to the proximity of the Work to all electrical cables, control conduits and utilities. Maintain maximum clear ceiling heights throughout.

1.6 METRIC CONVERSION

.1 All units in this Division are expressed in SI units.

.2 Submit all Shop Drawings and maintenance manuals in SI units.

.3 On all submittals (Shop Drawings, etc.) use the same SI units as stated in the Specifications.

1.7 CUTTING AND PATCHING

.1 Drill for expansion bolts, hanger rods, brackets and supports.

.2 Obtain written approval from the Contract Administrator before cutting or burning structural members.

.3 Patch building where damage from equipment installation, improperly located holes, etc. Use matching materials.

1.8 EQUIPMENT PROTECTION AND CLEAN-UP

.1 Protect equipment and materials in storage on-site during and after installation until Final Acceptance. Leave factory covers in place. Take precautions to prevent entry of foreign materials into working parts of piping systems.

.2 Protect equipment with crates and/or polyethylene covers.

1.9 TEMPORARY USAGE

.1 Usage by the City of any process device, apparatus, machinery or equipment prior to Total Performance being issued is not to be construed as acceptance.

1.10 CONTRACTOR USE OF PREMISES

.1 Limit use of premises for Work, for storage and for access, to allow City operations to operate the flood pumping station.

.2 Co-ordinate use of premises under the direction of the Contract Administrator.

.3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.4 Remove or alter existing Work to prevent injury or damage to portions of existing Work which remain.

.5 Repair or replace portions of existing Work which have been altered during construction operations to match existing or adjoining Work, as directed by the Contract Administrator.

.6 Execute Work with the least possible interference or disturbance to building operations and normal use of the premises. Arrange with the Contract Administrator to facilitate the execution of the Work.

1.11 OWNER OCCUPANCY

.1 The City will occupy premises during entire construction period for execution of normal operations.

.2 Co-operate with the City in scheduling operations to minimize conflict and to facilitate the City's usage.

1.12 EXISTING SERVICES

.1 Notify the Contract Administrator of intended interruption of any service required in order to complete the Work and obtain required permission.

.2 Where the Work involves breaking into or connecting to existing services, give the Contract Administrator 48 hours notice for necessary interruption of mechanical or electrical service throughout the course of Work. Minimize the duration of the interruption.

.3 Submit a schedule to and obtain approval from the Contract Administrator for any shut-down or closure of active service or facility including power services. Adhere to approved schedule and provide notice to the Contract Administrator.

1.13 DOCUMENTS REQUIRED

.1 Maintain at the job Site, one copy of each document as follows:

.1 Contract Drawings;
.2 Specifications;
.3 Addenda;
.4 Reviewed Shop Drawings;
.5 List of Outstanding Shop Drawings;
.6 Change Notices and Change Orders
.7 Field Test Reports;
.8 A copy of the Approved Work Schedule;
.9 Health & Safety Plan and Other Safety Related Documents;
.10 Other documents as specified.

1.14 OFFICES

.1 A site trailer is not required.

1.15 DEMOLITION AND WASTE DISPOSAL

.1 Turn the existing transfer switch over to the City for future use.

.2 Unless specified otherwise, all material no longer required at the Site shall become the Contractor's property. Contractor may retain them for salvage value or dispose of them at an acceptable licensed disposal facility.

1.16 CLEANING

.1 Handle waste materials not re-used, salvaged or recycled in accordance with appropriate regulations and codes.

.2 Remove tools and waste materials on completion of the Work and leave the Work area in a clean and orderly condition.

.3 Clean-up the Work area as the Work progresses.

1.17 SUBMITTALS PROCEDURES

.1 Administrative:

.1 Submit to the Contract Administrator for review. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of contract time and no claim for extension by reason of such default will be allowed. Work affected by submittals to proceed only after review is complete

.2 Review submittals prior to submission to Contract Administrator. Stamp and sign submittals certifying review of submission. This review represents that necessary requirements have been checked and coordinated with the requirements of Work and the contract documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.3 Notify the Contract Administrator in writing at the time of submission, identifying deviations from the requirements of the contract documents stating the reasons for the deviations.

.4 Verify the field measurements and that affected adjacent Work is coordinated.

.5 Contractor's responsibility for errors and omissions in submission is not relieved by the Contract Administrator's review of submittals.

.6 Contractor's responsibility for deviation in submission from the requirements of the contract documents is not relieved by the Contract Administrator's review.

.7 Keep one reviewed copy of each submission on Site.

.2 Contract Drawings and Specifications

.1 Drawings and specifications are complementary each to the other, what is called for by one shall be binding as if called for by both.

.2 Should any discrepancy appear between the drawings and specifications, which leave the Contractor in doubt as to the true intent and meaning of the plans, and specifications, notify the Contract Administrator. If this is not done it will be assumed that the most expensive alternative has been included in the Bid price. For any ruling to become binding, the Contract Administrator must issue the new direction in a published addendum.

.3 Examine all contract documents, including all drawings, specifications and work of other trades to ensure that work is co-ordinated and satisfactorily carried out without changes to the building or contract value.

.4 The drawings for mechanical work are performance drawings. They are generally diagrammatic and are not to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions showing every offset, fitting, valve or every difficulty encountered during execution of work and should not be used as an excuse for deficiencies or omissions.

.5 Follow the recommended installation details and procedures for equipment as found in Supplier technical data, supplemented by contract document details.

.6 Install piping, generally in the locations and routes shown on the drawings, close to the building structure to minimize interference with other services or free

space. Remove piping that is not properly installed and replace to the satisfaction of the City/Contract Administrator at no additional cost.

.7 Be completely responsible for the acceptable condition and operation of systems and equipment components forming part of the installation or associated with it. Promptly replace defective materials, parts and equipment and repair related damage.

.8 All serviceable items, such as valves, controls, must be installed in such a manner as to be accessible for service, maintenance, repair and replacement without the removal of other material or equipment, and without the need for specialized equipment such as lifts, harnesses, or other safety items. Basically, work to be installed to allow easy equipment isolation and servicing functions while all surrounding systems continue to operate.

.9 All individual pieces of equipment shall be provided with appropriate means of isolation and bypass so that systems may continue to operate during maintenance of individual components. It is understood that this may not be possible in all situations, but this is a requirement where isolation is possible.

.10 Drawings and specifications to be considered as an integral part of contract documents and neither drawings nor specifications are to be used alone. Misinterpretation of requirements of plans or specifications shall not relieve Contractor of responsibility of properly completing work to the approval of the Contract Administrator.

.3 Shop Drawings and Product Data:

.1 The term “Shop Drawing” means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data provided by the Contractor to illustrate details of portions of the Work.

.2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of section under which adjacent items will be supplied and installed. Indicate any cross references to design drawings and specifications.

.3 Submit to the Contract Administrator for review one electronic PDF set of detailed shop drawings.

.4 Check shop drawings for conformity to plans and specifications prior to submission.

.5 Submit shop drawings for all items specified. For equipment, provide performance, physical and operating data as described in the Specifications and listed in equipment schedules.

.6 Shop drawings shall include copies of applicable brochure or catalogue material clearly indicating manufacturer and model. Ambiguous shop drawings will not be reviewed.

.7 Clearly mark submittal to indicate all differences from the specified material. The Contract Administrator will require all options and material indicated on the shop drawing to be provided and installed. Specifically note on the submittal specified features such as tank linings, pump seal materials, painting finish, etc.

.8 Include dimensional and technical data sufficient to determine if equipment meets requirements, including weights, loading points, electrical data and motor sizes.

.9 Installed materials and equipment shall meet specified requirements regardless of whether or not the shop drawings were reviewed by the Contract Administrator.

.10 Each drawing to include name of project, equipment supplier and clause number equipment is specified under.

.11 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done "By Others" or "By Purchaser". Any item, equipment or description of work shown on shop drawings shall form part of contract, unless specifically noted to contrary.

.12 Take full responsibility for securing and verifying field dimensions. In cases where fabrication must proceed prior to field dimensions being available, check all shop drawings and approve for dimensions only. In this case guarantee that dimensions will be worked to and ensure that other sub-trades are aware of these dimensions and shall comply with them.

.13 Review by the Contract Administrator shall be mutually understood to refer to general design only. If errors in detailed dimensions or interference with work are noticed, attention of Contractor will be called to such errors of interferences, but the Contract Administrator's review of drawings will not in any way relieve Contractor from responsibility for said errors or interferences, or from necessity of furnishing such work, and materials as may be required for completion of work as called for in contract documents.

.14 The review by the Contract Administrator is for the sole purpose of ascertaining conformance with the design concept.

.15 Do not order equipment until the Contract Administrator has reviewed and returned the reviewed shop drawings.

.16 Keep one set of shop drawings on the site.

.17 Bind one complete set of checked shop drawings in each operating and maintenance instruction manual.

1.18 CLOSEOUT SUBMITTALS

.1 Project Record Documents:

.1 Maintain at the construction Site, two sets of white prints for record drawing purposes. Mark one set "FIELD DRAWINGS" and use these to record the initial data when field measurements are made. Mark the other set "RECORD DRAWINGS".

.2 Store the record drawings in the field office apart from other documents used for construction. Maintain the record drawings in clean, dry and legible condition. Do not use the record drawings for construction purposes.

.3 Record "As-built" information in red ink, accurately and concurrently with the construction progress. Do not conceal Work until all required information is recorded.

.4 Legibly mark each item to record actual construction, including:

.1 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.2 Changes made by Addendum, Change Order or Field Instruction.

.3 Details not on original Contract Drawings.

.4 References to related shop drawings and modifications.

.5 At completion of the project and prior to final inspection, neatly transfer "As-built" notations to the "Record Drawings" and submit to the Contract Administrator along with the "FIELD DRAWINGS".

.5 Provide and electronic (PDF) of all final shop drawings in an orderly fashion on one CD.

.2 Spare Parts, Maintenance Materials and Special Tools:

.1 Provide items of the same manufacture and quality as the items of the Work and of the same production run at the installed materials.

.2 Provide special tools with tags identifying their associated function and equipment.

.3 Deliver all items to Site or a location as directed by the Contract Administrator.

.4 Receive and catalogue all items and submit an inventory listing to the Contract Administrator. Include a copy of the inventory listing in the Operation and Maintenance Manuals.

.5 Obtain a receipt of delivered spare parts, maintenance and extra materials from the Contract Administrator and submit with request for final payment.

.3 Storage, Handling and Protection:

.1 Store spare parts, maintenance materials and special tools in a manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Remove and replace damaged products at the Contractor's expense and to the satisfaction of the Contract Administrator.

.4 Operation & Maintenance Manuals:

.1 Provide O & M Manuals to the Contract Administrator for review 2 weeks prior to final inspection. Submission of individual data will not be accepted unless directed by the City of Winnipeg. Make changes and incorporate the Contract Administrator's review comments as required and re-submit as directed by the Contract Administrator.

.2 Provide three (3) sets of manuals in separate 3 "D" ring, loose leaf binders with spine and face pockets, with the project name clearly indicated on the spine and face. The D ring binders shall have index tabs, each containing the Subcontractors and suppliers names and telephone numbers, data sheets, valve charts, brochures, operating, maintenance and lubricating instructions as well as number coded wiring diagrams and a complete set of reviewed shop drawings for all equipment provided by this Division.

.3 The final accepted copies shall be provided to the City.

.4 General catalog data for the Operations and Maintenance Manual is unacceptable. If manufacturer's specification sheets are generalized in any way, they shall be clearly marked to show exactly which item has been supplied, and the project designation for that item (e.g., PRV-1) is to be noted on

Manufacturer's specification sheet which includes all details for this unit, including complete model number, serial number, and construction & performance data.

.5 The outline for the Operating & Maintenance Manual shall be as follows:

- Introduction
- Purpose
- General Description
- Operating Instructions
- Seasonal Operations
- Normal Valve Positions and Control
- Recommended Inspection and Preventative Maintenance
- Maintenance Schedule
- Description of Maintenance Procedures
- Recommended Major Equipment Spare Parts List
- Estimated Annual O & M Costs (hours and equipment)
- Suggested Maintenance Record Form
- Appendices
- Equipment Shop Drawings
- Safety Practices
- Equipment Supplier Schedule
- Manufacturer Recommended O & M Information
- Exploded Views and Parts Lists
- As-Built Drawings (reduced)
- Control Narrative

.6 Include the following information in the manuals, incorporated into the outline format above, as applicable:

.1 Mechanical and Electrical Systems

.1 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their respective controls including sequences of operation.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

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

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.2 Maintenance data to include:

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

.2 Manufacturer's preventative maintenance procedures.

.3 Data to include schedules of tasks, frequency, tools required and task time including daily, weekly, monthly, semi-annual and annual checks.

.3 Performance data to include:

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

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Lubrication Information.

.5 List of Contractors and Equipment Suppliers including contact information.

.6 Parts and Troubleshooting Information

.2 Certification and Identification

.1 Inspection Certificates

.2 Balance Reports

.3 Component Information

.1 One section for each type of equipment to include shop drawings and installation and maintenance information.

.4 Safety Information

.5 Additional Information

.1 Prepare and insert into Operation & Maintenance Manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.5 Guarantees, Warranties and Bonds:

.1 Provide guarantees, warranties and bonds as specified.

.2 Guarantee satisfactory operation of all work and apparatus installed under this contract. Replace, at no expense to the City, all items, which fail or prove defective within a period of time as define in Division 1, but in no circumstances shall the warranty period be less than one (1) year after final acceptance of complete contract by the City. Make good all damage incurred as a result of failure or repair of mechanical work.

.3 No certification given, payment made, partial or entire use of equipment by the City, shall be construed as acceptance of defective work or acceptance of improper materials. Make good at once, without cost to the City, all such defective work or materials and consequence resulting, within the Warranty period.

.4 This general guarantee shall not act as a waiver for any specified guarantee and/or warranty of greater length of time noted elsewhere in these documents.

.5 Provide warranties on specified products, equipment and components as well as on the installation of these items. Include for all costs for cutting and patching, removals and restoration materials and work and repairs to other equipment affected in performance of warranty work.

.6 Provide warranty certificates, wherever given or required, that are in excess of the normal warranty period showing the name of the firm giving the warranty, dated and acknowledged, on specific equipment and system.

.7 Assemble warranties and bonds, executed by each of the respective manufacturers, suppliers and subcontractors.

.8 Provide a Table of Contents neatly typed, in orderly sequence. Provide complete information for each item:

.1 Product or Work item.

.2 List subcontractor, supplier and manufacturer with name, address and telephone number of responsible principal.

.3 Date of beginning of warranty or bond.

.4 Duration of warranty or bond.

.5 Proper procedure in case of failure.

.6 Instances which might affect validity of warranty or bond.

.9 Except for items put into use with the Contract Administrator's permission, leave date of beginning of time of warranty until Date of Total Performance is determined.

.10 Verify that documents are in proper form, contain full information and are notarized.

.11 Co-execute submittals when required.

.12 Retain warranties and bonds until time specified for submittal.

.13 Submit with the Contractor's Application for Certificate of Total Performance, warranties and bonds as required, execute in duplicate by subcontractors, suppliers and manufacturers.

.14 For items of Work, where acceptance is delayed materially beyond the Date of Total Performance, provide updated submittal within 10 calendar days after acceptance, listing date of acceptance as start of warranty period.

1.19 GENERATOR INSTALLATION

.1 Intent

.1 This section describes the general requirements for the generator supplier under the Contract relating to the supervision of installation, testing, operation and performance verification. The Contractor shall be responsible for the supply, installation, testing, operation and performance verification of the specified generator.

.2 Definitions

.1 Manufacturer: the manufacturer is the person, partnership or corporation responsible for the manufacture and fabrication of the generator provided to the Contractor for the completion of the Work.

.2 Manufacturer's Representative: the manufacturer's representative is a trained serviceman empowered by the manufacturer to provide installation, testing and commissioning assistance to the Contractor in his performance of these functions.

.3 Expertise and Responsibility

.1 The Contract Administrator recognizes the expertise of the manufacturer.

.2 Should the Contract Administrator issue a Field Order, Authorization for Contract Change or Instruction to Change the Work, which would, in the opinion of the Contractor, compromise the success or safety of the Work, then it shall be incumbent on the Contractor to notify in writing the Contract Administrator to this effect within two days.

.4 Generator Delivery

.1 Provide the generator for inspection before installation into the station. After acceptance by the Contract Administrator, installation can proceed.

.2 Any minor damage identified during the inspection shall be repaired as per the manufacturer's recommendations by the Contractor at no cost to the City. Any severe damage will be grounds for rejection of the generator. The severely damaged generator will be replaced at no cost to the City.

.3 Ten days before delivery, notice shall be given to the Contract Administrator so that arrangements for receipt and for inspection can be made. The shipping lists of materials will be carefully checked by the supplier in the presence of the Contract Administrator and the Contractor.

.4 The Contractor shall be responsible for receiving, off-loading and placing the generator at the site.

.5 The Contractor shall ensure that their staff is fully informed of the precautions to be taken in the unloading of the generator and its placement.

.5 Installation Assistance

.1 Before commencing installation of the generator, the Contractor shall arrange for the attendance of the manufacturer's representative to provide instructions in the methods, techniques, precautions and any other information relevant to the successful installation of the generator.

.2 The Contractor shall inform the Contract Administrator, in writing, of the attendance at the Site of any manufacturer's representative for installation training at least 14 days prior to arrival.

.3 The manufacturer's representative shall confirm Contractor is aware of all installation requirements before installation begins.

.6 Installation

.1 The Contractor shall install the generator as defined in the Specification. If necessary, or if so directed by the Contract Administrator during the course of the installation, the Contractor shall contact the manufacturer to receive clarification of installation procedures, direction or any other additional information necessary to continue or complete the installation in an appropriate manner.

.2 If it is found necessary, or if so directed by the Contract Administrator, the Contractor shall arrange for the manufacturer's representative to visit the Site to provide assistance during the installation.

.3 Prior to completing the installation, the Contractor shall inform the manufacturer and arrange for the attendance at the Site of the manufacturer's representative to verify successful installation.

.4 The manufacturer's representative shall conduct a detailed inspection of the installation including alignment, electrical connections, rotation direction, running clearances, lubrication, workmanship and all other items required to ensure successful operation of the generator.

.5 The manufacturer's representative shall identify any outstanding deficiencies in the installation to the Contract Administrator and the Contractor.

.6 The deficiencies shall be rectified by the Contractor and the manufacturer's representative will be required to re-inspect the installation, at no cost to the City.

.7 When the manufacturer's representative accepts the installation, they shall confirm in writing that the installation has been satisfactorily completed.

.8 The manufacturer's representative and the Contractor are to tag the generator with a 100 mm by 200 mm card stating "Engine Checked. Do Not Run." stenciled in large black letters and are to sign and date the card.

.7 Operation and Performance Verification

.1 Generator will be subjected to a demonstration, running test and performance tests after the installation has been verified and any identified deficiencies have been remedied.

.2 Inform the Contract Administrator at least 14 days in advance of conducting the tests and arrange for the attendance of the manufacturer's representative. The tests may be concurrent with the inspection of satisfactory installation if mutually agreed by the Contractor and the Contract Administrator.

.3 Performance tests shall be as dictated in the specifications for the generator or as reasonably required by the Contract Administrator to prove adherence to the requirements listed in the specifications.

.4 The Contractor shall submit the results of the performance tests to the Contract Administrator, documented and summarized in a format acceptable to the Contract Administrator. The Contract Administrator reserves the right to request additional testing. The generator shall be accepted and handed over to the City prior to the satisfactory completion of the performance tests and receipt of the test reports.

.5 All water, temporary power, heating or other ancillary services required to complete the initial demonstration, running test and performance tests are the responsibility of the Contractor.

.6 Should the performance tests reveal any defects, then those defects shall be promptly rectified and the performance tests shall be repeated to the satisfaction of the Contract Administrator. Additional costs incurred by the Contractor, due to performance retests shall be the responsibility of the Contractor.

.7 On successful completion of the performance tests, the Contract Administrator will provide written confirmation.

1.20 TRAINING

.1 Description

.1 This Section contains the requirements for training City staff, by persons retained by the Contractor specifically for the purpose, in the proper operation and maintenance of the generator and systems installed under this Contract.

.2 Training sessions are required during the generator testing.

.3 As a minimum, the Contractor is to allow for at least two hours of training per shift, as required for the generator system. Refer to the generator specification for specific time periods.

.4 The intent is that the City should receive sufficient training on the generator and systems that they are going to operate and maintain. The Contract Administrator shall have the authority to determine the duration and content of each training session required.

.2 Quality Assurance

.1 Where required by the generator specification, provide on-the-job training of the City staff. Training sessions will be conducted by qualified factory-trained representatives of the generator supplier with a minimum of two years of experience. Training includes instruction of City staff in generator operation and preventative maintenance and instruction on mechanics, electrical, instrumentation and communications in normal operation up to major repair.

.2 The trainers proposed by the Contractor shall be experienced in training plant operators and shall have relevant experience in similar work.

.3 Submittals

.1 Submit the following information in accordance with Section 1.19. For phased testing and start-up activities, separate submittals can be prepared for the generator. The material will receive a "REVIEWED" or "REVIEWED AS MODIFIED" status by the Contract Administrator no later than four weeks prior to delivery of the training:

.1 Lesson plans and training manuals, handouts, visual aids and other reference materials for each training session to be conducted by the Contractor's trainer(s).

.2 Date, time and subject of each training session.

.3 Training schedule. Concurrent classes will not be allowed.

.4 Location

.1 Where specified, conduct training sessions for City staff, operations and maintenance personnel, on the operation, care and maintenance of the generator and systems installed under this Contract. Training will take place at the Site of the Work and under the conditions specified in the following paragraphs.

.2 Field training sessions will take place at the Site. Classroom training is to take place in a WWD boardroom. The Contract Administrator may direct the classroom training to take place at another suitable location.

.5 Lesson Plans

.1 Prepare formal written lesson plans for each training session and coordinate with the Contract Administrator. Lesson plans are to contain an outline of the material to be presented along with a description of visual aids to be utilized during the session. Each plan will contain a time allocation for each subject. Furnish ten (10) copies of the necessary training manuals, handouts, visual aids and reference materials at least two weeks prior to each training session.

.6 Format and Content

.1 Include time in the classroom and at the Site for each training session. As a minimum, cover the following topics for the generator:

.1 Familiarization;

.2 Safety;

.3 Operation;

.4 Troubleshooting;

.5 Preventative Maintenance;

.6 Corrective Maintenance;

.7 Parts

.8 Local representatives.

.7 Video Recording

.1 Advise all suppliers providing training sessions that the training material may be videotaped. The City may record each training session and the material may be edited and supplemented with professionally produced graphics to provide a permanent record for the City's use.

.8 General Requirements

.1 Conduct training in conjunction with the generator testing period. Schedule classes such that classroom sessions are interspersed with field instruction in a logical sequence. Arrange to have the training conducted on consecutive days with no more than four hours of classes scheduled for any one shift.

.2 Provide final O&M Manuals, as defined in Section 1.19 and 1.20 for the specific generator to the City at least four weeks prior to the start of any training. (Video recording may take place concurrently with all training sessions.)

.9 Operator Classroom Training

.1 As a minimum, classroom generator training for operations personnel will include:

.1 The generator's specific location in the flood pumping station and an operational overview. Use slides and drawings to aid discussion.

.2 Purpose and plant function of the generator.

.3 Operational theory of the generator.

.4 Start-up, shutdown, normal operation and emergency operating procedures, including system integration and electrical interlocks, if any.

.5 Safety items and procedures.

.6 Routine preventative maintenance.

.7 Operator detection (without test instruments) of specific generator trouble symptoms.

.8 Required generator exercise procedures and intervals.

.9 Routine disassembly and assembly of the generator if applicable for purposes such as operator inspection of the generator.

.10 Exam.

.10 Operator Hands-on Training

.1 As a minimum, hands-on generator training for operations personnel will include:

.1 Identifying instrumentation: location of the primary element, location of instrument readouts, discuss purpose, basic operation and information interpretation.

.2 Discussing, demonstrating and performing standard operating procedures and visual inspection of the system operation.

.3 Discussing and performing the preventative maintenance activities.

.4 Discussing and performing the start-up and shutdown procedures.

.5 Performing the required generator exercise procedures.

.6 Performing the routine disassembly and assembly of the generator if applicable.

.7 Identifying and reviewing safety items and performing safety procedures, if feasible.

.11 Maintenance Classroom Training

.1 As a minimum, classroom generator training for maintenance and repair personnel will include:

.1 Basic theory of operation.

.2 Description and function of equipment.

.3 Routine start-up and shutdown procedures.

.4 Normal and major repair procedures.

.5 Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the “pass” and “no pass” test instrument readings.

.6 Routine and long-term calibration procedures.

.7 Safety procedures.

.8 Preventative maintenance and up to and including major repairs such as replacement of major equipment part(s) with the use of special tools.

.12 Maintenance Hands-on Training

.1 As a minimum, hands-on generator training for maintenance and repair personnel will include:

.1 Locating and identifying generator components.

.2 Reviewing the generator function and theory of operation.

.3 Reviewing normal repair procedures.

.4 Performing routine start-up and shutdown procedures.

.5 Reviewing and performing the safety procedures.

.6 Performing City approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting generator problems.

.7 Reviewing and using the Contractor’s manuals in the hands-on training.

.13 Generator and Systems for Training

.1 Provide training during the generator testing period for the following equipment:

.1 Natural gas generator system (engine)

.2 Transfer switch.

.2 Coordinate and finalize with the Contract Administrator on training schedules and duration of each training session.

.14 Training

.1 Training for the generator shall be conducted before the operation period.

.2 The Contract shall not be considered complete, for the purpose of issuing a Certificate of Substantial Performance, until the training has been provided.

1.21 COMMISSIONING

.1 General

.1 At the time of commissioning, the Contract Administrator shall advise the Contractor of the commissioning requirements.

.2 The Contractor shall refer to all Sections for details on commissioning procedures not included in this Section.

.2 Intent

.1 This Section describes the Contractor's responsibilities in commissioning and handover of the process, electrical and other systems to be installed as part of this Work.

.3 Definitions

.1 System: for the purpose of this specification, a system shall be defined as the equipment, piping, controls, ancillary devices, electrical power, etc. which together perform a specific function at the flood pumping station.

.2 Commissioning: for the purpose of this specification, commissioning shall be defined as the successful operation of a system in accordance with its design requirements for a period of seven days.

.3 Acceptance: for the purpose of this specification, acceptance shall be defined as the formal turnover of a system to the City for their operation and maintenance. This shall occur after the successful end of commissioning of each system through a formal agreement between the Contract Administrator, the City and the Contractor. Success of the commissioning period is determined by the Contract Administrator.

.4 Commissioning Team

.1 The Work of commissioning will be conducted by the Contractor, the City and the Contract Administrator.

.2 The City's appointed staff shall represent process personnel and operating staff.

.3 The Contractor shall provide personnel representing the appropriate trades including I&C personnel during the commissioning. These personnel shall be skilled workmen, able to expedite any minor repairs, adjustments, etc. as required to complete the commissioning with as few delays as possible.

.5 Commissioning Plans

.1 Develop a detailed methodology for the commissioning of each system at least 30 calendar days prior to the start of commissioning. The plan shall be drafted by the Contractor and reviewed by the Contract Administrator and shall include the following:

.1 Detailed schedules of events, including but not limited to the schedule for completion of testing of all component parts of the system prior to commissioning of a system.

.2 Planned attendance schedule for the manufacturer's representative.

.3 Contingency plans in the event of a process malfunction.

.4 Drawings and sketches as required to illustrate the planned sequence of events.

.5 List and details for any temporary equipment required to facilitate commissioning.

.6 List of all personnel required for commissioning and handover with information

.2 The commissioning plan shall be reviewed prior to its implementation. The Contract Administrator shall be the final arbiter.

.6 Equipment

.1 All process, mechanical, electrical, control and miscellaneous equipment related to a system shall be successfully installed and tested and any specific requirements noted.

.2 As required in Section 1.19, O&M Manuals will be submitted and reviewed by the Contract Administrator.

.3 Staff training sessions shall be completed.

.4 Temporary equipment will be installed and tested as necessary to ensure that it functions reliably and consistently through the commissioning period.

.7 Controls

.1 All controls which are the responsibility of the Contractor shall be installed and tested prior to commissioning.

.2 The Contract Administrator shall arrange for the simulation of the control sequences from the equipment under this specification. Every effort shall be made to ensure that the commissioning period provides for the full and comprehensive operation of the equipment under all anticipated normal and adverse operating conditions.

.8 Manpower

.1 Supply all staff required during commissioning as necessary to assist the City's staff in the operation of the flood pumping station.

.2 Supply competent staff capable of maintaining, repairing and adjusting the equipment and controls to achieve the intended design functions during the commissioning period.

.3 Ensure the equipment manufacturer's representatives are available as necessary to certify adjustments in equipment; to guide in setting correct operating limits

and to generally provide input as required for the appropriate operation of the equipment.

.9 Design Parameters

.1 Design parameters for the systems to be commissioned shall be as defined in the specifications and/or the operating descriptions. The commissioning team will identify to the Contractor, which parameters shall be modified prior to commissioning and shall be responsible for any subsequent changes during the commissioning period.

.10 Preparation

.1 Each item of equipment included in the systems to be commissioned shall be satisfactorily tested.

.2 Piping, wiring and other conduit systems shall be finished and tested.

.3 Electrical connections shall be completed and inspected to the satisfaction of the governing authorities.

.4 All other regulatory inspections shall be competed to the satisfaction of the governing authorities.

.5 Control systems shall be completed and the related control software debugged.

.11 Pre-commissioning Requirements

.1 The supplier and/or installation Contractor are to prepare pre-commissioning procedures and additional information as required for inclusion in the Project Commissioning Plan and final documentation. The required information is to be submitted to the City and Contract Administrator for review and approval prior to commissioning of the system.

.12 Sequence

.1 The following sequence of events shall be followed:

.1 O&M Manuals shall be available as per the requirements of Section 1.19 at least 14 days prior to the start of commissioning.

.2 Initial operator training shall be undertaken two weeks prior to commissioning.

.3 Equipment performance tests shall be conducted successfully.

.4 Start and run systems in manual mode.

.5 Turn equipment to automatic in a planned and logical manner. Ensure that the control system is operating the equipment in a manner which precludes damage to the equipment and which is consistent with the process operating requirements.

.6 Commence commissioning period of seven days. The equipment shall operate continuously and successfully throughout this period. Minor failures shall not void the commissioning period. A minor failure is defined as one which does not present a safety hazard, does not impact the overall process functioning and can be temporarily overcome by the use of available standby equipment. The commissioning period shall be re-started if a critical failure occurs.

.7 Upon completing the commissioning period, the system shall be granted formal acceptance by the Contract Administrator.

.13 Field Testing and Commissioning Requirements

.1 Systems commissioning will be conducted prior to substantial completion. The purpose of the Commissioning is to ensure all systems are functioning as designed prior to substantial completion.

.2 The supplier and/or installation Contractor are to provide all of the necessary equipment for conducting the required field tests. Again, the supplier and/or installation contractor are to prepare commissioning procedures and additional information as required for inclusion in the Project Commissioning Plan and the final documentation.

.3 The site tests, at a minimum, shall prove the following:

.1 Static Tests – Static pressure tests and valve leak tests.

.2 Running Tests – After installation but before being placed into service, the equipment shall be powered and tested to prove the following:

.1 All clearances and alignments are in order.

.2 Lubrication (if applicable) is adequate.

.3 Operation of each controller, relay, limit switch and all other control device is satisfactory and operates correctly.

.4 All circuits, controls and interlocks sequence of operation is correct.

.5 All protective and indicating devices operate satisfactory.

.4 Commissioning will require the presence of knowledgeable representatives of the necessary Mechanical Trades. The Mechanical Contractor shall include all necessary costs for systems commissioning. The Contract Administrator will participate to the extent deemed necessary.

.5 All plumbing control system testing is to be performed by the Contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the Contract Administrator is notified of the system demonstration.

.6 All control wiring shall be verified for proper connections, free of all shorts, ground faults and that the terminations are tight. All input devices shall be calibrated individually with the calibration procedures recommended by the manufacturer.

.7 Verify that all binary output devices operate properly and that the normal positions are correct. The installation contractor must also verify that all analog output devices are functional, that start and span are correct and that the direction and normal positions are correct.

.8 All aspects of mechanical systems operations will be operated, checked and verified. If any portion of the work fails to meet design requirements, the Commissioning procedure will be halted and only resumed when all necessary repairs are completed. All extra costs including costs for the Contract Administrator to revisit the site resulting from this postponement will be borne by the Contractor.

.9 Verify that the system operation adheres to the sequence of operation. All modes of operation shall be simulated and observed by overriding and varying inputs and schedules.

.10 Submit, to the Contract Administrator, a commissioning report detailing the commissioning tests performed and the results of these tests. Format of report is to be one sheet for each piece of mechanical equipment and it shall include: Equipment tag, Description, Location and point form description of tests and results.

.14 Acceptance

.1 When a process system has been commissioned satisfactorily, the process system shall be formally accepted for operation and routine maintenance by the City's forces.

1.22 SUBSTANTIAL COMPLETION

.1 Prior to requesting any substantial completion inspection, complete all of the following items:

.1 All systems shall be operational with alarms, interlocks and control functions.

.2 Obtain all certificates of approval from the authorities having jurisdiction.

.3 All manufacturer start-ups shall be complete.

.4 Complete valve tagging and identification of all new mechanical systems and components.

.5 Lubricate all equipment as per manufacturers' instructions.

.6 Submit required documentation and perform operator training.

.7 Provide all Manufacturers' reports required by the specifications.

.8 Complete all previously identified deficiencies.

.9 Clean equipment both inside and out.

.10 Complete final air and water balancing and submit reports.

.11 Complete final calibration.

.12 Provide As-Built record drawings in accordance with the Bid documents.

.2 After the completion of tests and adjustments, remove temporary covers, strainers and/or obstructions to flow. Drain, flush and refill piping systems as often as required until all piping is clear of dirt and debris.

.3 Leave all mechanical Works in their specified working order.

.4 Provide spare components as specific in this and other Sections of Division 26.

.5 Provide one set of all specialized tools required to service the equipment as recommended by the manufacturers.

1.23 DOCUMENTATION AND SYSTEM ACCEPTANCE

.1 Provide the following on substantial completion of the work:

.1 Operation & Maintenance Manuals as called for elsewhere in this Section.

.2 Site records (Record Drawings):

.1 The Contract Administrator will provide 1 set of reproducible mechanical drawings as required for each phase of work. Mark changes as work progresses and as changes occur.

.2 Transfer information weekly to reproducible drawings, revising the reproducible drawings to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.3 As-built drawings:

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

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

.3 Submit to the Contract Administrator for approval and make corrections as directed.

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

.5 Submit completed reproducible as-built drawings with the Operating & Maintenance Manuals.

.4 Extended warranty certificates where specified in other Sections of Division 26.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 – GENERAL

1.1 Section Includes

.1 Materials and installation for wire and box connectors.

1.2 References

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2 No.65, Wire Connectors.

PART 2 - PRODUCTS.

2.1 Materials

.1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors for armoured cable and flexible conduit as required to: CAN/CSA-C22.2 No.18.

PART 3 - EXECUTION

3.1 Installation

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

.1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

.2 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.2 References

.1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

1.3 Product Data

.1 Submit product data in accordance with Section 26 05 01 – Common Work Results - Electrical.

PART 2 - PRODUCTS

2.1 Building Wires

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 1 kV TECK90 Power Cable

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated. (12 AWG minimum where not indicated)

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight, explosion-proof approved for TECK cable.

2.3 600 V TECK90 Control Cable

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated. (14 AWG minimum where not indicated)

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight, explosion-proof approved for TECK cable.

2.4 300 V Instrument Cable – Armoured

.1 Conductors: 16 AWG, 7 strand concentric lay, Class B tinned copper, twisted pairs/triads.

.2 Insulation: PVC TW75, 75 °C Wet, 105 °C Dry (-40 °C), 300 Volt.

.3 Twisted pairs/triads cabled with staggered lays.

.4 Shielding: Individual twisted pair(s)/triads Aluminum/mylar shield with ST drain wire, 100 % shield. Overall aluminum/mylar shield with ST drain wire. Individual drain wires one size smaller than conductor AWG. Overall drain wire the same AWG as conductors.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material (90 °C, -40 °C).

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers. .

.8 Connectors:

.1 Watertight, explosion proof approved for armoured cable.

2.5 Type RW90 Conductor

.1 In accordance with CSA C22.2 No.38

.2 Circuit conductors shall be concentric stranded soft copper, size as indicated (12 AWG minimum where not indicated).

.3 Insulation to be chemically cross-linked thermosetting polyethylene rated type RW90 XLPE, 600V

.4 Suitable for installation in temperatures down to -40 °C.

.5 90 °C conductor operating temperature.

2.6 Wiring Identification

.1 Provide wiring identification in accordance with Section 26 05 01 – Common Work Results – For Electrical.

PART 3 – EXECUTION

3.1 Installation of Building Wires

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

3.2 Installation of TECK Cable 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors - 0 - 1000 V.

3.3 Installation of Armoured Cables

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors - 0 - 1000 V.

3.4 Installation of Control Cables

.1 Install control cables in conduit.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 NONE

.1 None.

Part 2 Products

2.1 FRAMING AND SUPPORT SYSTEM

.1 Materials:

.2 Conduit support structures shall employ an aluminum strut framing system together with the manufacturer's connecting components and fasteners for a complete system.

.3 Finishes:

.1 Wet locations: Aluminum.

.2 Indoors, dry locations: Aluminum.

.3 Nuts, bolts, machine screws: Stainless steel.

2.2 CONCRETE AND MASONRY ANCHORS

.1 Materials: hardened steel inserts, zinc plated for corrosion resistance.

.2 Components: non-drilling anchors for use in predrilled holes, sized to safely support the applied load with a minimum safety factor of four.

.3 Manufacturer: Hilti (Canada) Limited or approved equal in accordance with B7.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to solid masonry, tile and plaster surfaces with galvanized anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts, unless otherwise indicated.

.4 Do not drill through steel reinforcement encased in concrete.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Maximum spacing between conduit supports:

.1 As per 26 05 34.

.7 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole aluminum straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole aluminum straps for conduits and cables larger than 50 mm.

.8 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.9 For surface mounting of two or more conduits use channels, with maximum centre spacing as indicated above.

.10 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.11 Ensure adequate support for raceways and cables dropped vertically where there is no wall support.

.12 Do not use wire lashing or perforated strap to support or secure cables.

.13 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Contract Administrator.

.14 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.15 Touch up abraded surfaces and cut ends of galvanized members with an approved galvanizing repair compound.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 01 – Common Work Results - Electrical.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

.6 Material Requirements:

.1 Outdoor and Buried: PVC
.2 Main Floor: PVC
.3 Dry Well: PVC
.4 Wet Well: PVC

.7 Where conduit serves an area where metal material is required, utilize metal conduit, boxes, and fittings for the entire conduit run.

2.2 SURFACE MOUNTED OUTLET BOXES FOR METAL CONDUIT

.1 General Requirements:

.1 Acceptable materials:
  .1 Cast Aluminum
  .2 Cast ferrous alloy with corrosion resistant epoxy coating.
.2 Finish
  .1 Epoxy Enamel
.3 Suitable for threaded rigid conduit
.4 Mounting lugs as required.
.5 Wet location covers for all locations unless otherwise approved by the Contract Administrator.
.6 To CSA 22.2

.2 Round Boxes:

.1 100mm (4”) round.

.2 Tapped conduit openings and plugs.

.3 Manufacturer / Model:

.1 Crouse Hinds VXF series

.3 Device Boxes

.1 FS or FD cast aluminum boxes with factory threaded hubs and mounting feet for surface wiring of receptacles.

.2 Single gang unless specified otherwise.

.3 Manufacturer / Model:

.1 Crouse Hinds FS/FD series

2.3 SURFACE MOUNTED OUTLET BOXES FOR PVC CONDUIT

.1 General Requirements:

.1 To CSA C22.2 No. 18.

.2 Acceptable materials:

.1 PVC

.3 Grounding stud.

.4 Mounting lugs as required.

.5 NEMA 4X, unless otherwise indicated.

.2 Specific Requirements:

.1 Ceiling Outlets:

.1 IPEX OB series

.2 Device Boxes:

.1 IPEX FS/FD series

2.4 CONDUIT BOXES FOR METAL CONDUIT

.1 FS or FD cast aluminum boxes with factory-threaded hubs and mounting feet for surface wiring.

2.5 CONDUIT BOXES FOR PVC CONDUIT

.1 Non-metallic PVC boxes with mounting feet for surface wiring of devices.

.2 Acceptable products: Ipex

2.6 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Provide boxes sized as required by the Canadian Electrical Code.

.2 Support boxes independently of connecting conduits.

.3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.4 Vacuum clean interior of outlet boxes before installation of wiring devices.

.5 Provide permanent label or lamacoid for all device boxes indicating the circuit(s) contained within.

.1 Example: L10-2 (Panel L10, circuit 2)

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 Canadian Standards Association (CSA)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

.3 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

.4 C22.2 No. 45.2 - Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel (Tri-national Standard, with NMX-J-576-ANCE and UL 6A).

1.2 Preferences

.1 In general power and control wiring shall be by TECK or armoured cable.

PART 2 - PRODUCTS

2.1 Conduits

.1 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.2 Rigid aluminum conduit to CSA C22.2 No. 45.2-08

2.2 Conduit Fastenings

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at spacing as per Rule 12-1010 of the current edition of the Canadian Electrical Code for rigid metal conduit.

.4 Channel type supports for two or more conduits at spacing as per Rule 12-1114 of the current edition of the Canadian Electrical Code for PVC conduit.

.5 Threaded rods, 6 mm dia., to support suspended channels.

2.3 Conduit Fittings

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

2.4 Expansion Fittings for Rigid Conduit

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 21 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 Fish Cord

.1 Polypropylene.

PART 3 - EXECUTION

3.1 Installation

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Surface mount conduits.

.3 Install conduit sealing fittings in hazardous areas. Fill with compound.

.4 Minimum conduit size for lighting and power circuits: 21 mm.

.5 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.6 Mechanically bend steel conduit over 21 mm dia.

.7 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.8 Install fish cord in empty conduits.

.9 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.10 Dry conduits out before installing wire.

.11 Connect conduit to equipment securely to maintain continuity for the purpose of bonding to ground.

.12 Provide for expansion and contraction of the conduit system.

3.2 Surface Conduits

.1 Run parallel or perpendicular to building lines.

.2 Run conduits in flanged portion of structural steel.

.3 Group conduits wherever possible on suspended or surface channels.

.4 Do not pass conduits through structural members except as indicated.

3.3 Concealed Conduits

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 Conduits In Cast-In-Place Concrete

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

3.5 Conduits Underground

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

END OF SECTION

Part 1 General

1.1 DESCRIPTION OF SYSTEM & SITE

.1 Provide a standby power system to supply electrical power at 600 Volts, 3 Phase, 4 wire with sufficient capacity to supply all connected loads. Generator shall consist of a liquid cooled engine, a synchronous AC alternator, and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter.

.2 The generator shall have sufficient capacity to operate the following loads:

.1 Two (2) pumps, each rated 20 HP, controlled by a Full Voltage Non-Reversing starter.

.2 One (1) dry-type transformer rated 15kVA, single phase, with 75% load.

.3 Submit the generators rated power output from 0 to +40 ˚C ambient temperature at 270 meter elevation.

.4 The generator is to meet site noise requirements of 65 dBA, at 7 meters assuming no installed sound barriers beyond the lift station.

1.2 REQUIREMENTS OF REGULATORY AGENCIES

.1 An electric generating system, consisting of a prime mover, generator, governor, coupling and all controls, must have been tested, as a complete unit, on a representative engineering prototype model of the equipment to be sold.

.2 Conform to applicable CSA standards and NFPA 110 requirements.

.3 Underwriters Laboratories listing (UL2200) for a stationary engine generator assembly.

1.3 MANUFACTURER QUALIFICATIONS

.1 These systems shall be supplied by an original equipment manufacturer (OEM) who has been regularly engaged in the production of engine-alternator sets, automatic transfer switches, and associated controls for a minimum of 25 years, thereby identifying one source of supply and responsibility.

.2 The manufacturer shall have printed literature and brochures describing the standard series specified, not a one of a kind fabrication.

.3 Manufacturer’s authorized service representative shall meet the following criteria:

.1 Certified, factory trained, industrial generator technicians

.2 Service support 24/7

.3 Service location within 250 kilometres of lift station

.4 Service & repair parts in-stock

.5 Offer optional remote monitoring and diagnostic capabilities

1.4 SUBMITTALS

.1 Engine Generator specification sheets

.2 Automatic Transfer Switch specification sheets

.3 Controls specification sheets

.4 Installation / Layout dimensional drawings

.5 Wiring schematics

.6 Sound data

.7 Emission Certification
.8 Warranty Statement
.9 Alternator thermal damage and decrement curves
.10 Generator protective device time current curves
.11 Generator impedance values to be used for power system analysis by others

1.5 PREFERRED MANUFACTURERS

.1 Preferred manufacturer of the emergency generator include:

.1 Kohler Power Systems

Part 2 ENGINE

2.1 ENGINE RATING AND PERFORMANCE

.1 The prime mover shall be a liquid cooled, 4-cycle, natural aspiration design. It will have adequate horsepower to achieve rated kW output with at an operating speed of 1800 RPM.

.2 The engine shall support a 100% load step.

.3 The generator system shall support generator start-up and load transfer within 10 seconds. The generator shall accept a load step of a 20 HP motor with a full voltage non-reversing starter, with a maximum frequency dip of 5 Hz.

2.2 ENGINE OIL SYSTEM

.1 Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s).

.2 The oil shall be cooled by an oil cooler which is integrated into the engine system.

.3 The engine oil pan will contain a 120VAC thermostatically controlled crankcase oil heater.

2.3 ENGINE COOLING SYSTEM

.1 The engine is to be cooled with a unit mounted shell and tube heat exchanger, water pump, and closed coolant recovery system. The coolant system shall include a coolant fill box which will provide visual means to determine if the system has adequate coolant level.

.2 The shell and tube heat exchanger shall meet the following criteria:

.1 Designed for operation in 40 degrees C ambient temperature
.2 Existing potable water supply from ¾” line at an approximate pressure of 50 PSI
.3 Water outlet to drain into existing station wet well
.4 All water pipe connections shall be threaded
.5 Water shut-off solenoid valve to limit potable water use during generator operation
.6 All solenoid valve wiring shall be provided by generator manufacturer or supplier.

.3 The engine shall have (a) unit mounted, thermostatically controlled water jacket heater(s) to aid in quick starting. The wattage shall be as recommended by the manufacturer to suit the environmental conditions stated in paragraph 1.1.3 above.

.4 Engine coolant and oil drain extensions, equipped with pipe plugs and shut-off valves, must be provided to the outside of the mounting base for cleaner and more convenient engine servicing.

2.4 ENGINE STARTING SYSTEM

.1 Starting shall be by a solenoid shift, DC starting system.

.2 The engine's cranking batteries shall be lead acid. The batteries shall be the largest available by the manufacturer for this generator size. The batteries supplied shall meet NFPA 110 cranking requirements of 90 seconds of total crank time. Battery specifications (type, amp-hour rating, and cold cranking amps) are to be provided in the submittal.

.3 The generator shall have an engine driven, battery charging alternator with integrated voltage regulation.

.4 The generator shall have an automatic dual rate, float equalize, 10 amp battery charger. The charger must be protected against a reverse polarity connection. The chargers charging current shall be monitored within the generator controller to support remote monitoring and diagnostics. The battery charger is to be factory installed on the generator and suitable for operation in the environmental conditions stated in paragraph 1.1.3 above, or provided with supplemental heat as required. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.

.5 Thermostatically controlled battery blanket heaters are to be provided to maximize the batteries cold cranking capabilities.

2.5 ENGINE FUEL SYSTEM – NATURAL GAS

.1 The engine shall include a primary fuel filter, and water separator. Element shall be replaceable paper type.

.2 The gas fuel system shall include but not limited to; the fuel mixer, secondary gas regulator, gas solenoid valve, and flexible fuel line between the engine and the skid-mounted fuel system components.

2.6 ENGINE CONTROLS

.1 Engines that are equipped with an electronic engine control module (ECM) shall monitor and control engine functionality and seamlessly integrate with the generator controller through digital communications. ECM monitored parameters shall be integrated into the generator controllers NFPA 110 alarm and warning requirements. All ECM fault codes shall be displayed at the generator controller in standard language – fault code numbers are not acceptable.

.2 For engines without ECM functionality or for any additional generator controller monitoring, sensors are to be conditioned to a 4-20ma signal level to enhance noise immunity and all sensor connections shall be sealed to prevent corrosion.

.3 Engine speed shall be controlled with an integrated isochronous governor function with no change in alternator frequency from no load to full load. Steady state regulation is to be 0.25%.

2.7 ENGINE EXHAUST & INTAKE

.1 The manufacturer shall supply its recommended stainless steel, flexible connector to couple the engine exhaust manifold to the exhaust system. All components must be properly sized to assure operation without excessive back pressure when installed.

.2 The manufacturer shall supply a critical grade exhaust silencer as standard. For applications with site specific sound requirements (reference section 1.1), the silencer shall be selected to achieve site sound levels.

.3 All exposed exhaust piping including the silencer shall be thermally wrapped to minimize heat dissipation inside the enclosure.

.4 The engine intake air is to be filtered with engine mounted, replaceable, dry element filters.

Part 3 ALTERNATOR

.1 The alternator shall be the voltage and phase configuration as indicated in paragraph 1.1.1 above, and with sufficient capacity as indicated in 1.1.2 above.

.2 The alternator shall be a 4 pole, revolving field, stationary armature, synchronous machine. The excitation system shall utilize a brushless exciter with a three phase full wave rectifier assembly protected against abnormal transient conditions by a surge protector. Photo-sensitive components will not be permitted in the rotating exciter.

.3 The alternator shall include a permanent magnet generator (PMG) for excitation support. The system shall supply a minimum short circuit support current of 300% of the rating for 10 seconds.

.4 The alternator shall support starting of one of the 20 HP pumps with one (1) 20 HP pump, and the 15kVA transformer load previously in operation with a maximum voltage dip of 15%.

.5 Three phase alternators shall be 12 lead, broad range capable of supporting voltage reconnection. All leads must be extended into a NEMA 12 connection box for easy termination. A fully rated, isolated neutral connection must be included by the generator manufacturer.

.6 The alternator shall use a single, sealed bearing design. The rotor shall be connected to the engine flywheel using flexible drive disks. The stator shall be direct connected to the engine to ensure permanent alignment.

.7 The alternator shall meet temperature rise standards of UL2200 (120 degrees C). The insulation system material shall be class "H" capable of withstanding 130 degrees C temperature rise.

.8 The alternator shall be protected against overloads and short circuit conditions by advanced control panel protective functions. The control panel is to provide a time current algorithm that protects the alternator against short circuits. To ensure precision protection and repeatable trip characteristics, these functions must be implemented electronically in the generator control panel -- thermal magnetic breaker implementation are not acceptable.

.9 An alternator strip heater shall be installed to prevent moisture condensation from forming on the alternator windings. A topical coating shall also be applied to the alternator windings to provide additional protection against the entrance of moisture.

Part 4 CONTROLS

.1 The generator control system shall be a fully integrated microprocessor based control system for standby emergency engine generators meeting all requirements of NFPA 110 Level 1.

.2 The generator controller shall provide integrated and digital control over all generator functions including: engine protection, alternator protection, speed governing, voltage regulation and all related generator operations. The generator controller must also provide seamless digital integration with the engine’s electronic engine control module (ECM) if so equipped.

.3 The control system shall provide an environmentally sealed design including encapsulated circuit boards and sealed automotive style plugs for all sensors and circuit board connections. The use of

non-encapsulated boards, edge cards, and pc ribbon cable connections are considered unacceptable.

.4 Circuit boards shall utilize surface mount technology to provide vibration durability. Circuit boards that utilize large capacitors or heat sinks must utilize encapsulation methods to securely support these components.

.5 Provide a predictive maintenance algorithm that energizes an alarm contact when maintenance is required.

.6 Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture operational parameters during events, and simultaneous monitoring of all input or output parameters.

.7 In addition to standard NFPA 110 alarms, the application loads should also be protected through instantaneous and steady state protective settings on system voltage, frequency, and power levels.

.8 The control system shall provide pre-wired customer use I/O: 2 relay outputs (user definable functions), communications support Modbus via RS232, RS485, or an optional modem. Additional I/O must be an available option. One relay output shall be configured for generator run status at the factory, or by generator supplier to control lift station exhaust fan.

.9 A remote annunciator panel which communicates with the generator control system through a digital communication link, and powered from the generator control system must be an available option.

.10 The control panel will display all user pertinent unit parameters including: engine and alternator operating conditions; oil pressure and optional oil temperature; coolant temperature and level alarm; fuel level (where applicable); engine speed; DC battery voltage; run time hours; generator voltages, amps, frequency, kilowatts, and power factor; alarm status and current alarm(s) condition per NFPA 110 Level 1.

.11 The engine oil low level sensor shall be configured such that an alarm condition will occur before oil pressure decreases to levels that will result in engine damage.

Part 5 ENGINE / ALTERNATOR PACKAGING

.1 The engine/alternator shall be isolated from the generator frame with rubber isolators. The packaging shall not require the addition of external spring isolators.

.2 A mainline, circuit breaker carrying the CSA mark shall be factory installed. The breaker shall be rated between 100 to 125% of the rated ampacity of the generator. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections.

.3 The generator with all components and accessories shall be packaged onto a steel frame skid. The entire generator assembly shall be lowered into the lift station through the access hatch at grade level. Contractor shall remove and reinstall existing lift station equipment as required (such as the hatch, ladder, conduit, and light switches) to facilitate the generator installation. If disassembly of the generator skid is required to permit the generator installation, the number of components removed from the skid shall be kept to a minimum and reassembled within the lift station.

.4 All auxiliary equipment mounted on the generator skid which requires utility power such as block heaters, battery chargers, and receptacles, are to be supplied from a panelboard or load centre located on the generator skid complete with circuit breakers for each load. Power supply to panelboard or load centre to be provided by the Contractor and shall be 240 volts, single phase with neutral.

Part 6 AUTOMATIC TRANSFER SWITCH

6.1 GENERAL

.1 The automatic transfer switch shall be by the same supplier as the generator system.

.2 The automatic transfer switch shall be rated as follows:

- .1 600 volts
- .2 200 amps
- .3 18 kA symmetrical interrupting capacity
- .4 3 Pole, 4 wire, 3 phase
- .5 Solid Neutral
- .6 60Hz
- .7 NEMA 12 enclosure

6.2 MECHANICAL REQUIREMENTS

.1 Mechanically interlocked, electrically operated, mechanically held, solenoid operated contactors used for transfer switch. Motor actuated switches are not acceptable.

.2 Switching mechanisms lubricated for the expected live of the transfer switch.

.3 The standard transfer switch (without bypass-isolation) is to be provided with internal manual operating handle.

.4 All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.

.5 The contact transfer time shall not exceed one-sixth of a second.

6.3 TRANSFER SWITCH CONTROL SYSTEM

.1 The control module shall direct the operation of the transfer switch. The module's sensing and logic shall be a built-in microprocessor-based system for maximum reliability, minimum maintenance, and inherent digital communications capability. The control settings shall be stored in non-volatile EEPROM. The module shall contain an integral battery-backed programmable clock and calendar. The control module shall have a keyed disconnect plug to enable the control module to be disconnected from the transfer mechanism for routine maintenance.

.2 The control module and all associated controls and relays shall be protected by a Surge Protection Device (SPD) with a safety listing of UL 1449 4th Edition as a type 4 SPD, and under UL 1283 as an electromagnetic filter, maximum rated surge current of 120kA per phase, all modes of protection (L-N, L-G, N-G).

.3 The control module shall be mounted separately from the transfer mechanism unit for safety and ease of maintenance. Interfacing relays shall be industrial control grade plug-in type with dust cover.

.4 The control module shall include a user interface keypad with tactile feedback pushbuttons and light-emitting diode status indication. These features shall be user accessible when the enclosure door is closed:

- .1 Keypad pushbuttons:
  - .1 Start/end system test
  - .2 Set/end exercise

.3 End time delay

.4 Lamp test/service reset

.2 Light-emitting diode status indicators:

.1 Contactor Position: Normal, Emergency

.2 Source Available: Normal, Emergency

.3 Not in automatic mode

.4 Four stage time delay remaining

.5 Exercise: load, no load, set/disabled

.6 Test: load, no load

.5 Generator engine start gold flashed contact rated 2 amps @ 30 VDC/250VAC.

.6 One Programmable alarm contact output, and two transfer switch position contact outputs, rated 2 amps @ 30 VDC/250 VAC.

6.4 OPERATION

.1 All phases of normal and all phases of emergency shall be monitored for over and under voltage and single phase of normal and emergency for over- and under-frequency. In addition, the controller shall use anti-single phasing protection that detects regenerative voltage (using the phase angle of the source) to determine a failed source condition.

.2 Voltage and frequency sensing:

.1 Undervoltage pick-up set at 90% of nominal voltage, adjustable 85% - 100% of nominal voltage.

.2 Undervoltage dropout set at 90% of pickup voltage, adjustable 75% - 98% of pickup voltage.

.3 Overvoltage dropout set at 110% of nominal voltage, adjustable 105% - 135% of nominal voltage.

.4 Overvoltage pick-up set at 95% of dropout voltage, adjustable 85% - 100% of nominal voltage.

.5 Voltage dropout time set at 0.5 seconds adjustable 0.1 – 9.9 seconds.

.6 Voltage accuracy: 2%.

.7 Under frequency pick-up set at 90% of nominal frequency, adjustable 85% - 95% of nominal frequency.

.8 Under frequency dropout set at 99% of pick-up frequency, adjustable 95% - 99% of pick-up frequency.

.9 Over frequency dropout set at 101% of pick-up frequency, adjustable 101% - 105% of nominal frequency.

.10 Over frequency pick-up set at 110% of nominal frequency, adjustable 105% - 120% of nominal frequency.

.11 Frequency accuracy: 1%

.3 Time Delays:

.1 Time delay for engine start to delay initiation of transfer for momentary source outages: Range 0-6 seconds. Factory set at 3 seconds.

.2 Time delay for transfer to standby: Range 0-60 minutes. Factory set at 1 second.

.3 Time delay for transfer back to normal: Range 0-60 minutes. Factory set at 15 minutes.

.4 Time delay for engine cool down: Range 0-60 minutes. Factory set at 5 minutes.

.5 Failure to acquire standby source: Range 0-60 minutes. Factory set at 1 minute.

.6 Pre-transfer to normal signal: Range 0-60 minutes. Factory set at 3 second.

.4 User terminals shall be available to connect a normally open contact that, when closed, signals the control module to start and transfer load to the engine-generator. Opening these contacts shall initiate a retransfer and engine cool down sequence. The load shall be transferred to an available utility source immediately if the generator source should fail.

.5 The following features shall be built into the control module logic. These features shall be enabled at the factory or in the field.

.1 Phase rotation sensing programmable ABC or CBA.

.2 In-phase monitoring shall continuously monitor the contactor transfer times, source voltage, frequency and phase angle to provide a self-adjusting, zero crossing contactor transfer signal. A flashing LED on the user interface panel shall indicate active in-phase monitoring.

.3 Plant Exerciser: Programmable seven-day to thirty-day exerciser with user selectable load or no-load operation. An LED, on the user interface, shall indicate the type of exercise (load or no load). The time remaining on the exercise shall be indicated. The exercise time may be reset at any time with a single keystroke.

.4 The engine shall be allowed to run when the exercise period is terminated. The exerciser may be disabled for maintenance purposes. Amber LED shall flash on the user interface if the exerciser has been disabled. The exerciser shall have the capability of being programmed, using up to twenty-one (21) event for a calendar mode. The controller shall have provisions for disconnecting a load bank (during exercise) if there is a loss of normal power.

.5 The control module must be upgradeable with the following options:

.1 Preferred source switch

.2 Supervised transfer control switch

.3 Line to neutral voltage monitoring

.4 PC based communication application

.5 Provide a programmable input/output (I/O) module with two inputs and six outputs rated 2 amps @ 30 VDC/250 VAC

Part 7 ADDITIONAL PROJECT REQUIREMENTS

7.1 FACTORY TESTING

.1 Before shipment of the equipment, the engine-generator set shall be tested under rated load for performance and proper functioning of control and interfacing circuits. Tests shall include:

.1 Verify voltage & frequency stability.

.2 Verify transient voltage & frequency dip response.

.3 Load test the generator for 30 minutes.

7.2 OWNER'S MANUALS

.1 Three (3) sets of owner's manuals and one electronic copy on CD, DVD or USB flash drive, specific to the product supplied must accompany delivery of the equipment. General operating instructions, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included. Also provide list of recommended spare parts.

7.3 SHIPMENT

.1 Ship the generator, and transfer switch assembled to the greatest extent possible to the installation address indicated in the tender package. Deliver on a date determined and defined by the Installing contractor. Clearly define in your quotation, any assembly work that must be done in the field by others. Provide the installing contractor clear instructions as to generator, and transfer switch handling and installation procedures.

7.4 INSTALLATION

.1 The complete electrical generating system including all external fuel and cooling water connections shall be assembled and installed by the electrical contractor in accordance with requirements of CEC, NFPA, and the manufacturer's recommendations as reviewed by the Contract Administrator.

7.5 SERVICE

.1 Supplier of the generator, automatic transfer switch and associated items shall have permanent service facilities in this trade area. These facilities shall comprise a permanent force of factory trained service personnel on 24 hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

7.6 WARRANTY

.1 The standby electric generating system components, complete generator and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of five (5) years. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge for parts, labour and travel.

.2 The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. Also, in the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have the necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

7.7 START-UP AND CHECKOUT

.1 The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to checkout the completed installation and to perform an initial start-up inspection to include:

.1 Disconnect battery cables from batteries to prevent accidental starting.

.2 Turn engine several revolutions by means of hand-barring devices to ensure parts are free and there are no obstructions to its running.

.3 Check engine/generator alignment readings to ensure they match readings attained at time of manufacture.

.4 Check fluid levels and top up as necessary. Pre-lubricate engine and turbochargers as recommended by engine manufacturer. Install drip pan beneath engine.

.5 Confirm cooling system antifreeze is effective to at least minus 40 degrees C.

.6 Check belts as required for correct tension and adjust as necessary.

.7 Check and grease points.

.8 Check and tighten properly nuts, bolts.

.9 Confirm safety guards are in place and properly secured.

.10 Check linkages for damage and freedom of movement.

.11 Check fuel supply system for leakage.

.12 Ensure fuel supply and fuel injection systems are properly primed.

.13 Check and tighten properly electrical connections.

.14 Check starting battery electrolyte level specific gravity and for proper installation.

.15 Check battery charger for proper operation and adjust as necessary.

.16 Carry out generator winding insulation resistance test. If reading is unacceptable, carry out recognized drying procedure. Do not start unit until satisfactory reading has been achieved.

.17 Check jacket coolant heater for proper operation.

.18 Complete additional preparations deemed necessary.

.2 Performance verification: on completion of start-up preparations, take following action:

.1 Reconnect starting battery cables to starting battery.

.2 Check for and correct leakage from exhaust system, fuel system, cooling system, and lubricating oil system.

.3 Adjust vibration isolators.

.4 Observe and confirm lubricating oil pressure and coolant temperature are within limits and no harmful vibration or sounds are evident.

.5 Ensure voltage is within operating parameters and automatic voltage regulator is operating correctly.

.6 Ensure manual voltage control is operating correctly.

.7 Ensure frequency is within operating parameters and electronic governor is operating correctly.

.8 Check engine air ventilation system for proper operation.

.9 Check operation of engine-mounted protective sensing devices and adjust as necessary.

.10 Check phase sequence of normal power supply and ensure emergency power supply is in same sequence.

.11 Check operation of electronic controller protection, transfer, timing, metering, and annunciator functions and adjust as necessary.

.12 Check operation and calibration of metering and adjust as necessary.

.13 Apply electrical load, read the metres, and correlate these readings.

.14 Demonstrate:

.1 Ensuring the engine starts (both hot and cold) within the specified time.

.2 Unit start, transfer to load, retransfer to normal power, unit shutdown, on "automatic" control.

.3 Unit start, transfer to load, retransfer to normal power, unit shutdown, on “test control".

.4 Unit cranking, start, and shutdown by means of engine-mounted key switch.

.5 Run unit on full (nameplate) load for minimum period of 30 minutes to show load-carrying capability, stability of voltage and frequency, and satisfactory performance of engine ventilating system to provide adequate cooling, exhaust system.

.6 Every 5 minutes carry out and record readings on Test Chart.

.15 Test all operations of the automatic transfer switch.

.16 Simulate a utility power outage by disconnecting the main service breaker and test the operation of the system including the automatic transfer switch and generator for a duration of 30 minutes while supplying building load. Verify generator voltage and frequency is stable without fluctuations, within specifications and record results.

.17 Check engine/generator alignment readings after all load tests to ensure they match readings attained prior to load tests.

.18 Perform additional tests as required by the Contract Administrator to confirm unit is operating satisfactorily.

7.8 TRAINING

.1 Training is to be supplied by the start-up technician for the end-user during commissioning. The training should cover basic generator operation, automatic transfer switch operation, and common generator and transfer switch issues that can be managed by the end-user.

END OF SECTION