



Environnement
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STANDBY GENERATOR

AT

ENVIRONMENT AND CLIMATE CHANGE CANADA COMPLEX

SPECIFICATIONS

**REAL PROPERTY MANAGEMENT DIVISION, TECHNICAL SERVICES
91780 – 91782 ALASKA HWY.
WHITEHORSE, YT Y1A 5X7**

**PROJECT: WHF-015
DATE: SEPTEMBER 22, 2016
ISSUED FOR TENDER**

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1. SUMMARY OF WORK

1. The Contractor shall provide all labour and materials required to supply and install a new standby diesel generator, complete with associated systems including concrete pad, housekeeping pads, insulated enclosure, fuel delivery, controls, and testing/verifications at the Environment and Climate Change Canada (ECC) Whitehorse Complex – 91782 & 91780 Alaksa Hwy., Whitehorse, YT as described herein and shown on the drawings as described in the attached plans and specifications.
2. The work on this contract includes coordination and cooperation with other contractors and building personnel working on the site.
3. Work to be performed under this Contract includes, but is not limited to, the following items covered further in the Contract Documents, items below summarize major equipment, refer to full Contract Documents for complete listing.
 - .1 Supply and install a new standby diesel generator, complete with associated systems including concrete pad, housekeeping pads, insulated enclosure, fuel delivery, controls, and testing/verifications.
 - .2 Supply and install new distribution system for the Weather Offices and Combined Services Building. System to include: new automatic bypass isolation contactor based switch, standby generator and insulated enclosure, disconnects, CDP, utility and secondary metering, all cabling, conduits, trenching, terminations/connections and new fuel tank with connections. The new system should be connected to the existing fire alarm & security systems at the ECC building.
 - .3 Supply and install new utility connection to the generator enclosure.
 - .4 Supply and install new distribution feeders to both the Weather Offices and Combined Services Building from the generator distribution centre.
 - .5 Upon completion of the generator enclosure and new service feeders, decommission and remove existing utility service from the Weather Offices and Combined Services Building.

2. TIME OF COMPLETION

1. Commence work in accordance with notification of acceptance of your tender submission and complete the work including rectification of deficiencies within twenty four (24) weeks of commencement.

3. HOURS OF WORK

1. Work shall be carried out Monday to Friday from 07:30hrs to 17:30hrs.
2. Shutdown, bypassing or isolating any parts effecting the electrical system shall be undertaken after hours, Monday through Friday from 17:30hrs to 06:00hrs and/or on weekends from 06:00hrs to 18:00hrs.

3. Lock-Out / Tag-Out (LOTO) work shall be completed off-hours Monday through Friday from 17:30hrs to 07:00hrs and and/or on weekends from 06:00hrs to 18:00hrs. All Internal & External LOTO permits will be required to commence work.
4. Live Work procedures will not be permitted on this site.
5. The Contractor shall not permit his personnel to work alone on this project when the following activities are undertaken:
 1. Work assessment determined that the potential health & safety risk is high;
 2. Work requiring entry into or work within a Confined Space;
 3. Work requiring Lock-Out / Tag-Out (LOTO);
 4. Work requiring use of fall arrest equipment;
 5. Work on scaffolding;
 6. Work requiring supplied air respirators or similar equipment;
 7. Hot Work and/or Hot Tap activities;
 8. Work involving cranes or hoisting;
 9. Work or work situations identified by the Engineer.
6. Work affecting laboratory operations shall be carried out after normal hours as defined in 3.1 above. Any shut down of service effecting laboratory operations requires a minimum of 48 hours notice.

4. SCHEDULING

1. On award of contract submit a bar chart construction schedule for the work, indicating anticipated progress stages within time of completion. Minimum stages include, mobilization, shop drawing, product data MSDS sheets and samples submittal, order and delivery of major components and equipment, major approvals stages, interim and final inspection times, commissioning timeframes, final deficiency corrections, training, demobilization and manuals submission. When schedule has been reviewed and approved by the Engineer take necessary measures to complete work within scheduled times. Do not change schedule without written approvals from the Engineer.

5. CONTRACT DOCUMENTS

1. Drawings and specifications are complementary, items shown or mentioned in one and not in the other are deemed to be included in the contract work.
2. Any questions that arise in relation to the design shall be brought to the attention of the Engineer. Failure to comply with this procedure may necessitate amendments and other layout modifications as required to complete the Work, costs of which shall be solely the responsibility of the Contractor.
3. Study all documents, which describe, or are related to any operation before commencement of that operation. Report discrepancies discovered between existing conditions and documentation. Obtain ruling on required interpretation before commencing work.

4. Any changes to the scope of work are to be confirmed in writing by the Engineer and Contract value changes approved, prior to start of said work.
5. The cost of any additional work to the Owner shall be the actual cost of the work plus ten percent (10%) overhead and ten percent (10%) profit on the actual cost of the work.

6. CONTRACTOR'S USE OF SITE

1. Do not unreasonably encumber site, with material or equipment.
2. Execute the work with the least possible interference or disturbance to the normal use of the existing premises. Make arrangements with the Engineer to facilitate the work as stated.
3. Maintain existing services to the building and provide for personnel and vehicle access.
4. Maintain a proper solid or chain link security fence c/w suitable locks around work and storage areas at all times.
5. Where security is reduced by the work, provide temporary means to maintain security.
6. Contractor to supply their own site trailer (if required) phone, fax, and storage box. No storage will be provided within the building. Accommodation will be made for limited on-site storage at the discretion of the Engineer in area designated by the Engineer.
7. Maintain 1 copy of each of the following at the job site:
 - .1 Contract drawings
 - .2 Contract specifications
 - .3 Addenda to contract documents
 - .4 Copy of approved work schedule
 - .5 Reviewed/approved shop drawings
 - .6 Change orders
 - .7 Other modifications to contract
 - .8 Field test reports
 - .9 Reviewed/approved samples
 - .10 Manufacturers' installation and application instructions
 - .11 One set of record drawings and specifications for "as-built" purposes
 - .12 National Building Code of Canada 2015
 - .13 Current construction standards of workmanship listed in technical Sections
 - .14 Project Safety Plan – Including emergency contact names and directions to the nearest hospital.

7. CONTRACTOR PROJECT SUPERINTENDENT

1. The Contractor shall, upon award of contract, designate a Project Superintendent. The Contractor shall provide the name, cellular phone number to the Engineer at the preconstruction meeting. The Project Superintendent shall have full responsibility for the project and shall be authorized to accept and act upon any notice or direction provided by

the Engineer. Project Superintendent shall be available on site at all times that work is being performed under this contract.

2. Supervise and direct all persons engaged in the work, including all tradesmen and suppliers. Become familiar with the requirements of each trade. Coordinate delivery and work operations. Examine the work of all trades during work operations to ensure compliance with the contract requirements. Expedite all work to maintain the contract schedule.
3. Cooperate with all other contractors working on site in parallel or related projects.
4. Attend coordination and project meetings at the direction of the Engineer.

8. CONTRACTOR and SUB CONTRACTORS

1. The Contractor agrees to employ those sub-contractors proposed by him in writing as listed in the Contractor's tender submission.
2. Do not change or substitute approved contractor for sub-contractors without prior authorization from the design authority.
3. Contractor and sub-contractor personnel shall be qualified as per definitions under the Trades Qualification and Apprenticeship Acts and as required by regulatory agencies in Yukon Territory.
4. Electrical work shall be carried out by qualified and licensed electrical contractors as per Yukon Territory regulations.
5. Plumbing work shall be carried out by qualified and licensed plumbing contractors as per Yukon Territory regulations.

9. WORKMANSHIP

1. Workmanship shall be the best quality, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Engineer, if required, if work is such as to make it impractical to produce required results.
2. Do not employ any person unfit or unskilled in their required duties. The Engineer reserves the right to require the dismissal from the site, workers deemed incompetent, careless, insubordinate or otherwise objectionable.
3. The Work as covered by the tender documents is intended to comply exactly with the latest rules and regulations of the inspection authorities, and these rules are to be considered an integral part of the tender documents. In case of conflict, any ruling by the Inspection Authority shall be final. All changes and alterations to the Contractor's work required by an authorized inspector or any authority having jurisdiction shall be carried out at the expense of the Contractor.
4. Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with

the Engineer, whose decision is final.

10. RECORD DRAWINGS

1. As work progresses, maintain accurate records to show deviations from the contract drawings. Just prior to completion of work, supply to the Engineer one set of white prints with all deviations neatly inked in. Contractor to show actual layouts for underground services including elevations, all mechanical piping and ductwork and all electrical wiring diagrams, locations and sizes of electrical conduits, pull boxes and wiring, circuits etc.

11. SHOP DRAWINGS

1. Provide four (4) copies of the shop drawings as listed in the specifications and/or drawings to the Engineer prior to ordering materials. Shop drawings to illustrate details of portion of work specific to the project requirements. Information to clearly indicate the items to be reviewed. Generic drawings and faxed copies are not acceptable.
2. Allow five (5) working days for Engineer's review of each shop drawing submission.

12. CODES AND STANDARDS

1. The following codes and Standards are in place for work under this contract. The latest edition applicable at the time to be utilized.
 1. The National Building Code of Canada (NBC) 2015
 2. Provincial or Territorial Fire Code
 3. Canadian Electric Code
 4. Provincial or Territorial Plumbing Code
 5. Canada Labour Code Part II and Federal Occupational Health and Safety Policies
 6. Construction Standards and/or any other Code or bylaw of local application.
2. Comply with applicable local bylaws, rules and regulations enforced at the location concerned.
3. Meet or exceed requirements of Contract documents, specified standards, codes and referenced documents.
4. In any case of conflict or discrepancy, the most stringent requirements shall apply

13. FEES AND CERTIFICATES

1. Submit a completed Notice of Project Form to Provincial or Territorial Workers' Compensation Board as required by the notification requirements under the Regulations for Construction Projects made pursuant to the Provincial or Territorial Workers' Compensation Act. Provide copy to the Departmental Representative.
2. Obtain and pay for – Building Permit required by the local Municipality, Certificates, Licenses and other permits required by regulatory municipal, provincial or federal authorities to complete the work.

3. Provide inspection authorities with plans and information required for issue of acceptance certificates.
4. Furnish inspection certificates in evidence that the work installed conforms with the requirements of the authority having jurisdiction.
5. Submit to the Electrical Inspection Authority the necessary number of working drawings and specifications for examination and approval prior to commencement of work and pay all associated fees.
 - .1 Obtain and pay for all electrical inspection fees.
 - .2 On completion of the work provide copies of the Electrical Inspection Authority inspection approval certificates.

14. CONSTRUCTION SAFETY MEASURES

1. Observe and enforce construction safety measures required by the Canada Labour Code Part II, Occupational Health and Safety, Provincial or Territorial Workers' Compensation Board, and municipal statutes and authorities and site specific Health and Safety Policies and Directives
2. In the event of conflict between any provisions of above authorities, the most stringent will apply.
3. Provide and maintain guardrails, fences, barricades, lights, signs and other devices required for protection of workmen and public in accordance with the requirements of the Canada Labour Code Part II, Occupational Health and Safety, Provincial or Territorial Safety Act and Regulations for Construction Projects and Local by-laws. All signs shall be bilingual or CSA universal pictograms.
4. Ensure the safety of building personnel at all times when performing work.
5. Refer to Specifications Section 01 35 30 for additional requirements

15. FIRE SAFETY REQUIREMENTS

1. Comply with the National Building Code of Canada for fire safety in construction and the National Fire Code of Canada for fire prevention, fire fighting and life safety in building in use.
2. Comply with the Authority Having Jurisdiction (AHJ), Fire Commissioner of Canada (FCC) Standards;
 - .1 No. 301: Standard for Construction Operations
 - .2 No. 302: Standard for Welding and Cutting
 - .3 No. 374: Fire Protection Standard for General Storage (Indoor and Outdoor)
 - .4 Available from Fire protection Engineering Services, Labour program, HRDC or following internet site: http://www.hrsdc.gc.ca/eng/labour/fire_protection/policies_standards/index.shtml

.5 Retains all fire safety documents on site.

3. Refer to Section 01 35 30 of this document for further information on Health and Safety

16. WORKPLACE SAFETY AND INSURANCE BOARD

1. Prior to commencing the work, throughout the total performance of the work when requesting payments and prior to receiving final payment, the Contractor shall provide evidence of good standing with Workplace Safety and Workers' Compensation Board.

17. UTILITIES

1. Water supply is available on site and will be provided for construction usage at no cost. Facility Supervisor reserves the right to limit volume of water utilized.

2. Existing electrical services to a maximum of 15 kVA required for the work may be used by the Contractor without charge. Ensure capacity is adequate prior to connecting and imposing additional loads. Connect and disconnect at own expense and responsibility.

18. PROTECTION

1. Protect finished work against damage until take-over.

2. Protect the work and all surrounding equipment, landscape, structures, floors, ceilings, walls, etc., from damage.

2. Make good, at no cost to the Owner, any damage caused.

3. Protect any services, which are uncovered during work.

4. Protect all areas adjacent to the construction areas from dust and debris produced during construction. Use hoarding, solid walls, drop cloths, sealed dust screens and tarps and clean up and vacuum up all debris daily.

19. PRODUCT HANDLING AND STORAGE

1. Deliver materials in original and unopened containers or wrappings with Manufacturers' seals and labels intact and legible.

2. Deliver materials in sufficient quantity to allow continuity of the work. Do not encumber site with unnecessary materials.

3. All unused materials at the end of any working day shall be properly protected from damage.

4. All materials, equipment, etc. to be handled and stored as not to interfere with the operation of the building.

5. All material and equipment to be new unless specified otherwise.

6. Contractors who use controlled products must ensure that their workers are properly trained in the safe use and handling of such products in compliance with the Workplace Hazardous Materials Information System (WHMIS).
7. Comply with all requirements with respect to Controlled products labeling and Material Safety Data Sheets (MSDSs) according to the requirements of WHMIS and the Hazardous Products Act.

20. PRODUCT AVAILABILITY

1. Upon award of contract immediately review product delivery requirements and advise the design authority of any foreseeable delays.
2. In the event of failure to notify the Engineer at commencement of the work, the Departmental Representative reserves the right to require the supply of substitute products of equivalent quality at no increase in contract price to ensure adherence to project schedule.

21. MATERIALS STANDARDS

1. Materials shall be new and work shall conform to the minimum applicable standards of the Canadian General Standards Board, the Canadian Standards Association, the National Building Code of Canada and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirements shall apply.
2. Products (materials, equipment and articles) incorporated in work shall be new, not damaged or defective and of best quality compatible with specifications for purpose intended. If requested by the design authorities, furnish evidence as type, source, and quality of product.
3. Defective products will be rejected, regardless of previous inspections. Inspection does not relieve responsibility but is a precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
4. Should any dispute arise as to the quality of fitness of products, the decision shall rest with the Engineer based upon requirements of Contract Documents. The Engineer's decision shall be final.
5. Ensure that materials, equipment, services and labour are brought to site in sufficient quantity and in accordance with requirements of the work schedule.
6. Use materials/products containing highest percentage of recycled and recovered materials practicable – consistent with maintaining cost effective satisfactory levels of completion. Adhere to waste reduction requirements for reuse or recycling of waste materials, thus diverting materials from landfill

22. MATERIALS OTHER THAN SPECIFIED

1. Secure in writing, permission from the engineer to use any materials other than those

specified.

2. The listed suppliers/manufacturers are acceptable for their ability to meet the general design intent, quality and performance characteristics of the specified product. The listed equipment/materials does not endorse the acceptability of all products available from the listed manufacturers/suppliers.
3. It remains the responsibility of the contractor to ensure the products supplied are equal to the specified products in every aspect, operate as intended, and meet the performance specifications and physical dimensions of the specified product.
4. The contractor shall be fully responsible for any additional materials, to accommodate the use of equipment from the acceptable manufacturer and suppliers list.

23. HAZARDOUS MATERIALS

1. Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials: and regarding labeling and the provision of Material Safety Data Sheets (MSDS) acceptable to Human Resources Development Canada, Labour Program.

24. REMOVED MATERIALS

1. Unless otherwise specified, materials for removal become the Contractor's property and shall be taken from the site.
2. DI Resin Bed Tanks are the property of DI/RO Maintenance company (Filterco Water Treatment Ltd.). These will be carefully disconnected, set aside and protected so that they can be returned to the owner.

25. PROJECT CLEANLINESS

1. Remove waste materials and debris from the site at the end of each day. Leave the work area unencumbered upon completion of each work shift. Store materials and equipment.
2. Ensure site is clean, orderly and neat at all times during the work shift. Provide additional cleaning as requested by the design authority, facility supervisor.
3. At the end of the project, remove dirt, dust and other disfigurations from all surfaces affected by the project including, but not limited to ceilings, walls, floors, fixtures and lights. Clean by dusting, damp wiping, washing, waxing and polishing to the satisfaction of the design authority, facility supervisor.
4. Upon completion, remove scaffolding, temporary protections and surplus materials. Make good any defects noted at this stage.
5. Clean areas affected under contract, to a condition at least equal to that previously existing and to satisfaction of the design authority, facility supervisor.

6. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

26. WASTE MANAGEMENT

1. Comply with the Environmental Protection Act and the Provincial or Territorial Waste Management Act for waste management programs on construction and demolition projects.

27. EXISTING SERVICES

1. Where work involves breaking into or connecting to existing services, Carry out work at times directed by the Engineer. Connection to existing services shall be after hours and/or on weekends.
2. Before commencing Work, establish location and extent of service lines in area of Work and notify the Engineer of findings.
3. Submit schedule to and obtain approval from the Engineer for any shutdown or closure of active service or Facility. Adhere to approved schedule and provide notice to affected parties. Do not alter schedule without prior written consent of the Engineer.
4. Give the Engineer 48 hours notice related to each necessary interruption of any mechanical or electrical service throughout the course of the work. Obtain written authorization from the Engineer prior to any interruption. Keep duration of those interruptions to a minimum.
5. Where unknown services are encountered, immediately advise Engineer and confirm findings in writing.

28. CUTTING, PATCHING AND MAKING GOOD

1. Cut existing surfaces as required to accommodate new work. Openings shall be neatly cut and dimensioned to fit electrical conduits, mechanical pipes and/or ductwork passing through the surfaces. Obtain the Engineer's approval before cutting into structure. Cutting torches shall not be permitted.
2. Patch and make good cut on both sides of surfaces, damaged or disturbed to match or better existing conditions to the satisfaction of the Engineer.
Note: The Contractor shall patch and make good existing openings when Contractor utilizes the existing openings for his work.
3. Fill voids left around all electrical conduits, mechanical pipes and/or ductwork with appropriate fire-proofing material to maintain fire stop integrity. Finish patching with finishing compounds to the satisfaction of the Engineer.

29. DEMOLITION

1. Except if expressly stated otherwise, materials indicated for removal, become the Contractor's property and shall be promptly taken from the site.

30. EQUIPMENT

1. Provide and maintain equipment such as temporary stairs, ladders, ramps, scaffolds, swing stages, runways, chutes and the like, as required for execution of work
2. Provide and maintain conveying equipment such as cranes, hoists, derricks and the like, as required for execution of work.
3. Assume complete responsibility for construction strength, placing, anchoring and operation of derricks, cranes, hoists and other mechanical contrivances used for work; and ensure that loads carried thereon can be safely supported and be free from accidents to all persons.
4. Comply with all governing safety regulations in force at the time of construction.
5. Remove immediately such equipment when not required for work.
6. Provide and maintain, on site, suitable fire extinguishers in sufficient quantities, as required by the Safety Code.

31. LOADING

1. Take precautions to prevent the overloading of any part of the structure during the progress of the work. Make good, at no expense to Owner, any damage resulting from such overloading.

32. HOISTING

1. All crane operations are restricted to the following:
 - .1 All craning of materials and equipment must be done outside normal building operating hours, ensure interior areas below are kept unoccupied.

33. POWDER ACTUATED GUNS

1. Do not employ powder-actuated guns using explosives, unless expressly permitted by the Engineer. If permitted, comply with requirements of CAN3-Z166.2-M85 (Use and Handling of Powder Actuated Tools).

34. TAXES

1. Pay all taxes properly levied by law (including Federal, Provincial and Municipal)
2. The Provincial Sales Tax (PST) is NOT to be considered an applicable tax for the purposes of this bid. The bidder shall therefore include separately any amount in his bid price for the said HST. In the event the HST does apply, the successful Contractor will indicate on each application for payment as a separate amount the appropriate HST the Owner is legally obliged to pay. The Contractor's HST registration number must be shown on all invoices. This amount will be paid to the Contractor in addition to the amount certified for payment under the contract and will therefore not affect the contract price.

35. SIGNS – ADVERTISING

1. No advertising and/or posting of company signs shall be permitted.
2. Provide common-use signs as related to traffic control, information, instruction, health and safety, use of equipment, public safety devices, in both official languages or by the use of commonly understood graphic symbols to the Engineer's approval.

36. SECURITY CLEARANCES

1. All personnel employed on this project shall be subject to a security check. Obtain the requisite clearance as instructed for each individual required to enter the premises.

37. BUILDING SMOKING ENVIRONMENT

1. Smoking is prohibited in the building and on the roofs. Smoking is prohibited within a 6 metre radius of doors, windows and air intakes. Obey smoking restrictions on building property as directed by the Engineer.

38. GUARANTEE

1. Provide written one (1) year guarantee for all materials and labour provided as part of this Contract. Effective start date shall be date of final completion.
2. The contractor, at own expense, shall correct any defects in the work due to faulty products and/or workmanship appearing within the extended guarantee/warranty periods set out in the individual sections from date of final completion.

39. TRAINING AND DEMONSTRATION

1. Upon completion of the mechanical, electrical and controls installations provide qualified personnel to train and demonstrate the installations to the site's operations and maintenance personnel.
2. Contractor to review sources of power for newly installed equipment and demonstrate the start/stop and control functions of the installed equipment. Training and demonstration to be for a duration of four (4) hours. Training date and time to be coordinated with and approved by the Engineer.

40. EQUIVALENT EQUIPMENT

1. Where equivalent equipment has been submitted without specifics, it is the contractor's responsibility to provide detailed specifications highlighting differences to the specified unit prior to requesting for acceptance as equal. Requests without inclusion of sufficient details will automatically be rejected. Provide differences and clear quantifiable

characteristics why, how and where the unit meets performance and other requirements. Requests for substitution must be made to the Engineer.

2. Equipment specified serves to set minimum standard. Substituted equipment shall meet performance requirements and physical limitations, including fitting within space constraints.

41 OPERATIONS AND MAINTENANCE MANUALS

1. Provide two (2) sets of operations and maintenance data detailed in 01 78 00. Data to include detailed technical information, documents and records describing operation and maintenance of individual components.

END OF SECTION

PART 1 - GENERAL

1.1 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders [and scaffolding], independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.
- .5 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to occupants, and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.4 EXISTING SERVICES

- .1 Notify, Departmental Representative utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative [48] hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.

1.5 SPECIAL REQUIREMENTS

- .1 Carry out noise generating Work Monday to Friday from 18:00 to 07:00 hours and on Saturdays.
- .2 Submit schedule in accordance with Section 01 11 55 - Construction Progress Schedule - Bar (GANTT) Chart.
- .4 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .5 Keep within limits of work and avenues of ingress and egress.

- .6 Deliver materials outside of peak traffic hours 17:00 to 07:00 and 13:00 to 15:00 unless otherwise approved by Departmental Representative.
- .7 Prior to cutting or drilling horizontal or vertical surfaces including concrete, concrete block or other structural substrate, determine location of reinforcing, service lines, pipes, conduits or other items by x-ray, ground penetrating radar or other appropriate method. Submit findings to Departmental Representative prior to cutting or drilling.

1.6 SECURITY

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.
- .2 Security clearances:
 - .1 Obtain requisite clearance, as instructed, for each individual required to enter premises.
 - .2 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.

1.7 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions. Smoking is not permitted within 6m of a door, window or fresh air intake.

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 Shop drawings and product data.
- .2 Samples.
- .3 Certificates and transcripts.

1.3 Related Sections

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.

1.4 References

- .1 Canadian Construction Documents Committee (CCDC)
- .2 CCDC 2-[94], Stipulated Price Contract.

1.5 Administrative

- .1 Submit to Engineer submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not 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.
- .2 Work affected by submittal shall not proceed until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Engineer. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.
- .6 Notify Engineer, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are coordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Engineer's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Engineer review.

**1.6 Shop Drawings
and Product Data**

- .10 Keep one reviewed copy of each submission on site.
- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of 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 cross references to design drawings and specifications.
- .3 Allow 5 business days for Engineer's review of each submission.
- .4 Adjustments made on shop drawings by Engineer are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Engineer prior to proceeding with Work.
- .5 Make changes in shop drawings as Engineer may require, consistent with Contract Documents. When resubmitting, notify Engineer in writing of any revisions other than those requested.
- .6 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .7 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.

- .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
-
- .8 After Engineer's review, distribute copies.
 - .9 Submit (4) prints and an electronic copy of shop drawings for each requirement requested in specification Sections and as consultant may reasonably request.
 - .11 Submit (4) copies and an electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Engineer where shop drawings will not be prepared due to standardized manufacture of product.
 - .12 Delete information not applicable to project.
 - .13 Supplement standard information to provide details applicable to project.
 - .14 If upon review by Engineer, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.7 Samples

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Engineer's business address.
- .3 Notify Engineer in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Engineer are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Engineer prior to proceeding with Work.
- .6 Make changes in samples which Engineer may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.8 Mock-ups

.1 Not Used.

1.9 Progress Photographs

.1 Submit progress photographs in accordance with Section 01 33 00 - Submittal Procedures.

1.10 Certificates and Transcripts

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

END OF SECTION

1. SUBMITTALS

- 1.1 Make Submittals in accordance with Section 01 11 55 "General Instructions".
- 1.2 Submit a site-specific Health and Safety Plan, within 7 days after Notice to Proceed and prior to commencement of Work. The Health and Safety Plan must include:
 - 1.2.0 Site-specific safety hazard assessment.
 - 1.2.1 Safety and health risk or hazard analysis for site risks and operation.
- 1.3 Submit Construction Safety Checklists after completion.
- 1.4 Submit copies of reports or directions issued by Federal and Provincial health and safety inspectors.
- 1.5 Submit copies of incident and accident reports.
- 1.6 Submit to Engineer with Material Safety Data Sheets (MSDS).
- 1.7 Personal training requirements including as follows:
 - 1.7.1 Names of personnel and alternates responsible for site safety and health, hazards present on site, and use of personal protective equipment.
- 1.8 The Engineer will review the Contractor's site-specific Health and Safety Plan and provide comments to the Contractor within 7 days after receipt of the plan. Revise the plan as appropriate and resubmit plan to the Engineer within 3 days after receipt of comments from the Engineer.
- 1.9 Medical Surveillance: Within 7 days after date of the Notice to Proceed and prior to mobilization to the site, submit certification of medical surveillance for site personnel, and submit additional certifications as personnel are sent to the site.
- 1.10 On-site Contingency and Emergency Response Plan: Address the standard operating procedures to be implemented during emergency situations.

2. FILING OF NOTICE

- 2.1 File Notice with Provincial authorities prior to commencement of Work.

3. SAFETY ASSESSMENT

- 3.1 Perform a site-specific safety hazard assessment related to the project.

4. MEETINGS

- 1.1. Pre-construction meetings: The Contractor shall attend a Pre-Construction Meeting.

5. REGULATORY REQUIREMENTS

- 5.1 The Contractor shall comply with the specified standards and regulations to ensure safe operations. The latest editions are applicable.
- 5.5.1. Canada Labour Code Part II
 - 5.5.2. Canada Occupational Safety and Health Regulations
 - 5.5.3. National Building Code Part 8 – Safety Measures at Construction & Demolition Sites
 - 5.5.4. National Fire Code Part 4 – Flammable and Combustible Liquids
 - 5.5.5. National Fire Code Part 5 – Hazardous Process and Operations
 - 5.5.6. Provincial Health and Safety Act and Regulations including;

6. CONTRACTOR RESPONSIBILITY

- 6.1 The Contractor shall be responsible for the Health and Safety of persons on site, safety of property on site and for the protection of persons adjacent to the site and environment to the extent that they may be affected by the conduct of Work.
- 6.2 The Contractor shall comply with and enforce compliance by their employees with the safety requirements of the Contract Documents, applicable federal, provincial, local statutes, regulations, ordinances, and site-specific Health and Safety Plan.
(i.e. Occupational Health and Safety Acts and Regulations for Construction Projects, Canada Labour Code Part II)

7. CONTRACTOR ACCIDENT AND INCIDENT REPORT

- 7.1 The Contractor shall advise the Engineer of any accident, injury, near-miss incident, fire, explosion or chemical spill occurring at the Work site and any visit to the site by a governmental enforcement official.

8. UNFORSEEN HAZARDS

- 8.1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, the Contractor shall immediately stop work and advise the Engineer verbally and in writing.

9. WORK STOPPAGE

- 9.1 The Engineer and/or designated Health and Safety personnel may stop work for health and safety considerations.

10. CORRECTION OF NON-COMPLIANCE

- 10.1 The Contractor shall immediately address health and safety non-compliance issues identified by the Engineer and/or other designated Health and Safety personnel.
The Engineer may stop Work if non-compliance of health and safety regulations is not corrected by the Contractor.

11. DISCIPLINARY ACTIONS

- 11.1 The Contractor's disregard and/or lack of compliance to health and safety measures, procedures and policies shall lead to disciplinary action by the Engineer.

12. SITE HEALTH AND SAFETY POLICIES AND DIRECTIVES

- 12.1 The Contractor shall comply and follow all prescribed site Health and Safety Policies and Directives including but not limited to the following;

12.1.1 Worker Profile Sheet: The Contractor shall submit to the Engineer a completed Worker Profile Sheet c/w all attachments including copies of licenses, certificates and permits for supporting qualifications to perform required work for a given project for each individual worker requiring access to the site. The completed Worker Profile Sheets are required for each individual worker prior to working on site.

12.1.2 Hot Work Permit: The Contractor shall submit a completed Hot Work Permit to the Engineer for review and approval. The Engineer's approval is required prior to initiating hot work.

12.1.3 Hot Tap Permit: The Contractor shall submit a completed Hot Tap Permit to the Engineer for review and approval. Approval by the Engineer is required prior to initiating hot tap work.

12.1.4 Lock Out and Tag Out (LOTO) – Isolation Procedures: The Contractor shall submit a completed LOTO Isolation Form (Zero Energy) to the Engineer for review and approval for all work requiring LOTO. The Engineer's approval of isolation form is required prior to initiating LOTO work.

12.1.5 Live Work Procedure: The Contractor shall submit a completed Live Work Procedure Form to the Engineer for review and approval for all work requiring Live Work procedures. The Engineer's approval of the Live Work Form is required prior to initiating Live Work.

12.1.6 Emergency and Fire Evacuation Route: The Contractor shall obtain training on procedures of evacuating the site under emergency and/or fire situations. Contractor training and sign-off is required prior to initiating site work.

12.1.7 Trades Qualifications and Apprenticeship Act: The Contractor shall sign-off confirming that the Trades Qualifications and Apprenticeship Act shall be observed and followed. Contractor sign-off is required prior to initiating site work.

END OF SECTION

PART 1 - GENERAL

1.1 CONSTRUCTION & DEMOLITION WASTE

- .1 Carefully deconstruct and source separate materials/equipment and divert, from D&C waste destined for landfill to maximum extent possible. Target for this project is 75% diversion from landfill. Reuse, recycle, compost, anaerobic digest or sell material for reuse except where indicated otherwise. On site sales are not permitted.
- .2 Source separate waste and maintain waste audits in accordance with the Environmental Protection Act,
 - .1 Provide facilities for collection, handling and storage of source separated wastes.
 - .2 Source separate the following waste:
 - .1 Brick and portland cement concrete.
 - .2 Corrugated cardboard.
 - .3 Wood, not including painted or treated wood or laminated wood.
 - .4 Gypsum board, unpainted.
 - .5 Steel.
 - .6 Items indicated in a Deconstruction and Waste Products Workplan Summary.
- .3 Submit a waste reduction workplan indicating the materials and quantities of material that will be recycled and diverted from landfill.
 - .1 Indicate how material being removed from the site will be reused, recycled, composted or anaerobically digested in a Deconstruction and Waste Products Workplan Summary.
- .4 Submit proof that all waste is being disposed of at a licensed land fill site or waste transfer site. A copy of the disposal/waste transfer site's license and a letter verifying that said landfill site will accept the waste must be supplied to Departmental Representative prior to removal of waste from the demolition site.

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

- .1 Not Used.

END OF SECTION

PART 1 - GENERAL

- | | | |
|----------------------|----|---|
| 1.1 Section Includes | .1 | As-built, samples, and specifications. |
| | .2 | Equipment and systems. |
| | .3 | Product data, materials and finishes, and related information. |
| | .4 | Operation and maintenance data. |
| | .5 | Spare parts, special tools and maintenance materials. |
| | .6 | Warranties and bonds. |
| | .7 | Final site survey. |
| 1.2 Precedence | .1 | Not Used |
| 1.3 Related Sections | .1 | Section 01 11 55 - General Instructions. |
| | .2 | Section 01 91 00 - Commissioning |
| 1.4 Submission | .1 | Prepare instructions and data using personnel experienced in maintenance and operation of described products. |
| | .2 | Copy will be returned after final inspection, with Engineer's comments. |
| | .3 | Revise content of documents as required prior to final submittal. |
| | .4 | Two weeks prior to Substantial Performance of the Work, submit to the Engineer, two final copies of operating and maintenance manuals in English. |
| | .5 | Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work. |
| | .6 | If requested, furnish evidence as to type, source and quality of products provided. |
| | .7 | Defective products will be rejected, regardless of previous inspections. Replace products at own expense. |
| | .8 | Pay costs of transportation. |
| 1.5 Format | .1 | Organize data in the form of an instructional manual. |
| | .2 | Binders: vinyl, hard covered, 3 'D' ring, loose leaf with spine and face pockets. |
| | .3 | When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine. |
| | .4 | Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents. |
| | .5 | Arrange content by systems, under Section numbers and sequence of Table of Contents. |
| | .6 | Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment. |
| | .7 | Text: Manufacturer's printed data, or typewritten data. Data in tables are to be entered in MS-Excel format. Include PDF's |

- and spreadsheet on CD/DVD.
 - .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
 - .9 Provide 1:1 scaled CAD files in DWG-format and in PDF-format on CD/DVD.
- 1.6 Contents - Each Volume
- .1 Table of Contents: provide title of project;
 - .1 date of submission; names,
 - .2 addresses, and telephone numbers of Consultant and Contractor with name of responsible parties;
 - .3 schedule of products and systems, indexed to content of volume.
 - .2 For each product or system:
 - .1 list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
 - .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
 - .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
 - .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- 1.7 As-builts and Samples
- .1 In addition to requirements in General Instructions, maintain at the site for Engineer one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
 - .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
 - .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
 - .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
 - .5 Keep record documents and samples available for inspection by Engineer.
- 1.8 Recording Actual Site
- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Engineer.

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| Conditions | .2 | Provide felt tip marking pens, maintaining separate colours for each major system, for recording information. |
| | .3 | Record information concurrently with construction progress. Do not conceal Work until required information is recorded. |
| | .4 | Contract Drawings and shop drawings: legibly mark each item to record actual construction, including: <ul style="list-style-type: none"> .1 Measured depths of elements of foundation in relation to finish first floor datum. .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction. .4 Field changes of dimension and detail. .5 Changes made by change orders. .6 Details not on original Contract Drawings. .7 References to related shop drawings and modifications. |
| | .5 | Specifications: legibly mark each item to record actual construction, including: <ul style="list-style-type: none"> .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items. .2 Changes made by Addenda and change orders. |
| | .6 | Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections. |
| 1.9 Final Equipment Layout | .1 | Submit final as-built equipment layout, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents. |
| 1.10 Equipment and Systems | .1 | Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts. |
| | .2 | Panel board circuit directories: provide electrical service characteristics, controls, and communications. |
| | .3 | Include installed colour coded wiring diagrams. |
| | .4 | Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions. |
| | .5 | Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions. |

- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 22 20 10 - Testing, Adjusting and Balancing – Pure Water System. Company performing TAB will sign off on commissioning sheets and performance verifications forms.
- .15 Additional requirements: As specified in individual specification sections.

1.11 Materials and Finishes

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.12 Spare Parts

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.13 Maintenance Materials

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.

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| | .3 | Deliver to site; place and store. |
| | .4 | Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual. |
| | .5 | Obtain receipt for delivered products and submit prior to final payment. |
| 1.14 Special Tools | .1 | Provide special tools, in quantities specified in individual specification section. |
| | .2 | Provide items with tags identifying their associated function and equipment. |
| | .3 | Deliver to site; place and store. |
| | .4 | Receive and catalogue all items. Submit inventory listing to Engineer. Include approved listings in Maintenance Manual. |
| 1.15 Storage, Handling and Protection | .1 | Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration. |
| | .2 | Store in original and undamaged condition with manufacturer's seal and labels intact. |
| | .3 | Store components subject to damage from weather in weatherproof enclosures. |
| | .4 | Store paints and freezable materials in a heated and ventilated room. |
| | .5 | Remove and replace damaged products at own expense and to satisfaction of Engineer. |
| 1.16 Warranties and Bonds | .1 | Separate each warranty or bond with index tab sheets keyed to Table of Contents listing. |
| | .2 | List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal. |
| | .3 | Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work. |
| | .4 | Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined. |
| | .5 | Verify that documents are in proper form, contain full information, and are notarized. |
| | .6 | Co-execute submittals when required. |
| | .7 | Retain warranties and bonds until time specified for submittal. |

END OF SECTION

<u>Section</u>	<u>Title</u>	<u>Pages</u>
<u>Division 26 - Electrical</u>		
26 05 01	COMMON WORK RESULTS ELECTRICAL	12
26 05 04	CONTRACTOR TESTING	5
26 05 08	ELECTRICAL MAINTENANCE MANUALS	9
26 05 21	WIRES AND CABLES 0-1000V	2
26 05 25	IDENTIFICATION	3
26 05 28	GROUNDING	3
26 05 29	FASTENINGS AND SUPPORTS FOR ELECTRICAL SYSTEMS	2
26 05 31	JUNCTION, PULL BOXES AND CABINETS	2
26 05 32	OUTLET BOXES, CONDUIT BOXES AND FITTINGS	2
26 05 34	CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS	3
26 05 48	SIESMIC RESTRAINS FOR ELECTRICAL SYSTEMS	3
26 24 16	PANELBOARDS - BREAKER TYPE	4
26 24 20	DISTRIBUTION SYSTEM	3
26 32 10	DIESEL ELECTRIC GENERATOR	42
26 36 23	AUTOMATIC TRANSFER SWITCH	4
26 50 00	LIGHTING	5
26 52 01	UNIT EQUIPMENT FOR EMERGENCY LIGHTING	5
26 79 00	DEMONSTRATION AND TRAINING	3
<u>Division 27 - Communications</u>		
27 05 42	ELECTRICAL DATA/VOICE CABLES	3
<u>Division 28 - Electronic Safety and Security</u>		
28 16 00	INTRUSION DETECTION	6
28 31 01	FIRE ALARM SYSTEMS	16

END OF SECTION

PART I - GENERAL

1.1 GENERAL

- .1 This section includes general clauses applicable to the installation of all electrical systems.
- .2 It is the intent of the Drawings and Specifications to provide a complete and workable installation. Any work, fitting and/or necessary material not specifically mentioned or shown on the drawings, but obviously necessary to complete the installation, shall be furnished by the Contractor as if specifically mentioned herein and detailed.
- .3 Contractor is to make all allowances for work to be completed as specified in the general and supplemental conditions.

1.2 SITE VISIT

- .1 The bidding Contractors are encouraged to visit the site prior to tender closing to examine closely any local and existing conditions which may affect the performance of the work.
- .2 Arrangements for site visits are to be made with the Project Manager/Owner.
- .3 The bidding Contractors are expected to examine the existing site in detail to determine the specific work required to complete the contract.

1.3 SCOPE OF WORK

- .1 Supply and install new standby diesel generator, complete with associated systems including concrete pad, housekeeping pads, insulated enclosure, fuel delivery, controls, and testing/verifications as described herein and shown on the drawings. Include the travel and hourly cost for the Engineer of witness of Manufacturer testing in the bid price.
- .2 Supply and install new distribution system for the Weather Offices and Combined

Services Buildings. System to include: new automatic bypass isolation contactor based switch, standby generator and insulated enclosure, disconnects, CDP, utility and secondary metering, all cabling, conduits, trenching, terminations/connections and new fuel tank with connections. The new system should be connected to the existing fire alarm & security systems at the Combined Services Building. Carry the cost of the repair for pavement, concrete, wall penetration and all damages caused by the Contractor.

- .3 Provide detailed work schedule and shut-down time to be coordinated with the Owner and the Engineer prior to the shut down by minimum of 2 weeks.
- .4 Complete cable location to identify all existing cables, conduits and pipe routes at the proposed generator foot print, and proposed and existing instrumentation and power routing paths.
- .5 Supply and install new utility connection to the generator enclosure. Coordinate all work with the utilities.
- .6 Supply and install new distribution feeders to both the Weather offices and Combined Services Buildings from the generator distribution centre.
- .7 Upon completion of the generator enclosure and new service feeders, decommission and remove existing utility service from the Weather offices and Combined Services Buildings.
- .8 Supply and install new security and fire alarm devices as detailed in the drawings and specifications. Connect to existing systems in the Combined Services Building. Complete set-up, testing and verifications as required.
- .9 The Contractor scope of work to include all work shown on the drawings and

described herein, including but not limited to: turnkey generator and enclosure, distribution centre, trenching and backfill, pavement and concrete, and control and monitoring systems.

.10 All work (concrete pads, rough carpentry, trenching, backfill, wiring, auxiliary systems, testing, etc.) as shown on the drawings and described herein is the responsibility of the division 26 Contractor.

.11 Provide to the Engineer, for review, shop drawings for the enclosure concrete pad, stamped by a civil engineer licensed to practice in Yukon.

1.4 DRAWINGS AND SPECIFICATIONS

.1 The drawings and specifications are complementary each to the other and 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 or within the drawings or the specifications themselves, which leaves the Contractor in doubt as to the true intent and meaning of the drawings and specifications, a ruling shall be obtained from the Engineer before submitting his tender. If this is not done, it will be assumed that the most expensive alternative has been allowed for and shall be provided for by the Contractor.

.3 Electrical drawings indicate general location and Specifications route to be followed by 'system wiring' which includes; conduits, cables, cable trays and wiring, and do not show all architectural, structural, mechanical and landscape details. In some cases, system wiring is not shown on drawings or is shown diagrammatically in schematic or riser diagrams. The Contractor shall provide system wiring to form a complete operating job. System wiring shall be physically installed to conserve headroom,

furring spaces, and to coordinate with all trades and equipment provided.

1.5 RESPONSIBILITY OF CONTRACTOR

- .1 Promptly advise the Engineer of any specified equipment, material or installation same which appears inadequate or unsuitable, in violation of laws, ordinances, rules or regulations of authorities having jurisdiction, or of any necessary items of work omitted from the Contract Documents.
- .2 No consideration will be granted for failure to visit the site or for any resulting misunderstanding of work to be done. No additional charges will be considered for items which were apparent during a site visit.

1.6 WORK SCHEDULE

- .1 Provide work schedule, job completion, and the timing of work, to the Engineers approval.
- .2 Contractor shall maintain the down-time of electrical service to a minimum. At no time shall the Weather Offices be down between the hours of 7 AM and 1PM local time. Provide on-site power generation in the event of longer outages.
- .3 Coordinate all scheduled power outages with the Owner and Engineer a minimum of 2 weeks prior to date of shut down. All power outages to be prepared and staged to be completed with minimal down time.

1.7 COORDINATION WITH TRADES

- .1 In conjunction with other trades, prepare electrical coordination drawings to determine and coordinate efficient use of available space, proper sequencing of work, and protection of installed work, in order to resolve installations conflicts.
- .2 Electrical coordination drawings are to be available on-site for use by: all other trades, and shall be available for the Engineer's review during all site inspections.

- .3 Maintain electrical coordination drawings throughout the construction period. Record changes due to modifications and adjustments.
- .4 Coordination plans shall be made available to the Engineer at the Engineer's request; copy of drawings to be delivered to the Engineer's office within 3 working days of the Engineer's written request to the Contractor.
- .5 Engineer's review of coordination drawings is for general implementation design only and does not relieve the Contractor from complying with all requirements of drawings and specifications including coordination with the General Contractor and with all trades.

1.8 VOLTAGE RATINGS

- .1 Operating voltages: To CAN3-C235, latest edition.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.9 CODES AND STANDARDS

- .1 Do complete installation in accordance with CSA C22.1 - 2012 except where specified otherwise.
- .2 Comply with all CSA electrical bulletins as well as all local rulings in force at the time of tender.
- .3 Where reference is made to published standards the latest editions and revisions of such standards shall apply.
- .4 Notify Engineer of changes required by the Electrical Inspection Department prior to making changes.

1.10 PERMITS AND FEES

- .1 Submit to the Electrical Inspection Department, the Supply Authorities and the Building Inspection Authorities, the necessary number of drawings and specifications, for examination and approval prior to commencement of work.
- .2 Pay all fees and coordinate inspections required by the Authorities Having Jurisdiction (AHJ) for work provided by this division.
- .3 Furnish certificates of acceptance from each AHJ inspection department upon completion of work.
- .4 Notify the Engineer of changes required by the AHJ Department(s) prior to making changes. Changes required by the AHJ shall be implemented by the Contractor only after written instruction by the Engineer.

1.11 CARE, OPERATION AND START UP

- .1 Instruct operating personnel in the operation, care and maintenance of equipment as specified in further sections.
- .2 Provide specific training requirements as specified in further sections.

1.12 MATERIALS AND EQUIPMENT

- .1 Equipment and materials to be new and carry acceptable agency approval markings.
- .2 Factory assembled control panels and component assemblies.
- .3 Where equipment or materials are specified by technical description only, they are to be of the best commercial quality obtainable for the purpose.
- .4 All work to be executed in a neat and workmanlike manner by qualified tradesmen. Division 26 to keep a competent foreman and all necessary assistants, to the approval of the Engineer and to the approval of the AHJ(s), on the job during the work.

-
- .5 All electrical equipment to be CSA or Canadian equivalent Canadian standards approved. Electrical equipment that is shown on the drawings or called for in the specifications that is not CSA or equivalent approved is to be treated by the requirements of Division 26 requirements in one of the following ways:
- .1 make allowance in Contract Price to have the equipment CSA or equivalent approved, or
 - .1 make allowance in Contract Price for the most expensive CSA or equivalent approved equivalent.
- .6 Unless otherwise specifically called for in the specifications, uniformity of manufacturer to be maintained throughout the building for any particular item or type of equipment.
- .7 The Contractor shall be completely responsible for ascertaining that every item included in Contract complies in all respects with specifications and drawings. Any item of equipment found by the Engineer not to comply with specifications and drawings to be replaced at no additional cost with an item or unit of the Engineer's choice.
- 1.13 RECORD (As-Built)
DRAWINGS
- .1 Neatly record, as the job progresses, day by day, all work as installed. Make these drawings available to the Engineer for inspection and review from time to time as the Engineer sees fit. As-built drawings must be available on-site during all Engineer inspections.
- .2 Record all changes to contracted work as issued by addendum, site instruction, and change order.
- .3 Record all system's installations on record drawings. Include:
- .1 panel and circuit numbers,
 - .2 Feeder wiring details including;

- location, conductor gauge, cable assembly and conductor termination details. Required for all panel feeders, ATS, CDP(s) and service entrances.
 - .3 Conduit and cable tray details including: location, trade size.
 - .4 boxes, cabinets and consolidation points including: physical dimensions, NEMA type and seismic restraint,
 - .5 equipment: location, name plate data, overload protection location and trip settings, seismic restraint,
 - .6 all other details required to document the provided systems for use by the owner.
-
- .4 Record the location of all electrical equipment; Equipment designation to correspond to field label of equipment. Show connected circuit and panel identification.
 - .5 Record wiring logic diagrams and include written commentary for logic operation.
 - .6 Deliver marked up plans to the Engineer.
-
- 1.14 SHOP DRAWINGS AND OPERATING INSTRUCTION
- .1 Provide soft copies of shop drawings for all equipment and required details including the following:
 - .1 Electrical Permit.
 - .2 Maintenance Manual; tabs and binder art work wording and details.
 - .3 Cabinets and Pull Boxes.
 - .4 Seismic Restraint and Housekeeping Pads.
 - .5 Distribution Equipment.
 - .6 Fire Retardant Compound.
 - .7 Labels; lamacoid label materials, lettering description and final label wording.
 - .8 Equipment and materials as required in further sections of the specifications.
 - .2 The Contractor shall submit shop drawings and all supporting materials sufficiently

in advance of material ordering/delivery requirements to allow the Engineer time for review.

- .3 All shop drawings to be delivered in 8½ x 11" format only, or soft copies in pdf.
- .4 Shop drawings to be delivered to the Engineer's office unless otherwise approved by the Engineer.
- .5 Approval of shop drawings is for general design only and does not relieve the Contractor and/or the equipment supplier/manufacturer from complying with all requirements of the contract documents. The Contractor shall be responsible for conforming to and coordinating all dimensions. The Contractor shall take note that the Engineer's review of shop drawing submission(s) after the Engineer's second review as required for the Contractor to provide, in the opinion of the Engineer, materials to meet the requirements of the Contract Documents shall be at expense of the Contractor.
- .6 Prior to submission, all shop drawings shall be stamped, dated and signed by the Division 26 Contractor and the General Contractor.
- .7 The Contractor is to coordinate all shop drawing submission(s) with requirements of the contract documents. Individual equipment that forms an integral portion of a specific system will not be reviewed until all related shop drawings and product data is available in shop drawing submission, unless otherwise approved by the Engineer.
- .8 Division 26 to review shop drawings and assume responsibility for:
 - .1 Completeness - including all details specified.
 - .2 Dimensions and field measurements.
 - .3 Catalogue numbers and similar data.

- .4 Conformance with contract documents.
- .5 Colours.
- .6 Site conditions.
- .7 Interference with mechanical equipment including motor sizes and loads, equipment locations and connections points.
- .9 Shop drawing submissions to include:
 - .1 Name of Contractor, Sub-contractor, Supplier and Manufacturer
 - .2 Date and revision dates.
 - .3 Project name.
 - .4 All pertinent data.
 - .5 Dimensions. All dimensions and data to be in metric units.
 - .6 Colour
 - .7 Specification section number.
 - .8 Additional equipment information as necessary to describe equipment use.
 - .9 Contractor's and Division 26's stamp and signature.
 - .10 A clear space of 100 mm x 75 mm on each sheet for the placement of the Engineer's review stamp.
 - .11 Model and type numbers.
 - .12 Corresponding lamicoid label wording where and Operating required. Instructions
- .10 Shop drawings will not be reviewed if they:
 - .1 Are not clearly legible
 - .2 Do not contain all information required above.
 - .3 Describe other products or models not applicable to this project.
- .11 Include with shop drawing submittal, detailed pre-startup check lists, startup/post-startup procedures and check lists for each piece of equipment and for each system.
- .12 Submit shop drawings on all wiring devices, relays and motor controls. Include manufacturer's and field; wiring and termination drawings where applicable.

-
- .13 Provide equipment operation instructions as specified in further sections and where requested by the Engineer.
 - .14 Do not order material or equipment until the Engineer has reviewed the shop drawing(s).
 - .15 Maintain on-site, one complete indexed copy of all reviewed shop drawings.
- 1.15 MAINTENANCE MATERIALS
- .1 Provide maintenance materials as recommended by equipment suppliers and as specified.
- 1.16 MOUNTING HEIGHTS
- .1 Mounting heights as specified on the drawings and to the manufacturer's recommendation.
- 1.17 PROTECTION
- .1 Protect exposed live equipment during construction for personnel safety.
 - .2 Shield and mark live parts eg "Live 120 Volts".
- 1.18 PENETRATIONS
- .1 Use pre-manufactured poly-pans or approved alternate for any outlet or box located in or through vapor barrier.
 - .2 All penetrations through vapor barrier required for any component installed by Division 26 to be performed in accordance with R-2000 builders manual details and under the supervision of the General Contractor.
 - .3 Provide fire rating protection as required at all locations where electrical equipment penetrates fire separations.
 - .4 Where cables or conduits pass through floors and fire rated walls, pack space between wiring and sleeve full and seal with caulking compound conforming to ULC-S115, latest revision.
 - .5 Use HILTI FS-ONE Intumescent Firestop

Sealant or approved equal. Provide shop drawings for fire sealant.

- .6 Where boxes installed in fire rated wall, use Hilti CP 617 firestop putty pads on all boxes, alternate 3M fire barrier moldable putty pads MPP+.

1.19 IDENTIFICATION

- .1 Reference Section 26 05 25- "Identification".

1.20 COST BREAKDOWN

- .1 Within 14 days after the award of the contract, Division 26 is to submit a breakdown of the electrical contract price. The breakdown is to be detailed to the requirements of the Engineer and is to include but not be limited to the following categories:
 - .1 Mobilization, Coordination with utilities and permits.
 - .2 Grounding and Bonding.
 - .3 Distribution Equipment.
 - .4 Distribution Cabling and Conduits.
 - .5 Line-Voltage Controls Equipment and Wiring.
 - .6 Rough-in Wiring.
 - .7 Devices.
 - .8 Labeling.
 - .9 Operation and Maintenance Manual.
 - .10 Generator and enclosure
 - .11 Trenching
 - .12 Demobilization.

1.21 CONTEMPLATED CHANGE ORDERS

- .1 All pricing of contemplated Change Order (CCO) to be accompanied by a complete itemized breakdown of labor and material for each item of work.
- .2 Locate panels in service areas where possible. Do not locate in paneled or special finish walls without prior approval of the Engineer.
- .3 Access panels in ULC fire separations and fire rated walls shall have a compatible fire rating and ULC label. Acquire approval in writing from the local Fire Authority and Building Official where required.

- .4 Access panels shall be painted with a primer coat, if applicable and then with a finish coat, colour and type to the Engineer's and Owner's approval.

END OF SECTION

PART 1 - GENERAL

- 1.1 GENERAL INSTRUCTIONS .1 This section of the specification forms a part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2 Where specified and as required, coordinate with other Division Contractors to test and record, equipment and systems operation.

PART 2 - PRODUCTS

- 2.1 SCOPE .1 Test and check all new portions of the electrical systems for correct operation.
- .2 All test results shall be tabulated, signed and inserted into the Maintenance Manuals in the correlating system section's sub-section heading 'Test Results'.
- .3 Specific tests and procedures outlined in this section and in the referenced sections are in addition to normal visual and mechanical inspections prior to placing equipment in service.
- .4 Where required and where directed by the Engineer obtain copies of factory tests for comparative results.
- .5 Where directed by the Engineer, demonstrate field tests for equipment and system operation.
- .6 Test to comply with CEC 22.1-15, ULC codes and as required by these specifications and the Engineer.

PART 3 - EXECUTION

- 3.1 TESTING AGENCY AND/OR PERSONEL .1 All testing and commissioning will be performed by the Contractor's forces unless indicated otherwise.

- .2 This Division is responsible for coordinating with the Engineer for Engineer`s witness of the work detailed in this section and in the referenced sections.
- .3 Provide the Engineer with one journeyman electrician, or where a specialized sub-trade is required provide one specialized tradesman, as needed to gain access to equipment for testing, demonstration, removal and replacement of covers, wires and cables, etc.
- .4 All deficient equipment/devices shall be replaced and retested to the approval of the Engineer.
- .5 All covers, access doors opened for inspection to be replaced by the Contractor.
- .6 The costs for testing and test equipment will be the responsibility of the Contractor.
- .7 Generator initial tests as per C282 section 10. Generator manufacturer technical person is provided by the Owner for the initial test only, Contractor to coordinate with manufacturer for timing, Contractor forces to be onsite throughout the test to perform any required work associated with the test.

3.2 TESTING AND
INSPECTIONS REPORTS

- .1 Inspection and test results to be recorded on a suitable form which shall be furnished by the Contractor.
- .2 Upon completion of the project, the Contractor shall assemble a complete set of test and inspection results and report and insert in the operation and maintenance manuals.
- .3 Electrical coordination drawings are to be available on-site for use by all other trades, and shall be available for the

Engineer's review during all site inspections.

- .4 Maintain electrical coordination drawings throughout the construction period. Record changes due to modifications and adjustments.
- .5 Coordination plans shall be made available to the Engineer at the Engineer's request; copy of drawings to be delivered to the Engineer's office within 3 working days of the Engineer's written request to the Contractor.
- .6 Engineer's review of coordination drawings is for general implementation design only and does not relieve the Contractor from complying with all requirements of drawings and specifications including coordination with the General Contractor and with all trades.

3.3 TEST APPARATUS

- .1 The Contractor to be responsible for furnishing all apparatus and labour required for the test operations.
- .2 Division 26 to designate a senior experienced individual fully familiar with the project to demonstrate, test and report the electrical systems' operations.

PART 4 - SYSTEMS

4.1 GROUNDING TEST

- .1 As per section 26 05 28.

4.2 ELECTRICAL DISTRIBUTION SYSTEM

- .1 Before energizing any portion of the new electrical system, perform megger ohmmeter tests on include all distribution feeders, panelboard feeders and motor feeders.
- .2 Test readings to conform to the Canadian Electrical Code. Test results to be logged, tabulated and incorporated into operating and maintenance manuals.

4.3 MECHANICAL EQUIPMENT

- .1 Confirm motor rotation direction as

required.

- .2 Contractor to perform tests to the satisfaction of Engineer.

4.4 DEVICES

- .1 Test all new receptacles for proper polarity, circuitry and grounding.
- .2 Provide Contractors test results in Operation and Maintenance manuals. Test result form to be Contractor`s declaration that all receptacles have been tested and are operational.

4.5 EXIT, CONTROL,
EMERGENCY LIGHTING AND
UNIT EQUIPMENT

- .1 Test all new emergency lighting circuits and unit battery packs as following, as specified in specific equipment sections and as recommended by the equipment Manufacturer(s) for the generator enclosure.
- .2 Test and record each remote head voltage under full load operating conditions.
- .3 Test unit equipment operation including full load voltage and as recommended by the Manufacturer for equipment operation for code required rated output. Note that:
 - .1 Generator enclosure emergency lighting requirements are 2 hours to 91% of full load voltage.

4.7 FIRE ALARM SYSTEM

- .1 Test the fire alarm monitoring system and new installed devices for the generator enclosure, test run/trouble generator status monitoring; including: all auxiliary and peripheral control equipment and systems as specified in the specific sections and as recommended by the equipment Manufacturer(s).
- .2 Testing to include Contractor witness of signal received by approved Fire Alarm Monitoring station. Signal testing to be witnessed by the Engineer. Include monitoring station witness name and signature on Contractor's test results.
- .3 Test to be performed by the Contractor

forces and the fire alarm Supplier.

- .4 Carry in the bid price new verification for the added zones and new passive graphics for the building.
- .5 Contractor shall bear the hourly cost of all three parties, Contractor, Engineer and fire alarm Technician, during the fire alarm verification.

4.9 ADDITIONAL TESTS AS
REQUIRED BY THE ENGINEER

- .1 Make additional system tests as directed by the Engineer. Make allowance in bid price to provide an additional eight (8) journeyman man hours to test and document electrical systems as directed by the Engineer. Include allowance in bid price to provide Contractor test results in O+M manual.

END OF SECTION

PART 1 - GENERAL

- 1.1 GENERAL .1 This section covers items common to all sections of Division 26 and is to be supplemented with the requirements of other sections.
- 1.2 SCOPE OF WORK .1 Provide three (3) complete sets of electrical operation and maintenance manuals to be turned over to the Owner. One additional copy for the Engineer. Total four (4) sets.
- .2 Provide three (3) memory sticks complete with one copy of the final draft Operation and Maintenance Manual, one file in PDF format.
- .3 Documentation Agent or Contractor to submit complete system description, schematics and draft manuals by the substantial completion date. Draft manual to be submitted in temporary binder. All O&M manual material to be assembled and submitted in draft form to the Engineer's office for review at the substantial completion date.

PART 2 - PRODUCTS

- 2.1 DOCUMENTATION AGENT .1 Electrical operation and maintenance manuals shall be prepared by a documentation agent specializing in this type of work. Agent shall have previous experience in assembling O&M manuals as described below.
- .2 This Division is responsible for coordinating with the Engineer for Engineer`s witness of the work detailed in this section and in the referenced sections.
- 2.2 BINDERS .1 Electrical O&M manuals to be assembled in 210mm x 275 mm capacity, expanding spine catalogue binders complete with plated piano hinges, bound in heavy blue fabric,

hot stamped white lettering on front and spine. Provide sufficient volumes to allow each binder to hold system data while in full closed position (not expanded). Provide art work and fabric colour to the Engineer before having binders constructed.

2.3 BINDER COVER AND
SPINE TITLES

- .1 Cover title shall include: "Electrical Operation and Maintenance Manual"; volume number, if more than one; the name of project; the building number; the location of the building; the year of construction; the company name of the Electrical Engineer; and, the company name of the Electrical Contractor.
- .2 Spine title shall include: "Electrical Operation and Maintenance Manual"; volume number, if more than one; the name of the project; the building number; the location of the building; and, the year of construction.
- .3 All binder lettering shall be hot stamped white colour. Cover fonts shall be to the approval of the Engineer.
- .4 All final artwork to the approval of the Engineer.

2.4 TAB DRIVERS

- .1 All section headings shall be identified by worded tab dividers.
- .2 All tabs shall be no smaller than ½" wide, 1/20 cut.
- .3 All sub-section tab divider shall be worded and of the same size cut, print type, font, style and character case.
- .4 All tabs shall be cut, banked and positioned in a methodical order which applies directly to the Table of Contents with titles as specified.
- .5 All tabs to the Engineers approval.

-
- 2.5 INSIDE TITLE PAGE .1 Shall include identical information as the Binder Cover and Spine Title and shall also include the company names, mailing addresses, telephone and facsimile numbers, and e-mail addresses for the following:
- .1 Electrical Engineer.
 - .2 Electrical Contractor
 - .3 Suppliers
- 2.6 TABLE OF CONTENTS .1 The Electrical Operations and Maintenance Manual shall include a table of contents outlining the tab divisions utilized in the manual.
- 2.7 FIRST SECTION HEADING .1 First Section Only: the first section heading of the manual shall be called "General Information" and this section will be further divided into subsections. The subsections shall include, but not be limited to the following:
- .1 Introduction: A typewritten introduction identifying the scope of the manual.
 - .2 Legend: An outline of colour coding system used for the subsection tab dividers.
 - .3 General Safety: An outline of general safety recommendations.
 - .4 General Maintenance: An outline of general maintenance recommendations made by the equipment manufacturer and recommendations on preventative maintenance programs.
 - .5 List of Engineers: The list shall include the company names, mailing addresses, telephone and facsimile numbers, and e-mail addresses where applicable for the following:
 - .1 Electrical Engineer
 - .2 Mechanical Engineer
 - .3 Structural Engineer
 - .4 Seismic Engineer
 - .6 List of Major Contractors: The list shall include the company names, mailing addresses, telephone and facsimile numbers, and e-mail addresses for the following:
 - .1 Electrical Contractor

- .2 Electrical Subcontractor(s)
- .3 Mechanical Contractor
- .7 List of Suppliers of Electrical Equipment: The list shall include the company names complete with mailing addresses, telephone and facsimile numbers and a list of the equipment supplied by each.
- .8 Contractor Guarantee and Warranty Certificates: A letter of guarantee shall be provided by the Division 26 Contractor guaranteeing the work for a minimum of one year from the date of completion as per the specification's General Conditions. Guarantee and Warranty statements of sub-trades under the Division 26 contract shall also be included in this sub-section. All manufacturer warranty certificates shall be contained in this sub-section.
- .9 Inspection and Verification Reports: All Authorities Having Jurisdiction final inspections reports and certificates, and 3rd party verification reports shall be collected upon completion and contained in this sub-section.

2.8 OTHER SECTION
HEADINGS

- .1 The O&M manual shall be further provided with, but Headings not limited to, the following section headings (sample):
 - .1 Service Distribution.
 - .2 Standby Generator equipment
 - .3 Grounding
 - .4 Disconnect Switched/Breakers
 - .5 Wiring Devices
 - .6 Gutters/Pull Boxes and pull pits.
 - .7 New Connection to Fire Alarm System
 - .8 New Connection to Security Systems.
- .2 The Contractor shall allow for three (3) additional section headings complete with all tabs and sub-section tabs. These additional sections shall be added by the Contractor at the convenience of the Engineer. Additional sections shall be designated by the Engineer by site instruction or by instruction in O+M

manual review. The Contractor shall provide information in these additional sections and sub-sections as directed by the Engineer. Additional sections shall be designated by the Engineer by site instruction or by instruction in O+M manual review. The Contractor shall provide information in these additional sections and sub-sections as directed by the Engineer.

- .3 All section headings shall be sub-divided into the following sub-sections and be provided with, but not limited to, the following information:
 - .1 System Description
 - .1 A worded description of the system,
 - .2 include important information such as manufacturer's warranties and factory and manufacturer's commissioning reports,
 - .3 include equipment nameplate details such as make, model and serial numbers,
 - .4 include size and capacity of the equipment.
 - .5 include worded description of system interface to other equipment and other systems,
 - .6 include description of where equipment and further information can be found in the O+M manual
 - .7 in some cases the manufacturer's or the supplier's description of the system shall be provided,
 - .8 in some cases a line diagram shall be included to supplement the worded description,
 - .9 the system description shall describe the system in general terms highlighting all system features which may be of importance or concern to maintenance personnel.

- .2 System Components
 - .1 tabled format of all system components,
 - .2 include: supplier name and phone number, catalogue numbers, parts description, replacement parts list including part numbers (replacement parts list can be referenced to a manufacturer's shop drawing where replacement parts are listed on the shop drawing).
 - .3 include description of how each component interfaces with others to complete the system,
 - .4 include panel directories, distribution schedules schematic and single line diagrams, and equipment schedules as they pertain to each section.
- .3 Shop Drawings
 - .1 Insert in same numerical order as system components
 - .2 include seismic restraint shop drawing with associated equipment,
- .4 Operation and Maintenance Instructions
 - .1 Insert in same numerical order as system components
 - .2 include manufacturer's shop drawing (where replacement parts are listed on the shop drawing).
 - .3 include additional description where local requirements or site conditions required out-of-the-ordinary installation or system operation,
 - .4 include a description of each system and its controls,
 - .5 include control schematics for each system,
 - .6 describe operation of control

- .7 changes required for summer or winter operation as applicable, provide operation and maintenance instructions for each system and each component,
 - .8 include servicing, maintenance, operation and trouble-shooting instructions for each item of equipment and for interface equipment to other systems
 - .9 provide a description of maintenance action to be taken in the event of equipment failure,
 - .10 include safeguards to check if equipment goes off-line, as well as trouble-shooting sequences,
 - .11 reference replacement parts and/or maintenance materials lists provided and where to locate the references lists,
 - .12 prepare and insert all information pertinent to the electrical operation and maintenance when the need for the same becomes apparent during construction or installation, and when demonstration and instructions are carried out.
- .5 Test Results
- .1 Where applicable, insert in same numerical order as system components,
 - .2 this sub-section is reserved for Contractor and Manufacturer's test results only. 3rd party test results are to be inserted in the General Information section in sub-section Inspection and Verification Reports.
- .6 As-Built Drawings:
- .1 Reduced AutoCAD format (11" x 17").

- .2 include all wiring, termination details, wire numbers/designators, location, and size/dimensions where applicable,
- .3 include additional information as Necessary to document the installation for future maintenance of the system.

2.9 ADDITIONAL
INFORMATION

- .1 The following information shall also be included in addition to the specified requirements:
 - .1 Power distribution.
 - .2 Single Line Diagrams.
 - .3 Wiring Diagram(s).
 - .4 Underground Service Entrance Conduits Location Drawings(s).
 - .5 Panelboards.
 - .6 Molded Case Breakers.
 - .7 Receptacles and Outlets.
 - .8 Panel Directories.
 - .9 Maintenance Instructions.
 - .10 Trip Settings.
- .2 Grounding.
 - .1 System Ground.
 - .2 Equipment Grounding.
 - .3 Auxiliary Bonding.
 - .4 Connection Diagram.
 - .5 Ground Bus.
- .3 Exit and Emergency Lighting.
 - .1 Exit Luminaires.
 - .2 Emergency Lights.
 - .3 Battery Pack Relay Control Panel(s).
 - .4 Riser Diagram showing connections to Relay Control panel(s).
- .4 Fire Alarm System
 - .1 Devices
 - .2 Interface with Other generator System
 - .3 New Zone Plan.

END OF SECTION

PART 1 - GENERAL

- 1.1 WIRE DE-RATING .1 16Amp minimum wire ampacity after applicable de-rating factors.
- 1.2 AUXILLIARY SYSTEMS .1 Follow equipment Manufacturer's wiring and cabling recommendations.

PART 2 - PRODUCTS

- 2.1 BUILDING WIRES .1 Stranded for #10 AWG and larger for power wiring. Stranded for all control wiring.
- .2 Minimum size:
.4 #12 AWG for power and lighting
.5 #14 AWG stranded for control,
.6 #10 AWG for emergency lighting
- .3 Copper conductors only: size as indicated and as required for installation de-rating, with 600 V minimum insulation, 1000 V insulation where shown on the drawings, of chemically cross-linked thermosetting polyethylene material rated R90, RW90 or RWU90.
- 2.2 ARMOURED CABLES .1 Conductors: insulated, copper, minimum size to be #12 AWG.
- .2 Type AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- 2.3 CONTROL CABLES .1 Type LVT: 2 soft annealed copper conductors, sizes as indicated or where size has not been indicated provide wire conductor size as required by code and as required by the equipment manufacturer, LVT cables shall have thermoplastic insulation, outer covering of cotton braid thermoplastic jacket, and armor of closely wound aluminum wire.
- .2 Low energy 300V control cable:.
.1 Conductors: solid, multi-conductor, insulated, copper, minimum size #18

- AWG.
- .2 Insulation: 105 C flame retardant PVC.
- .3 Outer Jacket: 105 C flame retardant PVC
- .4 Armour: interlocked aluminum or galvanized steel with or without overall jacket.

PART 3 - EXECUTION

3.1 BUILDING WIRING

- .1 Install building wires as follows:
 - .1 In conduit systems in accordance with Section 26 05 34 "Conduit, Conduit Fastenings, and Conduit Fittings". To the approval of the Engineer.
- .2 AC cabling where specified in this section, the drawings, and only where permitted by code.

3.2 TESTING

- .1 Provide contractor testing as specified in section 26 05 04 "Contractor Testing".
- .2 AC cabling where specified in this section, the drawings, and only where permitted by code.

3.3 AS-BUILT INFORMATION

- .1 All wiring information shall be provided on the as built drawings.
- .2 Provide:
 - .1 Conductor gauge and type,
 - .2 Cable gauge and type,
 - .3 Splice locations,
 - .4 Terminal strip locations,
 - .5 Wire labels and designators
 - .6 Additional installation detail(s) as required to document the installation.
 - .7 To the approval of the Engineer.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK .1 General Requirements: Section 26 05 01.

PART 2 - PRODUCTS

- 2.1 IDENTIFICATION GENERAL .1 Refer to equipment sections for specific requirements.
- .2 Clearly identify the new installed/updated switchboards, power distribution centers, conduits, power panels, distribution panels, disconnect switches, starters, control stations, contactors, motor control centers, low voltage terminal cabinets, junction boxes, remote On/Off switches, motors and transformers by permanent nameplates described below.
- .3 Panels and CDPs: identify the installed panels as shown on drawings, and as per schedules, and the main voltage using lamacoid nameplates.
- .4 Transformers: show capacity, primary and secondary voltages, identify the transformer as shown on drawings using lamacoid nameplates.
- .5 Terminal cabinets and pull boxes: indicate the system and the voltages using lamacoid nameplates.
- .6 Remote On/Off switches: indicate areas being served or equipment controlled.
- 2.2 LAMACOID NAMEPLATES .1 Label all equipment using lamacoid nameplates as follow:
- .1 Nameplates of lamacoid plastic, white background with 10mm black letters beveled edges and two mounting screw holes, mounted in conspicuous locations on the surface of the equipment, except in finished areas locate nameplates in flush panels mounted on panel front inside

- enclosure.
- .2 Lamacoid labels to be fastened with metal screws, glue on labels will not be accepted.
 - .3 Lamacoid labels to include equipment description and circuit number. Equipment description shall correspond to Contractor as-built drawings.
 - .4 Lamacoid nameplates for all panelboards, starters, disconnect switches and terminal cabinets. Labels to indicate system and/or voltage characteristics and equipment name (example: Panel A, 120/208V 3-PH).
 - .5 Provide a complete list of nameplates for review by the Engineer, prior to placement of fabrication order. (Shop Drawing Review).
 - .6 Wording on nameplates to be approved prior to manufacture.
 - .7 Labels subject to the Engineer's approval. Allow for 20% rejection in the bid price.
- 2.3 PANEL SCHEDULES
- .1 Provide type written panel directories to be included with panels installed/updated.
- 2.4 COLOUR CODING
- .1 Exposed conduits in mechanical and electrical rooms, and exposed conduits above removable ceilings and where they enter or leave a box to be colour coded. Alternate option is to paint all conduit fittings.
 - .2 All junction boxes, pull boxes, panels and their covers shall be painted according to the colour coding schedule.
 - .3 Colour coding of this equipment is to provide an easy and consistent means of identification of all electrical systems.
 - .4 Colour Code Schedule:
 - .1 120/208 V - Power Grey
 - .2 120/208 V - Emergency (UPS) Grey with 50mm black letters.
 - .3 347/600 V - Power Sand.

- .5 All conduit entering or leaving these enclosures shall be identified by tape markers.

2.5 COLOUR CODING OF
CONDUCTORS

- .1 All conductors to be colour coded throughout the new work with same colour applying to the same phase throughout. Colour coding to be by insulation colour or permanently applied colour banding at termination ends. Color coding to be as follows:
- .1 Equipment Bonding: Green.
 - .2 Neutral Conductor: White.
 - .3 120/208 Phase Wires:
Red/Black/Blue
 - .4 347/600 Phase Wires:
Orange/Brown/Yellow
- .2 Each system to follow its own colour coding. If system of same colour coding terminates in same piece of equipment, each system to be identified to which system it belongs.

PART 3 - EXECUTION

2.5 CONDUIT
IDENTIFICATION

- .1 All cable and conduit for electrical systems to be identified within 200mm of exiting panel locations, pull box locations within 200mm of where they enter or leave a room or non-accessible ceiling space, and 4m on centre within an area.

2.5 IDENTIFICATION OF
CONDUCTORS

- .1 At all distribution centers, pullboxes, wireways, etc., feeder conductors of each feeder group to be neatly laced or clipped into a feeder group with each conductor identified as to load fed.

END OF SECTION

PART 1 - GENERAL

- 1.1 REFERENCE STANDARDS .1 Complete grounding work to CSA C22.1 2015.
- 1.2 SCOPE OF WORK .1 Refer to drawings for extent of grounding in addition to code requirements.
- .2 Provide new electrical system ground, in addition to code requirements.

PART 2 - PRODUCTS

- 2.1 MATERIALS .1 Grounding equipment to CSA C22.2 No. 41-07 (R2012); Grounding and Bonding Equipment.
- 2.2 EQUIPMENT .1 Grounding equipment to CSA C22.2 No. 41-07 (R2012); Grounding and Bonding Equipment.
- .2 Circuit and equipment grounding conductors: stranded copper, soft annealed, size as indicated or as required by code.
- .3 Insulated grounding conductors to Section 26 05 21.
- 2.3 MANUFACTURERS .1 Acceptable manufacturers: Burndy Corp., Erico Inc. Cadweld Div., Federal Pioneer Ltd., McGraw Edison.
- 2.3 PANEL SCHEDULES .1 Provide type written panel directories to be included with panels installed/updated.

PART 3 - EXECUTION

- 3.1 INSTALLATION GENERAL .1 Install connectors to manufacturer's instructions.
- .2 Protect exposed grounding conductors from mechanical damage.
- .3 Use mechanical connectors for grounding connections to equipment provided with lugs.

- .4 Soldered joints not permitted.
 - .5 Comply with requirements of CSA C22.2 No. 0.4 and Canadian Electrical Code.
- 3.2 CIRCUIT GROUND CONDUCTORS
- .1 Install grounding bushings, grounding studs and grounding jumpers at all distribution centers, pull boxes, motor control centers, panelboards where separate grounding conductors are indicated or required by code.
 - .2 Install grounding connection to typical equipment included in, but not limited to the following list:
 - .1 Service Equipment,
 - .2 Generator skid,
 - .3 Motor Frames,
 - .4 New Motor control centers CDPs and control panels, Generator enclosure
 - .3 Bonding Jumpers: green insulation, sized by Electrical Code Table 16. Connect to grounding bushings on conduit, to lugs on boxes, tubs and other enclosures.
 - .4 Install bonding wire as required by Code in all flexible conduit connected at each end to a grounding bushing, solderless lug, clamp, cup washer and screw.
 - .5 Integral bond conductor to be installed in all new conduits.
- 3.3 CABLE TRAY BONDING
- .1 If new cable tray required install cable bonding to the code where shown on the drawings and required by the Engineer.
- 3.4 AS-BUILT INFORMATION
- .1 At all distribution centers, pullboxes, wireways, etc., feeder conductors of each feeder group to be neatly laced or clipped into a feeder group with each conductor identified as to load feed.
Provide:
 - .1 Grounding and bonding locations,
 - .2 Grounding and bonding conductors gage and type,
 - .3 Additional installation detail(s) as

required to document the
installation.

PART 4 - TESTS

4.1 TESTS

- .1 Building system ground: existing.
- .2 Test all new installed equipment as directed by the Engineer.
- .3 Provide field test results for new installed equipments in O+M Manual.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK .1 Seismic Restraint: Section 26 05 48.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS .1 U shape, size 41 mm x 41mm, 2.5 mm thick or 25 mm x 25 mm x 2.5 mm, surface/suspended, set in poured concrete walls and ceilings as indicated and as required.

2.3 MANUFACTURERS .1 Acceptable manufacturers: Burndy Ltd., Electrovert Ltd., Unistrut Ltd..

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL .1 All equipment and conduits larger than 21mm securely attached to building structure. Conduits 21mm or smaller may be attached.

.2 Secure equipment to poured concrete with expandable inserts.

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

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

.1 One-hole malleable iron or steel straps to secure surface conduits and cables 50mm and smaller,

.2 Two-hole steel straps for conduits and cable larger than 50mm.

.3 Beam clamps to secure conduit to exposed steel work.

.5 Suspended support systems.

.1 Support 2 or more cables with 10mm diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits

to channels supported by 10mm diameter threaded rod hangers where direct fastening to building construction is impractical.

- .6 For surface-mounting of two or more conduits, use-channels.
- .7 Provide metal brackets, frames, hangers clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .8 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall or structural support.
- .9 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.
- .11 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with Manufacturer's installation recommendations.

END OF SECTION

PART 1 - GENERAL

- 1.1 DESCRIPTION
- .1 Submit shop drawings and product data for cabinets in accordance with Section 26 05 01.
 - .2 Flush mount boxes and cabinets shall be provided with covers that finish the box or cabinet in a cosmetically complete transition to architectural surroundings; openings left by poor fit to architectural surroundings will not be accepted.
 - .3 Where boxes and where cabinets are installed in fire separations and fire rated walls provide fire protection rated materials, equipment and installation as required.

PART 2 - PRODUCTS

- 2.1 JUNCTION AND PULL BOXES
- .1 Welded steel construction with screw-on flat covers for surface mounting as applicable in attic spaces, crawlspaces, electrical rooms and mechanical rooms.
 - .2 Covers with a 25 mm minimum extension around all edges for flush-mounted pull boxes and flush mount junction boxes.
- 2.2 CABINETS
- .1 Sheet steel cabinet with hinged door, latch, lock mechanism and back-pan.
 - .2 Covers with a 25 mm minimum extension around all edges for flush-mounted cabinets.

PART 3 - EXECUTION

- 3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION
- .1 Install pull boxes in inconspicuous, but accessible spaces.
 - .2 Mount cabinets with top not higher than 2m above finished floor.
 - .3 Only main junction and pull boxes are

indicated. Provide pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.2 IDENTIFICATION

- .1 Install identification labels indicating system name, voltage and phase in accordance with Section 26 05 00.

END OF SECTION

PART 1 - GENERAL

- 1.1 DESCRIPTION .1 Provide outlet boxes as required to enclose devices, permit pulling conductors and for wire splices.
- 1.2 REFERENCE .1 Reference Section 26 05 25- "identification".

PART 2 - PRODUCTS

- 2.1 OUTLET AND BOXES GENERAL
- .1 Size boxes in accordance with CSA CONDUIT C22.1, Section 12.
- .2 102mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.
- .4 Blank cover plates for boxes without wiring devices; covers to match surrounding device covers; to the approval of the Engineer.
- .5 Install barriers where outlets for more than one system are grouped.
- .6 Install properly sized boxes at the rough in stage. Box extensions will not be permitted.
- 2.2 SHEET STEEL OUTLET BOXES
- .1 102mm square flush outlet boxes for flush device installations in walls c/w extension and plaster rings as required.
- .2 102mm square or octagonal outlet boxes for lighting fixture outlets.
- 2.3 SURFACE CONDUIT BOXES - WP
- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle in outdoor locations.
- 2.4 FITTING GENERAL
- .1 EMT couplings and connectors to carry agency Approval acceptable for Yukon.

- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Conduit outlet bodies for conduit up to 32mm and pull boxes for larger conduits

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material.
- .3 For flush installations, mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers not allowed.

3.2 AS-BUILT INFORMATION

- .1 All outlet boxes and conduit boxes information shall be provided on the as-built drawing.
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- .2 For pull boxes provide:
 - .1 Box location,
 - .2 Box type,
 - .3 Additional installation detail(s)
As required to document the installation.

END OF SECTION

PART 1 - GENERAL

- 1.1 LOCATION OF CONDUITS
- .1 Drawings do not indicate all conduit runs. Those indicated are diagrammatic only.
 - .2 Note that where required so by drawings conduit is to be routed in a specific manner.
 - .3 Exact conduit installation location to be determined on-site, to the approval of the Engineer.
- 1.2 REFERENCE
- .1 Reference Section 26 05 25- "identification".

PART 2 - PRODUCTS

- 2.1 CONDUIT
- .1 Rigid metal conduit: to CSA C22.2 No. 45.
 - .2 Electrical metallic tubing (EMT) conduit: to CSA C22.2 No. 83.
 - .3 Liquid tight flexible metal conduit: to CSA C22.2 No. 56.
- 2.2 CONDUIT FASTENNINGS
- .1 One hole straps for conduits 35mm or smaller.
 - .2 Two hole straps for conduits larger than 35mm.
 - .3 Channel type supports for two or more conduits run in parallel and in close proximity
- 2.3 CONDUIT FITTINGS
- .1 Manufactured and approved for use with conduit specified.
 - .2 Factory bends required for use with conduit greater than 35mm diameter.

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 Liquid tight flexible metal conduit permitted if concealed or in service rooms, and the distance is less than 2000mm, and only where used for individual connection of specific equipment.
- .3 Conceal all conduits except as otherwise noted.
- .4 Surface mount conduit shall be acceptable in mechanical rooms, electrical rooms, LAN room, and above T-bar ceilings. Surface conduit in other areas requires the Engineers approval.
- .5 Run all conduits parallel or perpendicular to building lines where possible and fasten to common channel support.
- .6 Do not pass conduits through structural members without written approval from a Structural Engineer.
- .7 Where conduits pass through non-structural concrete, core the concrete with a diamond cutting tool or to approval of the Engineer.
- .8 Do not locate conduits to less than 75mm parallel to steam or hot water lines. Maintain a minimum 75mm clearance where conduit is run parallel to steam or hot water lines. Maintain a minimum of 25mm clearance at crossovers.
- .9 Size conduits to suit application and to code. Conduit sizes on drawings are minimum only based on design standards. The Contractor shall confirm all equipment requirements with shop drawings prior to rough-in of conduits.
- .10 Provide 2mm stranded nylon pull cord in empty conduits to facilitate future wire pull.

3.2 AS-BUILT INFORMATION

- .1 All conduit information shall be provided on the as-built drawing.
- .2 Provide:
 - .1 Conduit trade size,
 - .2 Conduit location,
 - .3 Box and cabinet size (dimensions) and NEMA rating,
 - .4 Conduit support details, where required by other sections provide Seismic shop drawings to supplement conduit support information,
 - .5 Spare conduit and pull box locations,
 - .6 Additional installation detail(s) As required to document the installation.
 - .7 Circuit and conduit designation.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED WORK .1 Fastenings and supports: Section 26 05 29.
- 1.2 WORK INCLUDED .1 Electrical equipment to operate without objectionable noise or vibration. If, in the Engineer's opinion, equipment is operating with excessive noise or vibration, equipment and isolation system shall be improved at no additional cost.
- 1.3 SEISMIC RESTRAINT .1 Provide seismic restraint and anchorage for all electrical equipment and services in accordance with the current edition of the National Building Code of Canada, 2010 edition, As well as per BC Electrical Contractors Association Seismic Restraint Manual, 1st Edition.
- .2 All support equipment shall be tested in an independent testing agency or shall be certified by a registered Professional Engineer to demonstrate that the equipment meets the requirements of all Codes and Bylaws.
- .3 All seismic bracing to be certified by a professional Engineer licensed to practice in Yukon.
- 1.4 SHOP DRAWINGS .1 Submit shop drawings in accordance with Section 26 05 01.

PART 2 - PRODUCTS

- 2.1 CONDUIT .1 Liquid-tight flexible metal conduit, size as indicated.
- 2.2 STRUCTURAL BASES .1 Structural steel rail base, sized for application, complete with isolation elements attached to base brackets, pre-drilled holes to receive equipment anchor bolts.

2.3 SEISMIC CONTROLS
MEASURES

- .1 General:
 - .1 Conduit trade size,
 - .2 Fasteners and attachment points to resist same maximum load as seismic restraint.
 - .3 Drilled or power driven anchors and fasteners not permitted.
 - .4 No equipment, equipment supports or mounts to fail before failure of structure.
 - .5 Supports made of cast iron or threaded pipe not permitted.
 - .6 Seismic control measures not to interfere with integrity of fire stopping.

- .2 Static Equipment:
 - .1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
 - .2 Suspended equipment:
 - .1 Use one or more of the following methods depending upon site conditions and/or as directed by the Manufacturer:
 - .1 Install tight to structure.
 - .2 Cross brace in all directions.
 - .3 Brace back to structure.
 - .4 Cable restraint system.
 - .3 Seismic Restraints:
 - .1 Cushioning to be gentle and steady
 - .2 Shall never reach metal-like stiffness.
 - .4 Vibration Isolation Equipment:
 - .1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9mm clearance during normal operation of equipment and system between seismic restraint and equipment.
 - .2 Incorporate seismic restraints into vibration isolation system to resist complete isolation unloading.
 - .5 Conduit:

- .1 Hangers longer than 300mm;
brace at each hanger.
- .2 To be compatible with
requirements of anchoring of
piping systems.
- .6 Bracing Methods:
 - .1 To the approval of Engineer.
 - .2 Structural angles or channels.
 - .3 Cable restraint system
incorporating grommets,
shackles and other hardware to
ensure alignment of restraints
and to avoid bending of cables
at connection points.
Incorporate neoprene into cable
connections to reduce shock
loads.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Make grounding connections, including
supplying all equipment and raceway
bonding conductors to all new installed
equipment.
- .2 Coordinate on-site with all trades and
Contractors for exact equipment location.

3.2 FIELD QUALITY
CONTROL

- .1 Perform test in accordance with Section 26
05 04.
- .2 Perform additional tests as required by
the authorities having jurisdiction.

3.3 FIELD QUALITY

- .1 Provide contractor testing as specified in
related sections.
- .2 Insert test results data in O+M manuals.

3.4 AS-BUILT INFORMATION

- .1 Provide: additional installation detail(s)
as required to document the installation.
- .2 Note that exact service conduit locations
to be shown by the Contractor on the as-
built drawings. Use measurements from at
least two separate permanent building ends
to triangulate the position of underground
conduits and conduit stubs.

Standby Generator
For CSB and WO
Whitehorse, Yukon

SEISMIC RESTRAINTS
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END OF SECTION

PART 1 - GENERAL

- 1.1 SHOP DRAWINGS
- .1 Submit shop drawings in accordance with Section 26 05 01 "Common Work".
 - .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimensions.

PART 2 - PRODUCTS

- 2.1 PANELBOARDS
- .1 Panelboards: to CSA C22.2-15 No. 29.
 - .2 Panelboards: mains, number of circuits, and number and size of branch circuit breakers, as indicated.
 - .3 Tin plated aluminum bus or silver plated copper bus with full size 100% rated neutrals.
 - .4 Finish trim for all panelboards with hinged door assembly as standard. Provide door lock for all flush mount panelboards.
 - .5 Provide equipment identification in accordance with Section 26 05 25 "Identification".
 - .6 Complete circuit directory with typewritten legend showing location and load of each circuit for all new panelboards.
 - .7 Sized for full width breakers.
 - .8 All surface mounted panels to be provided with drip-shield.
 - .9 All panelboards to have isolated neutral bus.
 - .10 All panelboards to be seismically rated for minimum of Zone 3 area.
 - .11 Provide: sub-feed lugs, and interconnect wiring as required. Note that sub-feed

wiring neutrals to be installed through common raceway as hot conductor sub-feed connections.

.12 Integral transient surge suppression unit where specified or shown on the drawings.

.13 All panels to be rated for use in sprinklered area.

2.2 BACKBOARDS

.1 All surface mounted panelboards to be mounted on 19mm G1S painted plywood backboards. Paint to be fire retardant grey colour. Backboards to be provided by division 26 Contractor.

2.3 EQUIPMENT

.1 Provide equipment identification in accordance with Section 26 05 25 "Identification".

.2 Complete circuit directory with typewritten legend showing location of each circuit.

.3 Panelboards: current capacity, minimum circuits, mounting method, integral transient surge suppression systems, and main breakers as indicated on the drawings and as specified

2.4 BREAKERS GENERAL

.1 GFEDP breakers for 30mA equipment protection.

.2 GFCI breakers for 5mA personnel protection.

.3 Manufacturer's tie-locks for critical and code required systems:

.1 Fire alarm.

.2 ULC approved communicators (and security equipment) used for fire alarm communication.

2.4 MANUFACTURERS

.1 Acceptable manufacturers: Schneider Electric, Eaton and Siemens.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true, and square to adjoining surfaces.
- .2 Install surface-mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.
- .3 Install flush-mount panelboard in wall framing. Report to the general contractor and to the Architect during rough-in where wall framing depth does not allow flush mount of electrical tub trim. General contractor to provide architectural trim around panel tub, increased depth of framed wall or other increased framing depth work to the approval of the Architect. Contractor to request written instructions from the Architect prior to implementation of trim or wall depth increase work.
- .4 Coordinate with the General Contractor for the provision of continuous fire rated wall, ceiling and floor assemblies where panelboards are flush mount in fire separations and fire rated partitions.
- .5 Mount panelboards to height specified in Section 26 05 01 "Common Work", 26 24 17 "Panelboards" or as indicated.
- .6 Connect loads to circuits.
- .7 Connect neutral conductors to common neutral bus with respective neutral identified.
- .8 All panelboard feeders to be continuous without splice.
- .9 All panelboards to have minimum three 21mm spare conduits to the ceiling space and three spare 21mm conduits to the floor space below the panelboard location (where applicable space is preset). Spare

conduits to be run to a free and clear location to the approval of the Engineer.

- 3.2 TESTING .1 Provide contractor testing as specified in Section 26 05 04 "Contractor Testing".
- 3.3 AS-BUILT INFORMATION .1 All panelboard information shall be provided on the as-built drawings.

_____ END OF SECTION _____

PART 1 - GENERAL

- 1.1 SCOPE OF WORK .1 To install service entrance equipment to the approval of the Engineer and the local supply authority and inspection authorities.
- 1.2 SHOP DRAWINGS .1 Submit shop drawings in accordance with Section 26 05 01.
- .2 Drawings to include:
- .1 Floor/wall anchoring method and foundation lofts.
 - .2 Dimensioned cable entry and exit locations.
 - .3 Dimensioned position and ampacity of bus.
 - .4 Dimensioned position and ampacity of bus.
 - .5 Dimensioned layout of internal and front panel mounted components.
- 1.3 MAINTENANCE DATA .1 Provide maintenance data for incorporation into maintenance manual specified in Section 26 05 01.
- 1.4 MAINTENANCE MATERIAL .1 Provide maintenance materials in accordance with Section 26 05 01.

PART 2 - PRODUCTS

- 2.1 POWER SUPPLY .1 Power supply: 120/208 V 3-phase, 4 wire, grounded neutral, 60 Hz supplied from existing ATCO pole-mounted transformers, ampacity rating as indicated.
- .2 This Division is responsible for coordinating with the Engineer for Engineer`s witness of the work detailed in this section and in the referenced sections.
- 2.2 AUTOMATIC TRANSFER SWITCH .1 Supply and install new single by-pass automatic transfer switch, rated 400Amps 120/208VAC. Refer to section 26 32 14 for details.

- 2.3 BACKBOARDS .1 All surface mounted distribution panels to be mounted channel supports, channel supports fastened to 19mm G1S painted plywood backboards. Backboard paint to be fire retardant grey colour. All panels to be rated for use in sprinklered area.
- 2.4 BREAKERS .1 Molded case circuit breakers, quick make, quick break type, for manual and automatic operation with temperature compensation for 40 degrees Celsius. Use common trip breakers with single handle for multi-pole applications. Full width breakers to suit application and to match panels.
- 2.5 EQUIPMENT IDENTIFICATION .1 Label all panelboards with lamacoid labels as to voltage, phase and panel number.
- 2.6 POWER SUPPLY AUTHORITY METER .1 Existing authority meter, supply costumer power quality meter on main switch gear only.
- 2.7 MANUFACTURERS .1 Acceptable manufacturers: Siemens, Eaton and Schneider Electric.

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Install panelboard flush or surface as indicated.
- .2 Install all surface panelboards on channel supports and plywood backboards.
- .3 Install seismic restraint measures as required.
- .4 Install breakers in panelboards
- .5 Install grounding and bonding conductors and connections.
- .6 Connect loads to circuits.
- .7 Connect neutral conductors to common neutral bus.
- .8 Install distribution single line drawing.

.9 Panel feeders to be free of splices
throughout length.

3.2 TESTING

.1 Provide contractor testing as specified in
section 26 05 04 "Contractor Testing".

3.3 AS-BUILT
INFORMATION

.1 All distribution system information shall
be provided on the as-built drawings.

END OF SECTION_____

PART 1 - GENERAL

- 1.1 GENERAL .1 One Standby diesel electric generator housed in an insulated outdoor, sound attenuated, enclosure with all required accessories required for a fully functioning standby power generation system according to CAN/CSA-C282-15, Emergency Electrical Power Supply for Buildings.
- 1.2 RELATED SECTIONS .1 As specified herein and shown on the drawings.
- 1.3 REFERENCES .1 Canadian Standards Association, (CSA International).
- .1 CAN3-Z299.3-85 (R2006), Quality Assurance Program - Category.
 - .2 CSA 282-15, Emergency Electrical Power supply for Buildings.
- .2 International Organization for Standardization (ISO)
- .1 ISO 3046-1-2002, Reciprocating internal combustion engines - Performance - Part I: Declarations of power, fuel and lubricating oil consumptions, and test methods - Additional requirements for engines for general use.
 - .2 ISO 3046-4-2009, Reciprocating internal combustion engines - Performance - Part 4: Speed governing
- .3 The Master Painters Institute (MPI)
- .1 Architectural Painting Specification Manual - March 1998.
- .4 National Electrical Manufacturers Association (NEMA).
- .2 NEMA MG 1-2009, Motors and Generators.
- .5 National Electrical Manufacturers
- .1 Architectural Painting Specification Manual - March 1998.

- .6 The Society of Automotive Engineers (SAE).
- .7 National Building Code NBC - 2010
- .8 Canadian Electrical Code as approved for use in BC, CSA C22.2
- .9 NFPA 37 Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.
- .10 UL-2200.
- .11 AS-2789.
- .12 C-282 Emergency Electrical Power Supply for Buildings 2015.

1.4 SCOPE OF WORK

- .1 This Section of the Specifications covers the Contractor's supply, delivery, installation, testing and commissioning of one (1) walk-in outdoor, acoustically attenuated, enclosure and one diesel engine-driven standby generator, along with their auxiliary equipment and a Generator Control Panel (GCP), transfer switches, switchgear and metering as specified in this Section.
- .2 Installation and testing as specified herein and in C-282-15 section 10.
- .3 Contractor shall coordinate with the Owner for exact location to off-load enclosure on-site. Contractor shall maintain minimum clearances around sensitive instruments and cabling on site. Cable locations to be completed prior to delivery of the genset.
- .4 Supply of the new standby generator system equipment generally consisting of:
 - .1 Sound attenuated walk-in self-contained Standby Generator set complete with all accessories.
 - .2 Utility, service entrance, metering and switchgear components as indicated on drawings.
 - .3 Provide all necessary mechanical and

electrical work for the genset including all fuel oil piping systems, wiring etc and as indicated on the drawings.

- .4 Maintenance materials and spare parts.
 - .5 Source quality control and factory tests to C282 standard.
 - .6 Delivery and off-loading at site in Whitehorse.
 - .7 Do not ship without engineers inspection and approval.
 - .8 Carry cost of time and travel for 'Engineer of record' to witness factory testing prior to shipping.
 - .9 Provision of Manufacturer's technical service Personnel to properly commission and test the newly installed equipment on-site.
 - .10 Provision of Manufacturer's technical training of The Owner's operating/maintenance personnel.
 - .11 Provision for fire alarm devices; including heat detectors, horn/strobes and pull stations.
 - .12 Provisions for security devices.
- .5 All work (concrete pads, rough carpentry, trenching, backfill, wiring, auxiliary systems, testing, etc.) as shown on the drawings and described herein is the responsibility of the Division 26 Contractor.
- .6 Onsite installation of all enclosure components shipped separately.

1.5 SEISMIC REQUIREMENTS

- .1 Seismic restraints shall be in accordance with the ECABC the latest edition.
- .2 Provide Registered Yukon Professional Engineer's review and certification of the seismic restraint system for generator enclosure components and installation on pad.

1.6 WARRANTY

- .1 Generators set and accessories:
 - .1 Provide equipment manufacturer's written warranty covering all

equipment supplied against defects in materials and workmanship.

- .2 The equipment warranty period is to be a minimum of five years commencing on the date the installed equipment is accepted and enters active service.
- .3 The minimum five-year warranty is to cover 100% of costs of on-site repair or replacement of defective materials and workmanship. Additional extended warranty may offer pro-rated material/labour charges.
- .4 Equipment warranty coverage is not intended to cover maintenance, service, or repair requirements which would routinely be expected for a continuous standby power generation application.
- .5 During the warranty period if the repair will need more than 72 hours, the Manufacture shall provide a free of charge temporary unit until the repair is completed.
- .6 Installation and related materials and workmanship are to be covered by a minimum 1-year warranty or as otherwise defined in the contract documents. The warranty is to cover 100% of costs of on-site repair or replacement of defective materials and workman-ship.

1.7 INSTALLATION DESIGN
COORDINATION

- .1 The manufacturer drawings and data to effect the proper installation and connection of all equipment supplied under this tender.
- .2 The manufacturer shall review and comment on the installation design details where necessary to effect the proper overall equipment installation.
- .3 Provide qualified equipment manufacturer's technical representative to inspect, coordinate, and advise as necessary during the equipment installation. Contractor to ensure that the Outdoor Genset is properly installed on concrete foundation pad.

Concrete foundation pad shall be constructed and installed by the Contractor and shall be designed by a Structural Engineer licensed to practice in the Yukon.

1.8 SYSTEM DESCRIPTION

- .1 Provide automatic, unattended, standby power supply system consisting of:
 - .1 Liquid cooled low voltage diesel electric generating unit with combined control, as described herein and shown on the drawings.
 - .2 Accessories and equipment specified in this specification.
- .2 Provide design, fabrication, testing, transportation, demonstration and equipment warranty.

1.9 DESIGN REQUIREMENT

- .1 Design equipment to meet following requirements:
 - .1 Total load: one 100kW generator.
 - .2 Voltage: 120/208V.
 - .3 Frequency: 60 Hz.
 - .4 Three Phase, Four Wire.
 - .5 Power factor: 0.8.
 - .6 Load harmonic content: 30% THD.
 - .7 Maximum rotational speed 1800 rpm.
 - .8 Interrupting capacity: minimum of 25 kA.
 - .9 Duty rating: full load standby 100% rating.
 - .10 Performance: automatic.
 - .11 Elevation above sea level: 700m.
 - .12 Ambient temperature: 40°C.
 - .13 Relative humidity: 60%.
 - .14 Minimum run time: 24-hours
- .2 Design unit capable of starting, attaining settled voltage and frequency limits and accepting 80% full rated load with voltage and frequency settling to specified steady state bands, in less than 10 seconds for any temperature between 0°C to 40°C.
- .3 Use engine manufacturer's standard, published continuous (prime) horsepower rating in assessing engine capacity and

de-rate this rating for specified conditions and engine driven accessories in accordance with ISO 3046-1.

- .4 Description of generating set operation:
 - .1 Automatic starting on signal from automatic transfer switch(s).
 - .2 Equip engine with digital controller for: start/stop/auto push buttons.
 - .3 Automatic shut down on:
 - .1 Low oil pressure.
 - .2 High coolant temperature.
 - .3 Overspeed.
 - .4 Overcrank.
 - .5 Engine sender unit fail.
 - .6 Fuel leak/fuel sender fail.
 - .7 Emergency stop.
 - .8 Critical low fuel shutdown.
 - .4 Generators pre-alarms:
 - .1 Main disconnect open.
 - .2 Automatic transfer switch in by-pass mode.
 - .3 Control switch not in auto.
 - .4 Day tank fuel leak.
 - .5 Low coolant level.
 - .6 Weak battery.
 - .7 Low fuel.
 - .8 Overspeed.
 - .9 Low oil pressure.
 - .10 High engine temperature.
 - .11 Low engine temperature.
 - .12 Overcrank.

1.10 SUBMITALS

- .1 Submit shop drawings in accordance with Front-end documents:
 - .1 Submittal Procedures. Dimensions and data in metric units and symbols followed by in bracket imperial units and symbols wherever applicable.
 - .2 Engine: make, model, rating and performance curves.
 - .3 Starter motor, make model.
 - .4 Generators: make, model and rating complete with generator saturation curves, heat damage curves, reactive capability and special data.
 - .5 Voltage regulator: make, model, type
 - .6 Governor: type, model.
 - .7 Battery: make, type, voltage,

- capacity.
 - .8 Charger: make, model, input, and output rating.
 - .9 Submit general outline drawing of complete assembly showing engine, radiator and generator mounting, exhaust, recirculation and intake air louver arrangement, exhaust gas silencer and pipe arrangement, locations of fuel and lubricating oil filters, fuel supply and return line connections, lubricating oil drain valve, radiator and coolant drain valves, air cleaner, engine instrument panel, starting motor, power and control junction boxes, engine and generator mounting feet. Indicate on drawings:
 - .1 Horizontal and vertical dimensions.
 - .2 Minimum door opening required for moving unit.
 - .3 Head room required for removal of piston and connecting rod.
 - .4 Weigh of engine, generator, baseplate, radiator, and exhaust silencer.
 - .10 Baseplate construction details and materials.
 - .11 Transfer and bypass system: make model, type.
 - .12 Outline and layout of panels.
 - .13 Schematic and wiring diagrams of engine, generator, control panel, automatic transfer isolation and bypass panels complete with interconnecting wiring diagrams.
 - .14 Single line diagram showing all breakers, switches, metering and protective relays.
 - .15 Field wiring diagram.
 - .16 Paralleling schematic and wiring diagram.
 - .17 Complete bill of materials, including manufacturer's name, catalogue number and capacity.
- .2 Lubricating oil system: where oil pump not provided, submit certification to Engineer

ensuring oil pump is not required and will not detract from service life of engine.

- .3 Walk-in enclosure: Layouts showing enclosure dimensions and location of equipment and panels as per these specifications and drawings.

1.11 CLOSEOUT
SUBMITALS

- .1 Provide maintenance data for diesel generating units for incorporation into manual specified in herein.
 - .1 Complete set of reviewed shop drawings.
 - .2 Factory test data of engine, generator, exciter, control logic, metering and other pertinent test data.
 - .3 Maintenance and operation bulletins for:
 - .1 Engine and Accessories.
 - .2 Generator.
 - .3 Voltage Regulator and Accessories.
 - .4 Exciter.
 - .5 Permanent magnet generator if installed.
 - .6 Battery charger.
 - .7 Speed Governor.
 - .8 Starting Motor.
 - .9 Batteries.
 - .10 Ventilating Equipment.
 - .11 Timers, Relays, Meters.
 - .12 Power Circuit Breakers.
 - .13 Controller, Contactors.
 - .14 Other Accessories.
 - .4 Submit original brochures; photocopies are not acceptable. Include technically relevant data.
 - .5 Complete sequence of system operation.
 - .6 Complete bill of materials including nameplate data of equipment and accessories.

1.12 STANDARD OF
ACCEPTANCE

- .1 Generator enclosure: ITB or Alumtek or Silhouette Steel.
- .2 Generator enclosure to be a part of the generator package from the same supplier

as a complete package.

- .3 Generators: CAT Genset or Simson Maxwell,
or Cummins.

1.13 QUALITY ASSURANCE

- .1 Do work in accordance with CAN3-Z299.3.

1.14 DELIVERY,
STORAGE AND HANDLING

- .1 Protect equipment against shipping and
storage damage.

1.15 WASTE MANAGEMENT
AND DISPOSAL

- .1 Separate and recycle waste materials to
the AHJ and standard Construction/
Demolition Waste Management and Disposal.
- .2 Separate and recycle waste materials to
the AHJ and standard Construction/
Demolition Waste Management and Disposal
- .3 Collect and separate for disposal
packaging material in appropriate on-site
bins for recycling in accordance with
Waste Management Plan.
- .4 Divert unused metal and wiring materials
from landfill to metal recycling facility
as approved by Engineer
- .5 Dispose of unused paint material at
official hazardous material collections
site approved by Engineer.
- .6 Do not dispose of unused paint material
into sewer system, into streams, lakes,
onto ground or other location where it
will pose health or environmental hazard
- .7 Dispose of lubricating oil, coolant and
fuel material at official hazardous
material collections site approved by
Engineer.
- .8 Dispose of unused batteries material at
official hazardous material collections
site approved by the Engineer. Area for
recycling.

1.16 WARRANTY FOR
GENERATOR SET AND
ACCESSORIES

- .1 For the Work of this Section the 12 months
warranty period, prescribed in subsection
GC 32.1 of General C conditions "C", is

extended to 60 months.

- .2 Provide equipment manufacturer's written warranty covering all equipment supplied against defects in materials and workmanship.
- .3 The equipment warranty period is to be a minimum of five years commencing on the date the installed equipment is accepted and enters active service.
- .4 The minimum five-year warranty is to cover 100% of costs of on-site repair or replacement of defective workmanship. Additional extended warranty may offer pro-rated material/labour charges.
- .5 Equipment warranty coverage is not intended to cover maintenance, service, or repair requirements which would routinely be expected for a continuous standby power generation application to be covered by a minimum 1-year warranty or as otherwise defined in the contract documents. The warranty is to cover 100% of costs of on-site repair or replacement of defective materials and workman-ship.

1.17 OPERATING AND
MAINTENANCE MATERIALS

- .1 Provide four (4) hard copies of operating and maintenance instruction manuals for the generating set and enclosure. Four (3) copies to owner - One (1) copy to the Engineer. Refer to section 26 05 08.
- .2 Bind manuals as described in section 26 05 08.
- .3 Content shall be individually sectioned and references with an index:
 - .1 Title page showing pertinent details of the subject generator set.
 - .2 Table of contents or index.
 - .3 Factory test report.
 - .4 Engine record card (showing serial number and pertinent configuration).
 - .5 Engine operator's manual.
 - .6 Voltage regulation equipment operations manual (if not included

- with generator).
- .7 Engine accessory equipment descriptive brochures for miscellaneous accessory equipment including batteries.
 - .8 Control panel equipment brochures.
 - .9 Automatic transfer switches equipment brochures.
 - .10 Mechanical drawings and complete bills of material for all components supplied
 - .11 Electrical drawings, including schematics, detailed power and control wiring diagrams, and complete bills of material for all components supplied.
 - .12 Include component manufacturer's name and component part number in material lists to permit proper ordering of spares.
 - .13 Update all drawings and material lists to as-built condition at the completion of factory tests. Include as-built versions in Operating and Maintenance Manuals.
- .4 Manual to include Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier.
- .5 Manual to include Operation and Maintenance instructions, installation instructions and parts manuals for engine, alternator, control panel, battery charger, battery, fuel system, to permit effective operation, maintenance and repair.
- .6 Manual to include the following technical data:
- .1 Illustrated parts lists with parts catalogue numbers.
 - .2 Parts list to include all part numbers for any filters required for the engine.
 - .3 Schematic diagrams of electrical controls.

- .4 Flow diagrams for fuel and lubricating oil systems.
- .5 Certified copy of factory test results. Test results to be type written and signed by the individual responsible.
- .6 Maintenance and overhaul instructions and schedules.
- .7 Precise details for adjustment and setting of time delay relays or sensing controls which are required on site adjustment.

1.18 MAINTENANCE EXTRA MATERIAL

- .1 For panels using relays, fuses or bulbs provide following:
 - .1 One spare control circuit breaker per rating.
 - .2 Twelve spare indicating light bulbs per rating.
 - .3 Twelve spare fuses per rating.
 - .4 One spare control relay and socket per rating and contact arrangement.
 - .5 One spare contactor operating coil.
- .2 Provide generator unit with standard set of engine manufacturer's spare parts for one year, normal 200 operating-hours. Spares to include, but not limited to, the following:
 - .1 Two fuel filter elements for each type of fuel filter/water separator.
 - .2 Two lubricating oil filter elements.
 - .3 Two air cleaner elements.
- .3 Provide conclusive evidence that Canadian distributor has been established and will stock in Canada spare parts likely to be required during normal life of engine.

1.19 SOURCE QUALITY CONTROL

- .1 This section lists the minimum required factory testing to test generator set including engine, alternator, and control panels.
- .2 Submit completed test results to Engineer upon completion of the test.
- .3 Test results to be submitted with shop

drawings.

- .4 Test procedure:
 - .1 Prepare blank forms and check sheet with spaces to record data. At top of first sheet record:
 - .1 Date.
 - .2 Generator set serial no.
 - .3 Engine, make, model, serial no.
 - .4 Alternator, make, model, serial no.
 - .5 Voltage regulator, make and model.
 - .6 Rating of generator set, kW, kVA, V, A, r/min, Hz.
 - .2 Mark check sheet and record data on forms in duplicate as test proceeds.
 - .3 Additional tests as recommended by manufacturer.
 - .4 Tests:
 - .1 The first two 15-min intervals shall be at 25% rated load. The load shall then be increased to 50% rated load. After a further 15-min interval the load shall be increased to 75% of rated load. The load shall be increased in this manner so that the set is operating at 100% rated load after 1 hour. The set shall operate for a total run time of four hours.
 - .2 Readings are to be taken at 15-minute intervals, and following is to be recorded:
 - .1 Time of reading.
 - .2 Running time.
 - .3 Ambient temp in degree C.
 - .4 Lube oil pressure in kPA.
 - .5 Lube oil temp in degree C
 - .6 Engine coolant temp in degree C.
 - .7 Exhaust stack temp in degree C.
 - .8 Alternator voltage: phases A, B, & C.
 - .9 Alternator current: phases A, B, & C.

- .10 Power in kW.
- .11 Frequency in Hz.
- .12 Power Factor.
- .13 Battery charger current in Amps.
- .14. Battery voltage.
- .15 Alternator stator temp in degree C.
- .3 After completion of 4-hr run, demonstrate following shutdown devices and alarms:
 - .1 Over-cranking.
 - .2 Over-speed.
 - .3 High engine temp. (Alarm and warning)
 - .4 Low lube oil pressure. (Alarm and warning)
 - .5 Low battery voltage, or no Battery charge.
 - .6 Low coolant level.
- .5 Demonstrate:
 - .1 Automatic starting of genset.
 - .2 Automatic shutdown of engine on resumption of normal power.
 - .3 That battery charger reverts to high rate charge after cranking.
- .6 Demonstrate low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.
- .7 Demonstrate low oil pressure and high engine temperature shutdown devices operation without subjecting engine to these excesses.
- .8 Reports to be type written and submitted to the Engineer before shipment of the generator
- .9 Additional tests as recommended by manufacturer.

PART 2 - PRODUCTS

2.1 DESCRIPTION OF

- .1 Outdoor Power Generation System.

SYSTEM

- .1 Sound-attenuated, vandal proof, weatherproof, walk-in outdoor generator enclosure is designed for a diesel fuelled generator, with appropriate clearance around generator for maintenance access to the manufacturer recommendations.
- .2 Designed for a minus 50 degree C outdoor ambient operating conditions, Nema-3R weather protective enclosure with an integral base.
- .3 Discharge plenum.
- .4 Unit Sound Attenuation: The sound pressure level shall average 68 dBA at measure 7m in a free field condition.
- .5 Size: in any case shall not exceed 40' - 0" long x 19' - 0" wide x 13' - 0" high for the overall dimensions.
- .6 Length at the base to accommodate the enclosure.
- .7 Weight: to the manufacturer recommendations and the structural engineer's approval.
- .8 Exterior shell construction: 10 gauge painted aluminum to ASTM B-221 with snap lock construction. Alternate of 12 gauge galvanized steel to ASTM A-653, all welded construction is acceptable.
- .9 Walls: extruded aluminum snap-lock wall panel system with integral posts 12" O.C, wall thickness nominal 0.100". Wall insulated with minimum 1" polyurethane foam and 4" mineral wool and covered with 22 gauge perforated galvanized steel lining mechanically fastened to the framing members. Alternate: 6" thick insulated with wall studs approximately every 16" OC is acceptable.
- .10 Designed to withstand wind loads as per NBC code
- .11 Roof: crowned walk-on with extruded alumni roof edge with 10" gauge aluminum roof skin. Provide muffler supports in the roof. Alternate: 10"

- deep with cross members approximately every 24" OC with 14GA skin fully seam welded is acceptable.
- .12 Designed to within standard snow loads as per NBC code.
 - .13 Roof has a 1" drains with ball valve to minimize ponding of water.
 - .14 Insulation: Roof: Minimum R20, Walls and Floor Minimum R20. Lower insulation value will NOT be accepted.
 - .15 Interior Liner 2.2 gauge perforated galvanized steel.
 - .16 Base: minimum 12" channel base frame with 3/16" checker plate floor, lift lugs to be CSA G40.21-350WT category 4 and lugs hole to be 2". 4 channel cross, lift lugs to be NDE tested members and with holes for seismic hold down.
 - .17 Floor is reinforced local to equipment mounting at two places along the generator base frame.
 - .18 All mounting is designed for seismic restraints.
 - .19 Engine and generator connected and mounted on a common skid base plate with spring isolators and seismic snubbers.
 - .20 Unit-mounted generator metering, control, and separate generator output circuit breaker.
 - .21 Engine driven battery charging alternator, battery, and rack.
 - .22 120VAC input solid state battery charger.
 - .23 Fuel filters.
 - .24 Engine exhaust flex and 'hospital Grade' exhaust silencing system.
 - .25 Exhaust system insulation blankets completely covering: Engine exhaust manifold, exhaust flex and entire exhaust silencer.
 - .26 Engine Block Heater (circulations type Hot Start) must be on separate circuit.
 - .27 Remote generate status Annunciator.
 - .28 Drip tray
 - .29 Sub-base dual wall fuel tank to

ULCS601 standards c/w float switch leak detection in the sub-base fuel tank. Minimum fuel tank capacity is at 100% full load, fuel tank shall be ULC approved as required by the National Fire Code requirements. Fuel tank has to be insulated and sprayed for low temperature use and shall be provided with heaters for cold weather. **Coordinate with the tank Manufacturer to maximize fuel storage without increasing base size.**

- .30 Doors: provide two 18-Gauge Aluminum door (3'-0" x 6'-8") c/w panic hardware with exterior thumb latch, weather stripping, stainless steel threshold and drip-edge.
- .31 Penetrations: Exhaust opening in the roof complete with rain shield.
- .32 Muffler mounting support channels in the ceiling are included.
- .33 Ventilation: Intake - 24 volt DC motorized & insulated intake damper (spring to open; power to close) with hood and galvanized bird screen. Replaceable filter bank and insulated damper with 24VDC 2-position actuators as per the manufacturer recommendations.
- .34 Recirculation: Recirculation via aluminum radiator plenum, and non-insulated dampers, each with 24VDC modulating actuators Recirculation is controlled by a modulating temperature controller that is based on room temperature.
- .35 Discharge - Supply and install motorized & insulated discharge dampers with recirculation ducting to rear of genset, snow hood and galvanized bird screen.
- .36 Enclosure Panelboard: 100Amp 120/208V, 3 Phase, 42cct combination bolt-on breaker panelboard with main circuit breaker, wired to the following:
 - .1 LED fixtures and switching at entrance doors.
 - .2 Two GFCI duplex receptacles.

- .3 Block heater wiring.
- .4 Anti-condensation heater wiring.
- .5 Jacket water heater wiring (jacket water heater larger than 4000W to be 3 phase)
- .6 Damper motor wiring.
- .7 Room heater controls.
- .37 Conduit, outlet box and cable ports rough-in for ceiling mounted fire detection equipment, security door contacts and cable port's for load testing.
- .38 Cables ports, 4" rigid steel conduit c/w removable rigid styrofoam plug, threaded galvanized cap for inside, all bolts and washers to be stainless steel, ¼" steel plate front and back painted with two coats of zinc primer and two coats matching generator enclosure paint, caulking between front plate and exterior wall and expanding foam insulation and fire caulking to seal 4" conduit in wall.
- .39 Battery charge wiring.
- .40 Four industrial 4KW interior space heaters and temperature controls.
- .41 All wiring is surface-mount EMT conduit.
- .42 Paint: All surfaces cleaned to SSPC-SP1, all seams sealed, primed with two coats of phenolic primer.
- .43 Exhaust System Interior mounted hospital grade muffler c/w mounting bands, elbow and rain cap. Interior Muffler is insulated with removable blankets.
- .44 Accessories: Snow hood, pre-fitted and installed by the contractor on site. Stairs for both exits of the enclosure if the height of the enclosure step is more than 12". Door canopy to be designed to withstand snow load.
- .45 Engine and generator connected and mounted on a common baseplate.
- .46 Unit-mounted generator metering, control, and generator output circuit breaker. Wall mounted control panel

- is acceptable to the Engineer's approval.
- .47 Charging alternator, battery, and rack.
 - .48 Fuel filters.
 - .49 Drip tray.
 - .50 Factory testing.
 - .51 Delivery and off-loading.
 - .52 Provide stairs for both exists of the enclosure, as required.
 - .53 Manufacturer's supervision of installation as necessary.
 - .54 Site commissioning, acceptance testing, and training.
- .2 Power generation system designed for automatic standby power service as part of an overall electrical power system shall consist of:
- .1 Sound-attenuated, vandal proof, weatherproof, walk-in outdoor generator enclosure is designed for a 100 kW diesel fueled generators, with minimum 1m clearance.
 - .2 Automatic starting and stopping initiated by remote automatic transfer switch.
 - .3 Timed shutdown control of the generator to be contained in the generator control panel.
 - .4 Automatic starting, and automatic stopping initiated by remote automatic voltage/frequency control when running.
 - .5 Automatic shutdown on conditions of over-cranking, over-speed, high engine over-temperature, low lube oil pressure, and low fuel level.
 - .6 Warning alarms for conditions of low coolant level, low tank fuel level, not-in-auto/main breaker open, low battery voltage, plus 2 spares for future use.
 - .7 Note: Not-in-Auto/Main Breaker Open alarm to also operate when generator is not running.
 - .8 Warning and shut down alarms taken to common alarm contacts for remote flashing alarm lights.

- .9 Provide full remote monitoring of generators status and alarms including fuel system both locally at the generators and remotely at the Master Generator Control Panel and the Local FA system. Remote annunciator to be provided for generator, minimum 15 indication lights, **to be located in the Environment Canada main entrance**, coordinate the final location on site with the Engineer.

2.2 GENERATOR SET
ASSEMBLY

- .1 Provide following items plus such other items as necessary to make units complete:
 - .1 Diesel Engine.
 - .2 Diesel Engine Accessories.
 - .3 Baseplate and Drip Pan.
 - .4 Vibration isolators.
 - .5 Governor.
 - .6 Engine Exhaust System.
 - .7 Engine Cooling System.
 - .8 Engine Ventilating System.
 - .9 Starting Motor.
 - .10 Batteries and Rack.
 - .11 Battery Charger.
 - .12 Generator and Exciter.
 - .13 Voltage Regulator and Accessories.
 - .14 Combined Control with paralleling, Transfer By-pass Panel.
 - .15 High Voltage Isolating and By-pass Panel.
 - .16 High Voltage Transfer and By-pass Panel.
 - .17 Spares and Accessories.

2.3 GENERATOR SET
MOUNTING

- .1 Supply shop drawings for all mounting system components. All shop drawings to include certified seismic control detail as specified in section 26 05 01 and section 26 05 48 ensuring that equipment can accept the seismic loads imposed and remain operational.
- .2 Complete generating set mounted on structural steel base of sufficient strength and rigidity to protect assembly from stress or strain during transportation, installation and under

operating conditions on suitable level surface.

- .3 Factory provided integral vibration isolation system to the requirements of 26 05 01 and 26 05 48.
- .4 Generator assembly is to be secured by direct bolts to the requirements of section 26 05 48.

2.4 DIESEL ENGINE

- .1 Full diesel, heavy duty, cold start, liquid cooled, vertical in-line or vee, and current manufacture of a type and size that has been service as a prime mover for electric power generation for not less than two years.
 - .1 Turbo supercharged engine acceptable providing brake mean effective pressure (BMEP) at rated output does not exceed 1800 kPa (225 psi).
 - .2 Mechanically driven superchargers not acceptable.
 - .3 Engine minimum of four cylinders.
- .2 Engine with auxiliary starting aids (e.g., glow plug assist start) not acceptable.
- .3 Equip engine air intakes with dry type standard duty air cleaners located close to inlet manifold.
 - .1 Cleaner element: directly replaceable with elements of Canadian manufacture.
- .4 Equip engine air intakes with dry type standard duty air cleaners located close to inlet manifold.
 - .1 Cleaner element: directly replaceable with elements of Canadian manufacture.
- .5 Provide engine wiring in liquid-tight conduit and fittings with insulated bushings.
 - .1 Use stranded, minimum No.14 AWG, TEW 105°C coloured coded wires.
 - .2 Terminate wiring with coded, insulated terminals flanged fork

- type. Terminal blocks heavy duty, screw type.
- .3 Wire markers of slip on oil proof type.
- .4 Junction boxes on unit of liquid-tight type.
- .5 Maximum of two wires per terminal block.
- .6 Provide a display on the digital controller to show: lubricating oil pressure, tachometer, coolant temperature, and other standard gauges and instruments.
 - .1 Calibrate and scale gauges and instrument in both metric and imperial units and symbols.
 - .2 Mount oil temperature sensors on engine full flow pressure line.
 - .3 Hoses or tubing for gages: high pressure reinforced type.
- .7 Mount unit accessories, including gauges, instruments, and protective sensors, to isolate or dampen vibrations.
- .8 Dynamically balance complete engine-flywheel generator arrangement after assembly.
 - .1 Torsional or other vibration tolerance within 10% above or below rated speed of nit, when operating unloaded or connected to any load within rating.
 - .2 Cyclic irregularity: 1/125 maximum.
- .9 Provide engine flywheel with graduated marking around its periphery to facilitate fuel injection and valve timing.
- .10 Provide removable wet type cylinder liners.
 - .1 Furnish cylinder head with removable valve seat insert and guides.
- .11 Provide personnel safety guards for exposed moving parts and exhaust manifolds.
 - .1 Provide platform for servicing upper part of engine if the generator block

is higher than 1700mm and where applicable.

- .12 Engine control panel complete with:
 - .1 Lubricating oil pressure gauge.
 - .2 Lubricating oil temperature gauge.
 - .3 Coolant temperature level gauge.
 - .4 Low coolant level gauge.
 - .5 Engine switch auto-off-crank-start selector switch and crank pushbutton.
 - .6 D.C. main power supply circuit breaker.
 - .7 Terminal blocks for connection to D.C. power supply, engine monitoring and shutdown device.
 - .8 Provide low oil pressure, high coolant temperature, low coolant level and overspeed protection to shut down engine on manual operation.

2.5 COOLING AND
VENTILLATING SYSTEM

- .1 Provide complete cooling and ventilating system for unit as indicated.
- .2 Thermostatically control system and maintain coolant, ethylene glycol, within engine manufacturer's tolerance, 88 °C with unit operating at rated load under specified conditions. Cooling system engine mounted radiator type.
 - .1 Design and supply complete modulating ventilating system as indicated where engine mounted radiator is required. Radiator cooling fan to be pusher type, minimum two belt drive with belt adjuster. Fan, pulley and belt with removable protective cage.
 - .2 Ventilation system to incorporate modulating damper with exhaust and recycle louvers designed to maintain steady indoor temperatures.
 - .3 Provide drain vales for draining coolant from engine block and radiator.
 - .1 Drain coolant conveniently into large container through flexible extensions.
 - .2 Dripping valves or leaking connections will not be permitted.

- .4 Ventilation system: complete with canvas connections, mounting hardware, modulating damper motors, dampers, inlet and outlet hoods, bird/insect screen, air filters, annual potentiometer, damper linkages, low voltage transformer, thermostat, and fan motor.
 - .1 Provide positive seal, zero heat loss louvers. Air filter 25mm deep disposable type with fiberglass filter media and initial static pressure drop not to exceed 25kPa based on face velocity of 2.54 m/s.
- .5 Ventilating system operation as follows:
 - .1 Air inlet and outlet damper closed when engine not running.
 - .2 On, engine star, air inlet damper to open.
 - .3 Inlet damper minimum opening to be set by manual potentiometer.
 - .4 Thermostat to modulate recirculation and outlet dampers to maintain set room temperature.

2.6 ENGINE
LUBRICATION SYSTEM

- .1 Provide full pressure lubricating system complete with filters and oil cooler.
- .2 Oil pump: engine driven gear type complete with strainer.
- .3 Equip filters with automatic by-pass valve and full flow filter elements conveniently located for servicing and directly replaceable with elements of Canadian manufacture.
 - .1 Cooler to have sufficient capacity to maintain oil temperature within engine manufacturer's tolerances with unit operating at rated load under conditions specified.
- .4 Equip engine oil sump with oil drain pipe, gate valve and pipe cap.
 - .1 Permit complete drainage in a convenient manner.

- .5 Ensure unit is able to start and assume full rated load within the specified of less than 10 second period when, operational requirements are such that unit may lay idle for periods up to one month.
 - .1 Provide electrical motor driven, integrally mounted, gear type oil priming pump with interval timer and breaker type combination starter
 - .2 Starter mounted in control panel.
 - .3 Lubrication oil pressure switch to stop priming pump when engine is running.
- .6 Metallic oil hoses: steel reinforced rubber type with crimped or swaged end fittings.

2.7 ENGINE FUEL SYSTEM

- .1 Provide complete fuel system including fuel lift pump and filters
 - .1 Filter elements to be directly replaceable with elements of Canadian manufacture.
- .2 Fuel supply and return lines to be to the manufacturer standards and the Engineer's approval.
- .3 Non-metallic fuel hoses: steel reinforced rubber type with crimped or swaged end fittings.
- .4 Division 26 to provide full fuel tank after time of substantial completion.

2.8 ENGINE EXHAUST SYSTEM

- .1 Provide complete exhaust system including heavy duty hospital grade silencer with condensate drain, plug and flanged couplings; stainless steel, corrugated expansion joints, length to suit, to absorb both vertical and horizontal expansion; flanges, bolts, gaskets, adjustable hangers and pipe and pipe-thimble to permit projection of pipe 2.9m beyond wall.
 - .1 Exhaust tail pipe end at 45 degree angle and terminated in bird screen

on exterior of walk-in enclosure.
Insulate interior exhaust piping and
silencer.

- .2 Arrange exhaust system to suit enclosure construction.
 - .1 Arrange exhaust run best suited to engine.
- .3 Provide exhaust pyrometers locate on common exhaust manifold or two pyrometers on separate manifolds.
 - .1 Insulate Interior Exhaust System.

2.9 ENGINE JACKET
COOLANT HEATER

- .1 Provide engine jacket coolant heater[s] complete with 20°C to 60°C adjustable immersion type thermostat. Size heater(s) to maintain coolant at 40°C in an ambient temperature of 0°C. If jacket coolant heater is larger than 4000KW provide a 3 phase jacket.
- .2 Standard block heaters sized to the manufacturer recommendation, if standard block heaters are not sufficient: Obtain circulation of heated coolant on thermosyphon principle.
 - .1 However, if this also does not provide sufficient circulation to avoid hot spots in system, provide electrical motor driven circulating pump to operate automatically when heater is energized.
 - .2 Motor: 120V single phase splash-proof type complete with breaker type combination starter.
 - .3 Starter in wall-mounting enclosure mounting supports to the manufacturer's control panel recommendations.

2.10 ENGINE SPEED
GOVERNOR

- .1 Provide full electronic governor with speed changer and dry type actuator.
 - .1 Governing system: in accordance with ISO 3046-4.
 - .2 Governor with following features:
 - .1 Ten turn locking type manual speed adjustment.

- .2 Speed regulation, steady state, no-load to full load and vice versa; +/-0.25%
- .3 Transient peak, no-load to full load and vice versa +/-10%
- .4 Recovery time to steady state condition on application of 80% of the full load from no-load not to exceed 3 seconds.
- .5 Frequency: externally adjustable from zero to 5% while engine is running.
- .6 Class A accuracy.

2.11 ENGINE STARTING
SYSTEM

- .1 Provide complete starting system including cranking starting motor, batteries, battery rack on genset skid (unit mounted battery rack), heavy-duty battery cables and battery charger. Provide seismic certification for battery bracing.
 - .1 Provide positive engaging type cranking motor(s). Cranking motor and flywheel ring gear arrangements which may permit tooth to tooth abutment not acceptable.
- .2 Provide lead acid battery with sufficient capacity in ambient room temperature of 0 degree C to crank unit engine at Manufacturer's recommended cranking starting speed for period of 3 minutes.
 - .1 Voltage measured at starting motor terminals at end of 3 minutes cranking, with cranking currents flowing, not less than 1.75 V per cell.
 - .2 Size battery to suit engine and battery manufacture's published data.
 - .3 Batteries: dry charged, specific gravity of electrolyte 1.22 when fully charged at 27°C.
 - .4 Battery termination: bolt-on or study type.
 - .5 Protect terminals and exposed electrical connections accidental short circuit by falling conductive objects on battery.
- .3 Provide battery charger with 120 volt AC

input and output equal to 1.20 of ampere-hour capacity of battery based on 8h rate.

- .1 Output voltage ripple: 3% or less.
 - .2 Provide AC input circuit breaker and 24h terminating equalizer timer with approximately 4m of connecting cord and permanent connectors connecting to battery terminals
 - .3 Provide 5 spare fuses inside charger panel.
 - .4 Charger: CSA approved.
- .4 Provide necessary heavy duty, maintenance-free battery cables and connectors.
- .1 Select cable wire size on the basis of allowing not more than 5% voltage drop at time of peak load
- .5 Fit turbocharged engines with one spring actuated, two stage accumulators per turbocharger to automatically provide pre-start and post run lubrication to turbocharger(s).

2.12 BATTERY CHARGER

- .1 Constant voltage, solid state, four stages from trickle charge at standby to bulk charge, to absorption charge to float charge after use.
- .2 Equalizer, float type.
- .3 Regulation: plus or minus 1% output for plus or minus 10% input variation.
- .4 Equipped with output display for output dc volts, output dc amps.
- .5 Minimum charger capacity: 15A.
- .6 The battery charger shall be capable of recharging a completely discharged battery to 80% of capacity within 4 hours and to full capacity in not more than 12 hours.
- .7 Standard of Acceptance: To the approval of the Engineer

2.13 ALTERNATOR

- .1 Alternator: to NEMA MG1.

- .2 Provide generator, drip proof, single bearing and close coupled to engine with SAE housing: to NEMA MG1.
 - .1 Generator: full amortisseur winding, direct connected brushless exciter with easily removable bolt-on diodes with surge protection.
- .3 Maximum deviation of open circuit terminal voltage waveform not to exceed 5%.
- .4 Provide permanent magnet generator (PMG) for generator short circuit sustaining capability not less than 2.4 times rated current.
- .5 Generator winding insulation: Class H; winding temperature rise not to exceed 125°C as measured by resistance in ambient temperature of 40°C.
- .6 Identify generator windings with metal tags.
 - .1 Bring windings to insulated terminals in metal junction box mounted on side or top of generator.
 - .2 Size junction box to permit mounting of engine and generator low voltage controls and wiring terminals blocks.
 - .3 Provide barrier in junction box to separate low and high voltage wiring.
- .7 Provide voltage regulation system complete with auto/manual control module.
 - .1 Voltage regulator: capable of withstanding continuous vibration, shock and temperature up to 50°C while maintaining accuracy to +/- 1%.
- .8 Steady-state voltage regulation not to exceed 1%.
 - .1 Transient voltage regulation, when full load is applied or removed, not to exceed 10% when measured by oscilloscope or high speed strip chart recorder with recovery time to steady-state less than 3 seconds. Voltage regulator to be a digital type regulator.

-
- .9 Design equipment to minimize radio frequency interference under operating conditions.
 - .1 Balanced telephone influence factor to: NEMA MG 1.
- 2.14 GENERATOR PANEL
- SERVICE
-
- .1 Panel: indoor, wall metal-enclosed steel mounted, dead front, construction complete with lifting eye bolts.
 - .1 Doors: formed edges, reinforced by stiffeners and complete with lockable handles.
 - .2 Design and construct panel to withstand strains, jars, vibrations and other conditions incident to shipping, storage, installation and service.
 - .3 Panel CSA certified. Mount a nameplate bearing CSA monogram in a prominent position on panel.
 - .4 Identify instruments and controls with lamacoid or metal engraved nameplates fastened by rivets or screws for permanent identification.
 - .1 Identify door mounted items with nameplates.
 - .2 Attach nameplates to removable items such as relays and wireway covers.
 - .5 Provide panel with bolted rear covers.
 - .6 Factory wire panel completely. Use stranded, minimum No.14AWG, TEW 105°C and coloured for control wiring. Used No.14AWG for C secondary connections:
 - .1 Blue - DC control.
 - .2 Red - AC control.
 - .3 Black - PT secondary connections.
 - .4 Orange - CT secondary connections.
 - .5 Green - non-current carrying ground.
 - .6 White - current carrying ground.
 - .7 Yellow - interlocks.
 - .8 Brown - generator excitation system.
 - .7 Code wiring at each wire end with permanent, non-aging slip on markers.

Support and run wiring neatly. Protect wiring from mechanical damage by grommets and shields.

- .8 Code terminal blocks, clamp type, serrated for positive grip and of tough, on-brittle, unbreakable nylon, size 3,453/0 or equivalent.
 - .1 For current transformer secondary circuits, provide terminal blocks of dual connector type.
 - .2 Provide test block for current transformer secondary connections.
- .9 Provide door detent mechanism to maintain hinged door at open position.
- .10 Supply loose 2 sets of wiring markers for each external wiring connection. Place markers in plastic bag and secured inside panel.
- .11 Use wiring duct for interconnection within panel.
- .12 Direct inter-panel connections not permitted, use terminal blocks.

2.15 GENERATOR
CONTROL PANEL

- .1 Provide a fully solid-state, microprocessor based, generator set control. The control shall provide all operating, monitoring, and control functions for the generator set. The control panel shall provide real-time digital communications to all engine and regulator controls via SAE J1939.
- .2 Generator set control shall be tested and certified to the following environmental conditions:
 - .1 -40°C to +70°C Operating Range
 - .2 100% condensing humidity, 30°C to 60°C
 - .3 IP22 protection for rear of controller; IP55 when installed in control panel
 - .4 5% salt spray, 48 hours, +38°C.
 - .5 Sinusoidal vibration 6G's RMS, 24-1000Hz

- .6 Electromagnetic Capability
(89/336/EEC, 91/368/EEC,
93/44/EEC, 93/68/EEC, BS EN 50081-2,
50082-2)
- .7 Shock: withstand 15G.
- .3 Functional Requirements: The following
functionality shall be integral to the
control panel
 - .1 The control shall include white
backlit graphical display with text
based alarm/event descriptions.
 - .2 The control shall include a minimum
of 4-line data display
 - .3 Generator set overview screen
displaying critical generator set
mechanical and electrical data on a
single screen.
 - .4 Audible horn for alarm and shutdown
with horn silence switch.
 - .5 Standard ISO labeling.
 - .6 Remote start/stop control
 - .7 Local run/off/auto control integral
to system microprocessor
 - .8 Cooldown timer
 - .9 Speed adjust
 - .10 Lamp test
 - .11 Emergency stop push button
 - .12 Voltage adjust
 - .13 Voltage regulator V/Hz slope -
adjustable.
- .4 Provide hinged front door.
- .5 Provide instrument switching and control
as listed in bill of material as indicated
and identified with check mark on drawing
as indicated. Electrical connection of
components shown in solid lines on
drawing.
- .6 Panel layout as indicated on tender
drawings.
- .7 Mount terminal blocks on common mounting
strips for interconnection wiring between
the following:
 - .1 Sub-panel and panel door.
 - .2 Sub-panel and external wiring from

- diesel generator unit circuits.
- .3 Sub-panel and external indicating circuits.
- .4 Sub-panel and secondary circuits of power sub-cubicle.
- .5 Sub-panel and external wiring from transfer panel.

- .8 Provide 1 cm x 4 cm horizontal copper ground bus for whole length of enclosure, and two ground lugs, one at each end.
 - .1 Lug: capable of accepting grounding conductor of range from No.8 AWG to 2/0.

- .9 Terminal blocks: CSA approved, clamp type, serrated for positive grip and of touch, non-brittle unbreakable nylon material; maximum two wires per terminal block.
 - .1 Use factory made terminal block jumpers wherever necessary.

- .10 Provide circuit breaker for equipment protection: use fuses where breakers are applicable.

- .11 Provide top and bottom entry for power and control cable.

- 2.16 ENGINE-GENERATOR CONTROLLER

 - .1 Provide solid state controller complete with control and power modules for sensing, timing, logic and instrumentation to control diesel generator set and automatic transfer system.

 - .2 Controller to include follow features:
 - .1 three position function selection switch - Reset, Off, Auto.
 - .2 Inverse time-voltage sensors for monitoring normal and standby voltage and frequency.
 - .3 Controls necessary to provide system operation.
 - .4 Annunciator lights for following:
 - .1 Overcrank.
 - .2 Low Oil Pressure.
 - .3 High Coolant Temperature.
 - .4 Low Coolant Level.
 - .5 Overspeed.

- .6 Frequency Limit.
 - .7 Voltage Limit.
 - .8 Contactor Failure.
 - .9 Fire Alarm.
 - .10 Fuel tank low fuel level.
 - .11 Fuel tank contamination leak.
 - .12 Engine speed.
- .3 Function selection to operate as follows:
- .1 Reset: to reset the engine-generator set after it has been shut down on protective device.
 - .2 Off: the engine-generator set is shut off.
 - .3 Auto: provides automatic operation of engine generator set and transfer system.
 - .4 Test No. Load: exercises engine generator set without load. In event normal power fails during this mode, transfer system will operate to connect load to set.
 - .5 Test Full Load: simulates normal power failure and runs engine generator set under load. If standby power fails under this mode, transfer system to operate to re-store normal power to load.
- .4 Provide sufficiently sized capacitors on power input terminals to controller to maintain supply voltage, especially on D.C. power input during engine start.
- .5 Controller to include following time delays and adjustments "manufacturer to provide recommendations of these set values, inform the Engineer of any recommended change";
- .1 Crank delay preset at 3-30 sec.
 - .2 Restart preset at 10 sec.
 - .3 Bypass preset at 8 sec.
 - .4 Anticipated fail preset at minimum time setting.
 - .5 Engine start preset at 2 sec.
 - .6 Emergency - normal preset at 2 sec.
 - .7 Cool down preset at 5 min.
- .6 Equip controller with cycle crank

provision to crank engine three times with adjustable rest delay of 3-30 seconds, preset at 5 seconds.

- .7 Equip controller with provision to reset controller and to select Category II operation from remote location. Category II operation to operate standby supply as main source to load and use normal source as standby.
- .8 Provide controller with following features:
 - .1 Front panel programming and display using keypad and to allow changing of parameters, operating configuration, status, and values.
 - .2 Security access code to prevent unauthorized changes.
 - .3 Self diagnostics, continually operating in the background, to ensure proper operation of microprocessor.
 - .4 Non-volatile memory to store operating logic, configuration and set points upon total loss of power.
 - .5 Sufficient internal power to maintain control outputs and operating sequence upon loss of DC supply from working battery.
 - .6 Isolation of inputs and outputs to ensure correct operation and no damage in event of transient voltages.
 - .7 Operation counter for number of diesel starts (non-resettable).
 - .8 Operating temperature 0-50 °C.
 - .9 Equip controller with communications system and uninterruptible power supply for remote monitoring and control.
 - .10 Provide necessary hardware, software and configuration for controller as well as necessary software for central remote monitoring and control. Provide Communications between genset controller and remote monitoring station through Manufacturer recommended network.

.11 Provide meter in the controller to read, but not limited to, the following: L-N voltage , L-L voltage , L-N amperage, PF, totalizer, load in kVA and kW, battery voltage, coolant temperature, oil temperature, oil pressure, and THD.

2.17 SIGNS

- .1 Provide at front top of each panel and on each generator junction box, lamacoid or metal engraved identification nameplate.
.1 Provide nameplates with letter and number identification designation to be given at time of acceptance tests.
- .2 Provide and attach to unit in prominent location, bilingual warning sign.
- .3 Where metric tools are required to service engine-generator unit, provide bilingual warning sign.

2.18 FINISHES

- .1 Clean, finish and paint equipment with smooth and durable finish including the two stairs for both doors at the generator enclosure.
.1 Use grey gloss: paint inside of panel white gloss in accordance with The Master Painters Institute (MPI) schedule of paint colors.
- .2 Provide one half pint can grey gloss paint for touch up.

2.19 WORKMANSHIP

- .1 Manufacture and construct equipment free from blemishes, defects, burrs and sharp edges; accuracy of dimensions and marking of parts and assemblies; thoroughness of welding, brazing, painting and wiring, alignment of parts and tightness of assembly screws and bolts.

2.20 QUALITY CONTROL

- .1 Contractor to coordinate and schedule witness test by 'Engineer of record' prior to shipment of unit. Inform the Engineer ten (10) working days in advance. Include travel cost, hourly rate, and accommodation expenses for one (1) representative.

- .2 General: before acceptance on site, assemble and set up the unit, complete with specified equipment, for tests at the Supplier's plant in accordance with Section 26 32 12 - Diesel Electric Generating Units Appendix B Factory Test.
 - .1 Ensure tests are witnessed by Engineer on mutually agreed date.
 - .2 Provide suitable test area with adjustable loading facilities.
 - .3 Ensure that engine has run in sufficiently prior to load test, test forms completed, system debugged and recorders connected.
- .3 Product examination: complete mechanical and electrical examination to determine compliance with specification and drawings with respect to materials, workmanship, dimensions and marking.
- .4 Non-operational tests and checks: perform following test and checks before starting the unit:
 - .1 Shaft alignment, end float, angular and parallel.
 - .2 Cold resistance of generator windings.
 - .3 Belt tensioning.
 - .4 Equipment grounds.
 - .5 Electrical wiring.
 - .6 All grease lubricating points.
 - .7 Personnel safety guards.
 - .8 Air Cleaner.
 - .9 Coolant.
 - .10 Lubricating oil type and level.
 - .11 Type of fuel.
 - .12 Vibration isolator adjustment.
 - .13 Temperature and pressure sensors.
 - .14 Engine exhaust system.
 - .15 Tools.
 - .16 Spares.
- .5 Operation test and check: on completion of non-operational tests and checks, start unit cold. Provide multi-channel recorder and record following:
 - .1 Time for unit to start and reach settled voltage and frequency.

- .2 Time from initiation of start to full load application, with voltage and frequency settled
- .3 Voltage and frequency transient and steady state limits for full load to no load, 3/4 load to no load, 1/2 load to no load, 1/4 load to no load and vice versa. Measure machine vibration levels under the same load conditions, in accordance with Section 26 32 12 - Diesel Electric Generating Units Appendix B Factory Test.
- .4 Record battery voltage drop during cranking.

- .6 Protection and control demonstration: on completion of operation test and check, demonstrate following:
 - .1 Overheat protection.
 - .2 Low oil pressure protection.
 - .3 Cranking cut out.
 - .4 Overcrank protection (3 tries).
 - .5 Overspeed protection.
 - .6 Under and over frequency.
 - .7 Under and over voltage.
 - .8 Electrical fault protection:
 - .1 Failure to close breaker.
 - .2 Failure to build up voltage.
 - .3 Generator short circuit and overcurrent.
 - .9 All control functions

- .7 Load tests: load test the unit for 24 hour at full rated load 100% in ambient room temperature of 40°C. Take following data at start of load test and every one hour interval thereafter:
 - .1 Frequency.
 - .2 Voltage.
 - .3 Current.
 - .4 Kilowatt.
 - .5 Generator winding temperature.
 - .6 Generator frame temperature.
 - .7 Engine coolant temperature.
 - .8 Oil temperature and pressure.
 - .9 Manifold pressure.
 - .10 Ambient room temperature.
 - .11 Generator cooling air outlet

- temperature.
- .12 Exciter field current and voltage.
- .8 Miscellaneous: provide accurate means for determining fuel and lubricating oil consumption.
- .1 Provide strip chart recorders for monitoring frequency, voltage and load.
- .2 Provide recorder with ability to select speeds to allow accurate measurement of voltage, frequency and time during tests.
- .3 Calibrate recorder by the recorder manufacturer (or designated representative) within three months of factory testing.
- .9 Interpretation of ambient room temperature: consider ambient room temperature as that temperature, which is lowest temperature registered out of a group of three thermometers when placed in engine room as follows:
- .1 One thermometer located on each side of engine block, approximately two-thirds of length of block back from front (radiator) end of block, 900mm out from block and at height equal to height of block.
- .2 Locate third thermometer over end of exciter to unit centre line, approximately 150 mm above top of exciter.
- .3 Take thermometer showing lowest temperature to give true ambient air temperature.
- .4 Adjust temperature to maintain this thermometer at 40°C during heat test.
- .10 Voltage and frequency regulation tests: on completion of load tests take hot resistance reading of generator windings.
- .1 Subject the unit to hot voltage and frequency regulation tests for full load to no load, 3/4 load to no load, 1/2 load to no load, 1/4 load to no load and vice versa.

- .11 Panel performance and functions: check sequence of operation under service conditions.
 - .1 Make provision for supplying and connecting required levels of voltage for primary circuits
 - .2 Test overcurrent relays by impressing current in secondary circuits.

- .12 Additional tests: perform tests, consistent with contract, which Engineer may require to satisfy adequacy and satisfactory operation of the unit.

- .13 In accordance with Section 26 32 12 - Diesel Electric Generating Units Appendix B Factory Test will serve as a guideline for acceptance testing by Engineer.
 - .1 Complete forms with requisite information pertaining to make, model and serial numbers prior to test.

- .14 Record test data on appendix forms, recording charts and manufacturers' test forms to be complete with diagrams and description of test results, deficiencies and corrective action.
 - .1 Ensure test data sheets signed by supplier and Engineer.

- 2.21 SEQUENCE OF OPERATION
 - .1 Upon a loss of normal power, the generator shall initiate the start sequence. Design unit capable of starting, attaining set voltage and frequency limits, and accepting 80% full rated load with voltage and frequency settling to specified steady state bands, in less than 10 seconds for any ambient room temperature between 0°C to 40°C.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Locate generating unit and install as indicated.
- .2 Coordinate fuel supply system as required.
- .3 Coordinate ventilating air duct system as required.
- .4 Coordinate piping of exhaust piping and muffler drain as required.
- .5 Coordinate insulation of exhaust system as required.
- .6 Coordinate insulation of fuel day tank as required.
- .7 Install isolation pads between the generator skid and the building.
- .8 Complete wiring and interconnections as indicated including interconnection to transfer switch.
- .9 Start generating set and test to ensure correct performance of components.
- .10 Division 26 will carry out 4-hour on-site test and demonstrate operation to Owners and the Engineer.

3.2 TESTING GENERAL

- .1 Perform on-site tests in accordance with Section 26 05 01 - Common Work Results Electrical.
- .2 Notify Engineer in writing 10 working days in advance of test date.
- .3 Notify the Project Manager in writing 10 working days in advance of test date.
- .4 Notify the YTG building inspection branch in writing 10 working days in advance of test date.
- .5 Division 26 to provide fuel for testing.
- .6 Submit completed test results to Engineer for each test completed.

3.3 OPERATIONAL TEST

- .1 With the engine in a 'cold start' condition and the standby load at its normal operating level, a power failure shall be simulated by opening all switches or breakers that supply the normal power to the building or facility. The test load shall be that load which is normally served by the facility.
- .2 The operational test shall continue for one hour, after which normal power shall be restored to the building or facility and satisfactory transfer of the load and shutdown of the standby generating set shall be demonstrated.
- .3 The following shall be observed and recorded:
 - .1 The time delay on start;
 - .2 The cranking time until the engine starts and runs;
 - .3 The time required to come up to operating speed;
 - .4 The time required to achieve a steady-state condition with all switches transferred to the emergency position;
 - .5 The voltage, frequency, and amperes at start-up and at any observed change in load;
 - .6 The engine oil pressure, water temperature where applicable, and battery charge rate at 5 min intervals for the first 15 min, and at 15 min intervals thereafter;
 - .7 The time delay on retransfer for each transfer switch; and
 - .8 The time delay on engine cool down and shutdown.

3.4 FULL LOAD TEST

- .1 Following the test prescribed in Clause 26 32 14.3.3, the standby generator set shall be subjected to a 4-hour 100% load test, followed by a 1-hour test at 110% of full load.
- .2 The Contractor shall supply the required supplemental load bank that will be required. Rating to be 110% of rated nameplate as required. Cable leads to be of sufficient length to locate load bank outside and away from the building.
- .3 Full load shall equal the nameplate kW rating of the standby generator set less the applicable derating factors for site conditions. A unity power factor is acceptable for onsite testing, provided that rated load tests at the rated power factor have been performed by the manufacturer of the standby generator set prior to shipment.
- .4 The full load test may be initiated by any method that will start the engine and, immediately upon reaching its rated speed, pick up the full load in one step.
- .5 The data listed in Clause 26 32 14.3.3 shall be recorded at first load acceptance and every 15 min thereafter until the completion of the test period.

3.5 CYCLES CRANK TEST

- .1 The engine shall be prevented from running by utilizing any method recommended by the manufacturer. The control switch shall then be placed in the 'run' position to cause the engine to crank.
- .2 The crank cycle shall be observed and recorded.
- .3 The crank cycle shall be repeated a second time to demonstrate that the batteries have sufficient capacity for a total cranking time of 60s as specified in Clause 26 32 14.2.1.8.2.

- .4 The time required to recharge the batteries or the compressed air shall be demonstrated to meet the requirements of Clauses 26 32 14.2.2.6 as appropriate.
- 3.6 SAFETY SHUTDOWN AND ALARM TEST
- .1 The standby supply shall be tested as recommended by the Manufacturer to ensure that all safety shutdowns and alarms respond as specified in 26 32 14.2.4.13.
- .2 Demonstrate low oil pressure and high engine temperature shutdown device operations without subjecting engine to these excesses.
- 3.7 VENTILATION TEST
- .1 During the generator tests described in the forgoing clauses it shall be demonstrated that the ventilation system will maintain the room temperature with-in the following limits:
- .1 The safe operating temperature of the engine is not to be exceeded.
 - .2 The service room temperature will not exceed 40 degree C.
 - .3 The service room temperature shall be above 10 degree C at all times.
- .2 During the generator tests described in the forgoing clauses it shall be demonstrated that the ventilation system will supply adequate combustion air to the engine.

END OF SECTION

PART 1 - GENERAL

- 1.1 SCOPE OF WORK .1 Supply and install one automatic, single bypass, isolation transfer switch rated 400Amp 120/208VAC as shown on the drawings. Unit footprint as shown on drawings and to be 45"x 25".
- 1.2 RELATED WORK .1 Related work in all the sections.
- .2 Service Entrance Equipment: new service equipment as shown on the drawings and described herein.
- 1.3 REQUIREMENTS OF REGULATORY AUTHORITIES .1 To all Yukon Government policies in force at time of tender.
- 1.4 REFERENCES .1 C22.2 No. 178-latest edition, Automatic Transfer Switches.
- .2 C22.2 No. 34- latest edition, Switchgear Assemblies.
- .3 C282-15, CSA Emergency electrical Power Supply For Buildings.
- 1.5 DESCRIPTION OF SYSTEM .1 Automatic load transfer equipment to:
- .1 Monitor voltages on all phases of utility/standby power supply.
- .2 Monitor for phase loss, reversal and unbalance conditions on utility power supply.
- .3 Initiate cranking of standby generator unit on normal power failure or abnormal voltages on any one-phase below present adjustable limits for the adjusted period of time.
- .4 Transfer load from normal supply to standby unit (when standby unit reaches rated frequency and voltage pre-set adjustable limits).
- .5 Transfer load from standby unit to normal power supply (when normal power restored, confirmed by sensing of voltage on all phases above adjustable pre-set limit for adjustable time period).

- .6 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.
- .7 Load shed to neutral position upon signal (contact closure) from external device.

1.6 SHOP DRAWINGS

- .1 Submit product data in accordance with Section 26 05 01 and as directed by the Engineer.
- .2 Include:
 - .1 Make, model and type.
 - .2 Motor Load.
 - .3 Interrupting capacity.
 - .4 Single line diagram showing controls And relays.

1.7 OPERATIONS AND
MAINTENANCE DATA

- .1 Transfer switch supplier to provide four (4) copies of transfer switch data to be specified in the Operation and Maintenance manual specified in Section 26 05 01. Photocopies not acceptable.
- .2 Manual to include Operation and Maintenance Manual instructions for particular units supplied and not general description of units manufactured by supplier.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- .1 Automatic bypass isolation transfer switch.
- .2 Auxiliary form 'C' contact for exercising the generator. Controller to have failsafe operation: in the event of generator failure, transfer switch to fail to utility position.
- .3 ULC and CSA listed.
- .4 Two three-phase contactors mounted on common frame, in double throw arrangement, mechanically and electronically interlocked.

- .5 Rated 120/208V, 60 Hz, 25kA interrupting capacity for 400 Amps continuous.
- .6 Main contacts: silver-surfaced, protected by arc disruption means, including separate arcing contacts, arc splitters and blow-out coils for load current.
- .7 Switch and relay contacts, coils, springs and control elements accessible for inspection and maintenance from front of panel without removal of switch panel or disconnection of drive linkages and power conductors.
- .8 Provide 3-position selector switch on switch gear enclosure.
- .9 Provide adjustable warm up and cool down times. Preset cool down time to 8 minutes.
- .10 Provide normal and emergency lights, system status lights. All lights to be mounted on cover of switch gear enclosure.
- .11 Provide neutral position delay and auxiliary contacts.
- .12 Provide field adjustable, programmable, neutral transition 0 - 7.5 seconds.
- .13 Provide field adjustable minimum re-transfer time after disturbance has cleared. Preset at 20 minutes.
- .14 Microprocessor controlled.
- .15 Front access to all control boards and contactors.
- .16 Drip proof construction.

2.2 MANUFACTURERS

- .1 Acceptable manufacturers: Cummins/Onan, Cutler Hammer, Siemens, Schneider or approved equal. Submit shop drawings before ordering the equipment.

PART 3 - EXECUTION

- 3.1 INSTALLATION .1 Install transfer switches to approval of local authorities and according to Manufacturer's written instructions.
- 3.2 OPERATION TEST .1 Test operation of transfer switch by simulating power failure and restoration of power.
- .2 Perform other tests as recommended by the manufacturer.
- .3 Submit test results to the Engineer for approval.
- .4 One copy of test results shall be inserted into for each O&M manual.

END OF SECTION

PART 1 - GENERAL

- 1.1 RELATED WORK .1 Common Work Results Electrical Section 26 05 01.
- 1.2 SHOP DRAWINGS AND PRODUCT DATA .1 Submit shop drawings in accordance with Section 26 05 01.
- 1.3 FIXTURE CATALOGUE REFERENCE .1 The fixture catalogue numbers listed may not include all required accessories to provide a complete installation of the fixtures as intended or as required. The description of each fixture should be carefully read prior to quoting the Tender price and shall include all such necessary accessories and characteristics. The Contractor shall be entirely responsible for furnishing all lighting requirements shown on the drawings and as specified.
- 1.4 SCOPE OF WORK .1 Provide lighting fixtures and accessories for all outlets as listed in the fixture schedule, as shown on drawings, and as required to provide a complete lighting system for the new generator enclosure.
- .2 Lighting fixtures shall be structurally well-designed and constructed, using new parts and materials of the highest commercial grade available.
- .3 Ground all lighting equipment to the grounding system.
- .4 Verify all ceiling types and finishes before ordering fixtures and provide fixtures suitable for mounting in or on ceilings being installed in each area, as specified. Where fixture types specified are not suitable for ceiling being installed, obtain written instruction from the Engineer before ordering fixtures.
- .5 Verify all ceiling dimensions before ordering fixtures and provide fixtures suitable for mounting in or on walls being installed in each area, as specified. Where fixture types specified are not

suitable for ceiling/wall dimension being installed, obtain written instruction from the Engineer before ordering fixtures.

- .6 Install seismic restraint on all fixtures. Installation detail as per BC Electrical Contractors Association Seismic Restraint Manual, 1st Edition.
- .7 Provide lighting control as indicated on the drawings, in the fixture schedule and as described in the specifications.

1.5 ALTERNATE FIXTURES

- .1 Fixtures specified indicate the design standard requirements. Fixtures which entirely meet or exceed the design standard, at the discretion of the Engineer and to the Engineer approval, shall be considered as an alternate equivalent. At any time after close of tender the Engineer finds that the alternate equivalent does not perform or provide the electrical, lighting output or architectural equivalence to the specified fixture, the Contractor shall provide and bear all costs to provide the specified fixture.

PART 2 - PRODUCTS

2.1 MOUNTING HARDWARE

- .1 Division 26 to provide all factory hardware as required for suspended fixtures.
- .2 Suspension method as per drawing details and manufacturers requirements and recommendations.
- .3 Provide shop drawings for all mounting hardware.

2.2 LAMPS

- .1 As per fixture schedule and to match fixtures.
- .2 Suspension method as per drawing details and manufacturers requirements and recommendations.

- .3 Provide shop drawings for all mounting hardware.
- 2.3 LUMINAIRES .1 Fixtures as shown on fixture schedule and as specified.
- 2.4 BALLASTS .1 All ballasts shall have power factor correction to 90% or more.
- .2 Ballasts as per fixture schedule and as specified.
- .3 Fluorescent ballasts shall be instant start electronic ballasts, equipped with thermal overload protection and 10% or less Total Harmonic Distortion (>10% THD).
- .4 H.I.D. ballasts to be high power factor, epoxy encased "super quiet" ballast assemblies for all ballast-mounted interior fixtures.
- .5 All ballasts on exterior fixtures to be rated -30° C.
- 2.5 GUARANTEE .1 Replace ballasts that fail or exceed their original noise level rating within 12 months of substantial completion.
- .2 Replace any lamps that fail within 3 months of substantial completion.
- 2.6 LIGHTING CONTROL .1 As shown on the drawings and as specified.
- .2 Reference section 26 09 24 "Lighting Control Devices - low voltage".
- PART 3 - EXECUTION
- 3.1 INSTALLATION .1 Locate and install luminaries as indicated. Luminaire locations in generator enclosure rooms to suit equipment layout; provide fixture hangers and fixture layout to suit the mechanical equipment and to provide a illumination for the complete room.
- .2 Install T-Bar fixtures at locations shown.

- .3 Short section of AC90 where concealed behind architectural finishes is acceptable for single fixture drops. Using AC90 fixture to fixture is not acceptable.
- .4 All fixtures in straight rows, parallel to building lines and as shown on the drawings.
- .5 Make connections to lighting control as specified in section 26 09 24, as detailed in this section and as detailed on the drawings.

3.2 WIRING

- .1 Connect luminaries to lighting circuits as shown and as required.
- .2 Ensure that installed lighting circuit ampacities are suitable for wiring gauge and over-current protection. Where required for voltage drop increase conductor gauge and conduit sizing to suit.
- .3 Provide 2 wire circuits for all fluorescent and all HID lighting; sharing neutral conductors is not acceptable.
- .4 Provide manual lighting control locations as shown and as required.
- .5 Provide automatic lighting control and integration to other control systems as shown and as specified.
- .6 Provide LED Driver for all LED Luminaries and for all fixtures required to be controlled, LED driver to match controls and perform the functions called for in the design

3.3 TESTING

- .1 Provide contractor testing as specified in section 26 05 04 - "Contractor Testing".
- .2 Insert test result data in O+M manuals.

3.4 AS-BUILTS

- .1 All lighting system information shall be provided on the as-built drawings.
- .2 Provide:
 - .1 Equipment locations,
 - .2 Equipment identification for reference to shop drawings,
 - .3 Seismic restraint system,
 - .4 Cabling and wiring information including wire labels and designators,
 - .5 Additional installation detail(s) as required to document the installation.
 - .6 Controls schematic and sequence of operations, provide detailed operation instruction in the O&M manuals, and shall be used for the training purposes.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

- .1 Submit product data in accordance with Section 26 05 01.
- .2 Data to indicate system components, mounting method, source of power and special attachments.

1.2 SCOPE OF WORK

- .1 Provide a complete emergency lighting system including of independent unit emergency battery supplies and emergency lighting fixtures to provide emergency lighting in the event of loss of normal power supply to the Generator enclosure.
- .2 Provide system testing, operator training and system documentation as specified.
- .3 Provide surge suppression receptacles for the electrical room battery packs.

PART 2 - PRODUCTS

2.1 EQUIPMENT GENERAL

- .1 Supply voltage: to match lighting voltage.
- .2 Suspension method as per drawing details and manufacturers requirements and recommendations.
- .3 In an area covered by an emergency lighting device, the emergency lighting must activate upon failure of any lighting circuit to that area. Reference CSA C22.1-15 section 46. Installation to the approval of the Engineer.
- .4 Operating Time:
 - .1 Electrical distribution: 2-hours.
- .5 Battery: sealed, long life, lead acid, maintenance free.
- .6 Charger: fully automatic, current and voltage limited, inverse temperature, solid state, short-circuit protected.

- .7 Battery recharge time of 24-hours.
- .8 The unit shall have a full function auto test and auto diagnostic system. It shall automatically perform 5 minute discharge tests monthly and every 6 months it shall run two 30 minute discharge tests, 24 hours apart. It will test both full battery capacity and recharge capability, as required by the Fire Code. The self-diagnostic circuit shall warn of a problem, including low battery capacity. It shall indicate malfunction by means of status indicator lights which change colour. Battery or charger malfunction is indicated by a red LED. A yellow LED shall indicate lamp circuit malfunction. Two green LEDs illuminated shall indicate proper operating status, and unit in boost charge mode. One green LED on shall indicate normal operation "OK" and unit in float charge mode. All units shall have a manual test switch for testing after maintenance. The system shall also include an automatic 10-minute time delay function to allow for HID lighting to warm-up and restrike.
- .9 Solid-state transfer (up to 9 amp load) Sealed transfer relay for loads of 10 to 30 amps.
- .10 Low voltage disconnect: solid state, operates at 80% battery output voltage.
- .11 Signal lights: solid state, life expectancy 100,000 hr minimum for "AC power ON" and "High Charge".
- .12 Lamp heads: integrated on unit 360 deg. Horizontal and 180 deg. Vertical adjustment. Fixture shall be die cast construction. Lamp type: LED Emergency MR16 style Rated 5 W or 6 W or 9 W; lamp wattage as indicated on the fixture schedule and as shown on the drawings.
- .13 Cabinet: suitable for direct mounting to wall or shelf mounting. Cabinet

constructed of steel with removable front panel for easy access to batteries.

- .14 Finish: Standard colour: white. Baked enamel finish.
- .15 Auxiliary equipment:
 - .1 Test switch
 - .2 Mounting shelf complete with seismic rating.
- .16 Approvals: The complete unit shall be CSA C22.2 No.141 approved.
- .17 Remote Heads:
 - .1 Double adjustable heads as indicated.
 - .2 Wall or ceiling mounted as indicated on the drawings.
 - .3 LED MR16 fixture, die cast construction. Lamp type: LED Emergency Rated MR16 style. Lamp wattage as indicated on the drawings and in the fixture schedule.

2.2 PRODUCT

- .1 Unit Equipment Design Standard: Ready-Lite LDX24-AD- WHT; unit wattage capacity as shown on the drawings.
- .2 Remote Head Design Standard: Ready-Lite LD9 WHT; and as indicated on the fixture schedule. All black where indicated.

2.3 OPERATION

- .1 Emergency lighting shall illuminate on normal utility power failure to the building and on power failure to lighting circuits as shown on the drawings. Provide a complete and operational system.

2.4 WIRING OF REMOTE HEADS AND EXIT LIGHTS

- .1 Wiring methods as per Section 26 05 21 "Wires and Cables 0-1000V".
- .2 Minimum wire size: #10 AWG. Voltage drop not to exceed 5% from battery pack to the furthest remote head in the circuit. Contractor to provide wiring as required for less than 5% voltage drop from battery pack to the furthest remote head.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 Install unit equipment for emergency lighting in accordance with CSA C22.2 No. 141.
- .2 Install conduit and wiring as indicated. Receptacles to which unit equipment is to be connected shall be not less than 2.5 m above the floor, where practicable, and shall be not more than 1.5 m from the location of the unit equipment. This applies to 120 volt equipment. 347 volt equipment shall be permanently connected.
- .3 Unit equipment shall be installed in such a manner that it will be automatically actuated upon failure of the power supply to the normal lighting in the area covered by that unit equipment.
- .4 The emergency lighting equipment shall be supplied by the circuits indicated on the panel schedule. Label circuits supplying emergency lighting units at the panel and install a lock on device on these circuits to prevent accidental interruption of the supply to the units.
- .5 Install unit equipment and remote mounted fixtures as indicated.
- .6 Cut and re-cap cord to remove surplus. (where applicable).
- .7 Direct heads as indicated.
- .8 Mount double remote heads on outlet box such that the two heads will be horizontal with the building lines.
- .9 Charge the batteries and test the system for proper operation. Minimum run time as per requirements of Canadian Building Code.
- .10 The circuit conductors to remote lamps shall be of such size that the voltage

drop from the lamp connections terminals to the lamp load does not exceed 5%.
Comply with CSA C22.2 No. 141.

3.2 TESTS

- .1 Measure and record DC output voltage of each battery pack while AC power is disconnected to battery pack.
- .2 Measure and record DC input voltage to each remote head while AC power is disconnected to associated battery pack.
Note: tests to be performed with all remote heads and exit lights in connected circuit energized - full connected battery load.
- .3 Test results to be submitted in the O+M manuals.
- .4 Test operation of normal utility power to the building failure (main service switch) and each specified power failure to lighting circuits as shown on the drawings. Include test results in O+M manuals.

3.3 AS-BUILTS

- .1 All unit equipment and emergency lighting system information shall be provided on the as-built drawings.
- .2 Provide:
 - .1 Equipment locations,
 - .2 Equipment identification for reference to shop drawings,
 - .3 Seismic restraint system,
 - .4 Cabling and wiring information including wire labels and designators,
 - .5 Additional installation detail(s) as required to document the installation.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL INSTRUCTIONS .1 This section of the specification forms a part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.1 RELATED WORK .1 General Requirements: Section 26 05 01.
.2 Maintenance Manuals: Section 26 05 08.
.3 Contractor Testing: Section 26 05 04.

PART 2 - PRODUCTS

2.1 SCOPE .1 Provide on-site demonstration of all electrical systems to the Owner and the Owner's representatives.
.2 Provide on-site operating instructions of all provided electrical systems to the Owner and the Owner's representatives.
.3 Division 26 to designate a senior experienced individual fully familiar with the project to coordinate and chair each demonstration and instruction session.
.4 Division 26 Contractor shall be responsible for keeping a 'Demonstration and Instructions of Electrical Systems' Record Log. Include Record Log copies of each session in each electrical operations and maintenance manual.
.5 Division 26 Contractor to make allowance in tender price to provide a minimum of two 2-hour sessions for demonstration and training of Owner designated personnel.

PART 3 - EXECUTION

3.1 SITE TOURS .1 Provide a Contractor guided walk-through tour to allow Owner designated personnel to familiarize themselves with all provided electrical systems.

- .2 Coordinate timing of demonstrations and instructions with the Owner to ensure that designated personnel have a minimum of five (5) working days notice prior to conducting each demonstration and instruction session. Follow all additional instructions in the general contract.
- .3 Division 26 to keep a log of all site tour demonstration and instruction sessions conducted. Log shall include tour date, persons and firms represented and names, signatures and comments to those present. Copies of same shall be tabulated and included in electrical operations and maintenance manuals, with demonstration log sheets.
- .4 The Contractor shall provide the on-site services of all sub-trade designates to demonstrate and instruct the Owner's personnel in the specialized systems. The sub-trade designates shall be senior personnel fully trained and competent in the installation and in the operation of the system.

3.2 SYSTEMS INCLUDED
IN ELECTRICAL
DEMONSTRATION AND
INSTRUCTION

- .1 Unless otherwise indicated, provide sessions in Electrical to fully demonstrate and familiarize the owner and the owner's representatives with electrical systems, electrical operations and the general maintenance requirements for all provided electrical systems.
- .2 Operations and Maintenance Manuals shall be used on-site for all demonstration and instruction sessions.
- .3 Where demonstration and instructions sessions show that additional work or information is necessary to provide a complete and useable Maintenance Manual for user and maintenance staff, the Contractor shall provide the necessary changes and resubmit the O+M manuals for Engineer's review prior to the

Contractor's manuals turn over to the
Owner.

- .4 Systems Include:
 - .1 Maintenance Manuals
 - .2 Disconnect switches
 - .3 Surge protection equipment
 - .4 MCC and Panel boards
 - .5 Contactors
 - .6 Lighting fixtures and controls
 - .7 Exit and emergency lighting
 - .8 Fire alarm
 - .9 Data and voice
 - .10 Motors and starters
 - .11 Intrusion detection system
 - .12 Additional systems where directed by
the Engineer.

END OF SECTION

PART 1 - GENERAL

- 1.1 SCOPE .1 To install Level 6 Unshielded Twisted Pair (UTP) cables as detailed in this specification and on the drawings.
- 1.2 RELATED WORK .1 Canadian Standards Association (CSA International)
.1 CSA-C22.2 No. 214-02, Communications Cables (Bi-National standard with UL 444).
.2 CSA-C22.2 No. 232-M1988(latest edition), Optical Fiber Cables.
- .2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)
.1 TIA/EIA-568-B.1-(latest edition), Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.
.2 TIA/EIA-568-B.2-(latest edition), Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.
- .3 TIA/EIA-568-B.3-(latest edition), Optical Fiber Cabling Components Standard.
- .4 TIA/EIA-568-B.3-(latest edition), Optical Fiber Cabling Components Standard.
- .5 TIA TSB-140-(latest edition), Telecommunications Systems Bulletin - Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.
- .6 TIA-598-C-(latest edition), Optical Fiber Cable Color Coding.
- 1.3 GENERAL REQUIREMENTS .1 The workmanship and installation shall meet the minimum standards as set forth in these specifications, as well as the standards listed below:
.1 'Government of Yukon Structured Wiring System Standard Specification and Implementation Criteria in YTG

Buildings' dated February 23, 2000.

- .2 Canadian Electrical Code 2015,
Canadian Standards Association,
EIA/TIA-568A-A, EIA/TIA-569-A,
EIA/TIA-568-B.3, and BICSI-TDM.
- .2 Provide, overall, a data/voice system of
Level 6 outlets as indicated on the
drawings. Exact locations to be determined
by the work station layout with the
approval of the Engineer and the Owner.
All cat6 cables must be FT6 rated.

1.4 PRODUCT DATA

- .1 Submit product data in accordance with
Specification Section 26 05 01.

PART 2 - PRODUCTS

2.1 DATA/VOICE CABLE

- .1 Four pair enhanced level six (Category 6)
FT-6 UTP cable to the approval of the
owner and the Engineer.
- .2 Category 6 cable must meet or exceed all
requirements of TIA/EIA - 568-B.2-1.
- .3 Reference Specification Section 27 07 28.

PART 3 - EXECUTION

3.1 CABLE SYSTEM

- .1 Work stations and/or computer station
outlets are indicated by the tel/data
symbols on the drawings.
- .2 Single data, double data and tel/data
outlets are indicated on the drawing by
specific symbols or a note covering the
entire room.
- .3 Install two - four pair 100 ohm unshielded
twisted pair (UTP) cable to each outlet
shown on the drawings. Cables terminate at
the LAN communications backboard; 1 to
data head end, 1 to telephone head end.
- .4 Leave 3 meters minimum coil of extra cable
at the backboard/head end.
- .5 Leave 1 meter minimum extra cable in the

wall behind the work station outlet.

- .6 Ensure that all runs are straight through, with no splices.
- .7 Pull runs grouped so that cables do not pull against each other.
- .8 Installation to be under the direction of the Owner and the Engineer.
- .9 The maximum cable length for each run shall be limited to 90 meters.
- .10 Install cables in conduit system, cable trough system and in open D-rings for short exposed lengths for transition between conduit system to cable trough.
- .11 Install cables in conduit in finished walls and for vertical runs.

3.2 GROUNDING

- .1 Install all grounding conductors as required by the local authorities and to the approval of the Engineer.
- .2 Reference Specification Section 26 05 28.
- .3 Bond all metal conduits and metal conduit sleeves.

END OF SECTION

PART 1 - GENERAL

- 1.1 SCOPE OF WORK .1 Supply and install expansions to the existing security system, located in the Combined Services Building, for the new generator enclosure. Provide all detection and control devices, cables and conduit. Provide configuration and set up as required for a fully operational system.
- 1.2 RELATED WORK .1 When the intrusion alarm system has been set, activation of any intrusion monitoring device or switch on that intrusion partition shall initiate an intrusion alarm signal to the monitoring station, activate the signaling horn in the alarmed partition. The alarm initiating partition keypad shall annunciate intrusion alarm and shall allow acknowledgement and reset of the intrusion alarm.
- .2 Mechanical alarms shall initiate a separate dedicated alarm signal to the monitoring station without activating signaling horns. The mechanical room keypad shall annunciate mechanical alarms and shall allow acknowledgement and reset of mechanical alarms.
- .3 Heat trace failure alarm monitoring to be provided as part of the Mechanical alarms partition.
- .4 Normal arming/disarming control by alpha numeric keypad(s). System to have adjustable delay in arming/disarming to facilitate exiting/entering the building.
- .5 The building shall be separated into partitions as shown on the drawings. Partition programming shall allow the following:
- .3 Disarming/Arming of the specific intrusion partition at the local partition keypad.
 - .4 Each intrusion partition shall be accessible at the partition's keypad

by an entry code; each partition shall have a different entry code.

.5 The system shall have capacity in programming for master code common to all keypads and shall allow control of all intrusion partition at all keypads.

.6 Disarming/Arming of mechanical alarms at the mechanical room keypad.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Specification Section 26 05 01.

.2 Supply complete manuals and interconnection wiring diagram for all components of the security system to the Engineer at shop drawing submittal.

.3 Contractor to supply copy of electrical permit for security system installation with shop drawing submittal.

.4 Provide copies of security system installation certification (company and staff) with shop drawing submittal.

.5 Security system components shall be the product of one supplier unless otherwise specified or acceptable to the Engineer. Supplier to match existing.

.6 Provide in shop drawing submittal, a complete security system load calculation including all supporting information. Load calculation shall include backup battery and battery charging capacity.

.7 Provide in shop drawing submittal, detailed installation information on door contacts including door and contact type.

1.4 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for the Security Alarm system for incorporation into manual specified in Section 26 05 01.

.2 Include:

.1 Operation and maintenance instructions for complete security

- alarm system to permit effective operation and maintenance. Include all component data and specification sheets.
- .2 System interconnect diagram showing all device connections, device layout and wiring.
 - .3 Technical data: illustrated parts lists with parts catalogue numbers.
 - .4 Copy of approved shop drawings.
 - .5 Device plan showing all devices and device reference numbers.
 - .6 Complete operational description of system operation including arming and disarming procedure. Include operating instructions for post alarm signal reset.
- .3 Complete security system riser diagram, with wire runs and device information.**

PART 2 - PRODUCTS

2.1 CONTROL PANEL

- .1 EXISTING

2.2 KEYPADS

- .1 Keypads shall be surface mounted and capable of fully programming and operating the system. Each keypad shall be assignable to operate the entire system or an individual partition.
- .2 LCD keypads shall be complete with 32 character liquid crystal display (LCD) to provide plain language programming instructions, operating instructions and display of all alarms and supervisory conditions.
- .3 All keypad keys and displays shall be backlit and include backlighting boost to provide extra high key lighting when any key is pressed.
- .4 All keypads shall have LED indicators for Ready, Armed, and Trouble or Status; and shall be equipped with a Piezo Buzzer to provide audible feedback for correct key entries, pre-alert, and trouble

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- .5 Manufacturer to match existing.
- 2.3 DOOR SWITCHES
- .1 Coordinate installation with door installer.
- .2 Provide, at shop drawing submittal, detailed installation information on door contacts including door and contact type. Door contacts shall be securely fastened to prevent false alarms.
- 2.4 HORNS
- .1 Provide horns as indicated and as specified.
- .2 One horn shall be located in each intrusion partition.
- .3 An individual partition horn shall annunciate intrusion in that specific partition only.
- .4 Manufacturer to match existing.
- 2.5 SOFTWARE
- .1 The base panel shall come complete with the software necessary to implement every system feature and to allow for the addition of every expansion or functional module without changes or addition to the basic software.
- 2.6 POWER CALCULATION
- .1 Provide, with the shop drawing submittal a spreadsheet indicating the power consumption of each device and the rating of the power supplies.
- .2 Ensure that the on-board power supply load does not exceed 80% of rated capacity. Any auxiliary power supplies are to be supplied by the system manufacturer.
- 2.7 AS-BUILT PLAN
- .1 Supply and install updated Security System Zone Plan: in glazed frame, black lettering, to approval of the Engineer, minimum size 8½ X 11 inches, to be mounted in close proximity to the security alarm panel. Professional drafting quality or CADD reproduction. Supply one copy for each maintenance manual.

PART 3 - EXECUTION

3.1 INSTALLATION

- .1 All work by qualified security installation technician as defined by the Private Investigators and Security Guard Act, holding an electrical contractor license of Class D or better. Provide copies of security system installation certification with shop drawing submittal.
- .2 Locations shown for motion sensors on plans are suggested only. Contractor shall provide motion detectors in the areas specified on the drawings. Contractor shall be responsible for determining the best mounting location of motion sensors in each area to provide full coverage while minimizing false alarms.
- .3 Install and connect panel, annunciator, motion detector(s), door contact(s), temperature sensor(s) and keypad(s) as shown.
- .4 Provide connections to mechanical system control panel for common mechanical alarms output signal to security system control panel.
- .5 Label all alarm devices with zone number.

3.2 TESTS

- .1 Install all grounding conductors as required by the local authorities and to the approval of the Engineer.
- .2 Reference Specification Section 26 05 28.
- .3 Bond all metal conduits and metal conduit sleeves.

3.3 INSTRUCTION TO STAFF

- .1 Contractor to conduct training for staff to allow system users to understand and perform the following actions:
 - .1 Arming and disarming of system.
 - .2 Alarm programming and control.
 - .3 Other aspects important for the maintaining and full operation of the

intrusion alarm system.

- .2 Reference and provide requirements of Section 26 79 01 'Demonstration and Training'.
- .3 Contractor to produce written documentation indicating date and time of training as well as the names of the personal present. Contractor is to obtain signature of the Owner's representative indicating that satisfactory training has been completed. Include copy in O&M manual.

3.4 AS-BUILT DRAWINGS

- .1 Record all wiring, pipe runs, junction box, device locations and device numbers on the as-built drawings.
- .2 Provide cross reference of device numbers and actual device part numbers.
- .3 As-built drawing to be signed and dated by installation Contractor.
- .4 As-built drawings to be to the approval of the Engineer.
- .5 As-built drawings to indicate the programmed voice dialer telephone numbers.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION OF
SYSTEM

- .1 Supply and install new initiation and notifications zones for the new generator and enclosure.
- .2 System to approval of the local AHJ and applicable CSA and ULC standards and codes.
- .3 Isolation modules as per drawing details and ULC standards.
- .4 The system shall actively poll each addressable device and associated wiring to confirm that the device and associated wiring is functional. Loss of this signal at the Fire Alarm Control Panel shall result in a trouble indication at the FACP, Annunciators, and (where required) the Fire Alarm Monitoring Station.

1.2 SCOPE OF WORK

- .1 Provide all devices and equipment as indicated on the drawings and specified herein as required to provide a complete and operational system. Equipment to include, but is not limited to the following:
 - .1 Trouble system devices.
 - .2 Manual alarm stations, smoke and heat detectors to suit application.
 - .3 Audible and visual signal devices.
 - .4 End-of-line devices.
 - .5 Ancillary devices.
 - .6 Power supply facilities.
 - .7 Annunciators and zone maps.
 - .8 Provide relay units to initiate fan shutdown on alarm.
 - .9 All panel modules.
 - .10 All software programming as required.
 - .11 All wiring and connections.
 - .12 Provision for connection to system monitoring Structural steel mounting base and seismically rated vibration isolation system.
- .2 The contractor is to include in hard copy and in Microsoft Word or Excel format

(disk copy) a list of all fire alarm devices, modules and complete panel description. List to include the device number used in software and as recorded on the as-built drawing. Device numbers to correspond to fire alarm verification device numbers. Include hard and soft copies with the O&M manual submission.

.3 Install new zones and annunciator panel as shown.

1.3 REFERENCES

- .1 Factory Mutual Research Corporation for Property Conservation - Approval Guide.
- .2 CAN/ULC-S524 Installations of Fire Alarm Systems.
- .3 ULC-S525 Audible Signal Appliances, Fire Alarm.
- .4 CAN/ULC-S527 Control Units, Fire Alarm.
- .5 ULC-S528 Manually Actuated Signaling Boxes, Fire Alarm.
- .6 CAN/ULC-S529 Smoke Detectors, Fire Alarm.
- .7 ULC-S530 Heat Actuated Fire Detectors, Fire Alarm.
- .8 CAN/ULC-S531 Smoke Alarms.
- .9 CAN/ULC-S536 Inspection and Testing of Fire Alarm Systems.
- .10 CAN/ULC-S537 Verification of Fire Alarm Systems.
- .11 DFC No. 310(M) Computer Systems.
- .12 DFC No. 410(M) Fire Alarm Systems.
- .13 NBC National Building Code of Canada 2010.
- .14 CSA-B44 safety code for elevators and escalators
- .15 All references to the latest edition of

these standards.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings on accordance with Section 26 05 01.
- .2 Include manufacturer supplied battery load calculations. One copy for O&M manual.
- .3 Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
- .4 Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit.
- .5 Provide with shop drawings the following: Complete manufacturer's literature on system including operating concepts, maintenance procedures, schematics, and block diagram. This literature shall, upon receiving acceptance by the Engineer, be included in the project operating and maintenance manuals.

1.5 OPERATING AND
MAINTENANCE
INSTRUCTIONS

- .1 Provide operating and maintenance instructions in accordance with Section 26 05 08.
- .2 Provide with shop drawings and following: Complete manufacturer's literature on system including operating concepts, maintenance procedures, schematics, and block diagram. This literature shall, upon receiving acceptance by the Engineer, be included in the project operating and maintenance manuals.

1.6 AS-BUILT DRAWINGS

- .1 Show all wiring and connections on the as built drawings.

1.7 WARRANTY / SERVICE

- .1 Contractor responsible for this division is to include, as part of the base tender price, a guarantee stating:
 - .1 System service is to be provided within 24-hours of request for

- service during the warranty period.
- .2 Full warrant on new system to be provided for the duration of 1-year from the date of final acceptance of work.
- .3 During this warranty period the Contractor is to repair and replace all such defective work and other work to the new system which fails or becomes defective during the term of the warranty, provided that such failure is not cause by improper usage or physical damage.
- .4 Should the system installer fail to comply with sub-item 1 above, work will be pre-formed by others at this Contractor's expense.

- .2 Warranty date will commence from the date of the final acceptance of this work.

PART 2 - PRODUCTS

2.1 MATERIALS GENERAL

- .1 Equipment ULC listed and labelled.
- .2 Equipment supplied by a single manufacturer.
- .3 Audible devices to ULC-S528.
- .4 Manual fire alarm stations to ULC-S528.
- .5 Thermal detectors to ULC-530.
- .6 Smoke detectors to CAN/ULC-S529.
- .7 All equipment and components shall be new, and the manufacturer's current model.
- .8 All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

2.2 OPERATION OF

- .1 Stage One operation:

SYSTEM

- .1 In any area of the building, an alarm is caused by actuation of any of the following devices:
 - .1 A manual breakglass stations, or
 - .2 A thermal detector, or
 - .3 A smoke detector, or
 - .4 A sprinkler flow device is activated,
- .2 When the alarm is triggered the following shall occur:
 - .1 Activate signal to sound and activate visual signals throughout the facility.
 - .2 Signaling devices shall be capable of being manually silenced throughout the building from the FAP or the annunciator.
 - .3 Illuminated light to indicate the zone of the alarm initiating device at each annunciator panel.
 - .4 Shut down all mechanical air handling systems.
 - .5 Door hold-open and electromagnetic hold-close devices shall release.
 - .6 Release security systems on all automatic and power assisted doors in the building.
 - .7 Release security systems on all interior corridors electromagnetic lock doors in the building during alarm.
 - .8 Override all hardwired to the multiplexer speakers in the building (Class rooms speaker).
 - .9 Release security systems and all maglocks on all doors in the building during alarm.
 - .10 Activate elevator controls and invoke homing.
 - .11 Provide visual indication at all LCD annunciators.
 - .12 Send alarm signal to remote location (remote location shall be the off-site monitoring station, coordinate with

Owner/YTG).

- 2.3 OPERATION OF FIRE ALARM TROUBLE INDICATION .1 Should any of the following fire alarm system trouble conditions occur:
- .1 An open circuit in extended wiring, or
 - .2 A ground on extended wiring, or
 - .3 Any device or module is removed/disconnected, or
 - .4 Loss of normal power or disconnection of DC back-up, or
 - .5 A supervisory trouble device is activated.
- .2 The system will perform the following:
- .1 Light a trouble light at the panel to indicate the applicable condition and the zone affected, and
 - .2 Sound a trouble buzzer at the fire alarm panel and each annunciator, and
 - .3 Cause coded sets of contacts to change status to enable signaling of the appropriate trouble condition to a remote point.
- 2.4 CONTROL PANEL .1 EXISTING
- 2.5 POWER SUPPLY .1 EXISTING
- 2.6 MANUAL ALARM STATIONS .1 Manual alarm stations: pull lever, break glass, wall-mounted semi-flush or surface type, Single-stage with additional normally open switch to ULC - S528.
- 2.7 FIRE ALARM COMMUNICATOR .1 EXISTING
- 2.8 SMOKE DETECTORS .1 Smoke Detectors: Multi criteria smoke detector (six sensitivity levels, detector to provide the following detection: IR sensing for flames, photo electric smoke detection, thermal detection, CO detection). Base assembly with integral red alarm lamp, and terminals for remote relay alarm lamp as required. Smoke detectors to CAN/ULC - S529.
- .2 Provide duct type smoke detectors as shown. Provide sampling tubes and

enclosures to suit installation. Provide test button and LED indicator.

- .3 Provide beam type detectors as shown. Install to manufacturer recommended standard of acceptance: Notifier FSB series.
- .4 Provide detector bases with additional dry contactors for elevator return function. Supply and install all wiring for operational elevator return.

2.9 THERMAL DETECTORS

- .1 Thermal fire detectors, combination fixed temperature and rate-of-rise, non-restorable fixed temperature element, self-restoring rate-of-rise, fixed temperature 57° C, rate-of-rise 8.3° C per minute as required. Thermal detectors to ULC - 530. Confirm exact type with Engineer prior to ordering.

2.10 VISUAL SIGNAL DEVICES

- .1 Provide visual signal devices in locations as shown on the drawings.
- .2 Visual signals to be synchronized.
- .3 Visual signal devices to ULC - S528.
- .4 Design Standard: NOTIFIER SpectrAlert advanced series.

2.11 FAULT ISOLATION MODULES

- .1 Provide a minimum of two (2) Fault Isolation Modules between each fire alarm zone, as required by the NBC-2010, to protect the rest of the loop.
- .2 Fault Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop.
- .3 Short circuit isolation shall be installed per floor and for every 25 devices within the floor where class A loops are utilized.
- .4 Fault Isolation Modules shall limit the number of modules or detectors that may be rendered inoperative by short circuit

fault on SLC Loop.

- .5 When the short circuit condition is corrected the isolation module should automatically reconnect the isolated section of the SLC Loop.
- .6 LED indicators on the Fault Isolation Module shall provide visual confirmation for a fault condition or a normal operational status.
- .7 Design Standard: NOTIFIER ISO-X Fault Isolator Module.

2.12 CONTROL RELAY
MODULE

- .1 Each relay circuit shall be capable of being activated (change in state) by any initiating device or from any combination of initiating devices.
- .2 The relay module shall provide green ON/OFF LEDs and yellow LEDs (indicates disabled status of the relay).
- .3 The module shall provide a momentary switch per relay circuit that may be used to manually turn the relay ON/OFF or to disable the relay.
- .4 The control relay module shall be provided with removable wiring terminal blocks for ease of installation and service.

2.13 ANNUNCIATOR

- .1 LED and minimum 80 character LCD display complete with system acknowledge, signal silence and system reset buttons, local piezo sounder with alarm trouble resound. LED display to annunciate all Alarm and supervisory zones as per fire alarm riser.
- .2 Standard of acceptance: Notifier LCD 80 with ACM/AEM- 48A annunciators complete with recessed back box at each location. Review site conditions of each annunciator prior to ordering back box.

2.14 DOOR HOLD OPEN

- .1 Fail Safe operation, release door on fire alarm signal.

- .2 Door hold open devices 120V: Notifier FM series.
- 2.15 END-OF-LINE DEVICES
- .1 End-of-line devices to control supervisory current in alarm circuits and signaling circuits, sized to ensure correct current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel.
- .2 Mount EOL devices in separate box with labels indicating zone. For addressable devices on single zone per device end of line may be installed in device box.
- 2.16 AS-BUILT RISER DIAGRAM
- .1 Provide Fire Alarm System Coloured Zone Plan: in glazed frame, black lettering, to approval of the Engineer, minimum size 11" X 17" inches. Professional drafting quality in CADD or equivalent reproduction. One copy for each maintenance manual. One copy directly adjacent to each annunciator panel. One copy directly adjacent to the fire alarm control panel. All fire alarm zone plans to be permanently affixed at each location. Carry the cost of professional drafting for the zone plans in the bid price.

PART 3 - EXECUTION

- 3.1 INSTALLATION
- .1 Installation to CAN/ULC-S524-14.
- .2 Install system in conduit.
- .3 Install new devices to approval of Fire Marshall and applicable CSA and ULC standards and codes.
- .4 All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

- .5 Locate and install remote relay units to control fan shut down.
- .6 Locate alarm panel and annunciator where shown on the drawing.
- .7 Connect devices to zones as shown.
- .8 Install fire alarm riser diagram adjacent to the fire alarm annunciator.

3.2 BRANCH CIRCUIT

- .1 The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 30 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be #12 AWG. The control panel cabinet shall be grounded.
- .2 Branch circuit breaker feeding the fire alarm Backup to the control panel shall be provided with a permanent breaker tie to hold it in the on position.

3.3 WIRING METHODS

- .1 New wiring only, all wiring must be inside EMT conduits.
- .2 Provide all wiring for fire alarm system c/w R-90 crosslink polyethylene insulation as allowed by codes.
- .3 Provide the following sizes:
 - .1 120V A.C.: minimum #12 AWG.
 - .2 Alarm initiating circuits: Non-metallic sheathed ULC listed minimum FT-4 rated, fire alarm circuit cable minimum #18 AWG, minimum 6 conductors installed in conduit.
 - .3 Horn circuit cable: minimum #14 AWG.
 - .4 Annunciator circuits: Non-metallic sheathed ULC listed, fire alarm circuit cable minimum #18 AWG, minimum 6 conductors installed in conduit.
 - .5 Size all horn circuit wiring for maximum 5% voltage drop at maximum load at last device in run.

- .4 Provide Engineer, at time of completion of project, a copy of a drawing showing connections made and numbering of wires.
- .5 Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or back-boxes, except where conduit entry is specified by the Manufacturer

3.4 DEVICE LOCATIONS

- .1 Location of outlets for fire alarm devices shall be approximately as shown on the drawings and as set out in CSA standard ULC S524.
- .2 Location of outlets shall be subject to change, without extra cost, provided information is given prior to installation. No extra amount will be paid, for extra labour and materials, for relocating outlets up to 3m from their original locations, nor will credits be anticipated where relocation up to 3m reduces materials and labour. Other cases will be considered on their individual merits.
- .3 All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.
- .4 Where devices are grouped together (i.e. horns, pull stations and end-of-line resistors), they shall be aligned vertically.
- .5 Locate detectors centrally in rooms and corridors, unless lights and/or mechanical devices interfere. Check relocation with the Engineer before proceeding.
- .6 Mount heat detectors out of line of direct heat and minimum 3m from unit heaters.
- .7 Maintain minimum 600mm clear in all

directions around smoke detectors.

- .8 Where detectors are located on split elevation ceiling locate detectors on high part of ceilings. Locate detectors 900mm from peak in peaked ceiling spaces. Maintain minimum 600mm clear in all directions around detectors. Advise the Engineer, at the rough-in stage, if there are areas of the finished ceiling which do not have adequate smoke detector coverage for the type of detector supplied.
- .9 Promptly advise the Engineer prior to rough-in if the smoke detector locations shown on the drawing do not match the highest part of the ceiling.
- .10 Do not locate smoke detectors within 1 meter of air outlets. Maintain at least 600mm radius clear space on ceiling below and around detectors.

3.5 DEVICE NUMBERING

- .1 Provide device listing including device number, part number and device location on CD-ROM in excel format to Engineer. Copy to be included in O&M manuals. Device number to correspond with device number on verification report. Description of device locations to be coordinated with Owner prior to programming of system.
- .2 Label all devices to indicate device #, loop # and zone #.

3.6 MOUNTING HEIGHTS

- .1 All mounting heights are to the equipment centre line unless otherwise indicated:
 - .1 Manual pull-stations: 1100 mm
 - .2 Annunciator, display or control legend: 1800mm maximum to top.
 - .3 Audible devices: where allowed not less than 2300 mm or 300mm from ceiling to top of horn where ceiling is low.
 - .4 Visual signal devices general: between 2000 - 2400mm to strobe light or 300mm from ceiling to top of strobe where ceiling is low.
 - .5 End-of-the-line resisters: 1700 mm.

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- 3.7 MANUAL ALARM STATIONS
- .1 Locate and install manual alarm stations as indicated and connect to alarm circuit wiring.
 - .2 Ensure that final location is clear of door swings and that device is located in a logical location so that the device is acceptable to evacuating occupants.
- 3.8 AUDIBLE AND VISUAL SIGNAL DEVICES
- .1 Locate and install Horn/strobe devices as indicated and connect to signaling circuits.
- 3.9 SMOKE DETECTORS
- .1 Check smoke detector location as per Specification, drawings and to the approval of the Engineer.
 - .2 Locate and install smoke detectors and connect to alarm circuit wiring.
 - .3 Mount smoke detectors associated with smoke control doors, on the ceiling on either side of the doors; typically 1200mm from door. Do not mount detectors closer than 900mm or farther than 1500mm from the doors.
 - .4 Coordinate onsite for installation of duct type smoke detectors. Install sampling tubes and enclosures to suit installation. Make connections to LED indicator.
- 3.10 TESTS AND COMMISSIONING CONTRACTOR
- .1 Test all initiating, signaling, ancillary, annunciation and control zones.
 - .2 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors transmit alarm to control panel and actuate alarm and ancillary devices.
 - .3 Test each signal device and each signal circuit.
 - .4 When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to

address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

- .5 Check all annunciator panels to ensure zones are shown and actuated correctly. Ensure that each smoke detector and zone is properly annunciated.
- .6 Simulate grounds and breaks on new and renovated alarm and signaling devices and circuits to ensure proper operation of trouble signals.
- .7 Test to include witness of any and all fan shutdown, kitchen equipment under hood fan shut down and magnetic door hold open devices.
- .8 Tests to be carried out by the contractor or the contractor's agent.
- .9 Contractor to submit to Engineer, copy of Contractor provided Test and Commissioning report to Engineer prior to verification. Report to include test documentation for all devices. Report to be in Word or Excel (or equivalent) format.

3.11 TESTS AND
COMMISSIONING
VERIFICATION AGENT

- .1 Verify all zones, signal, alarm, and annunciation which have been installed or modified in any fashion.
- .2 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors transmit alarm to control panel and actuate first stage alarm, general alarm and ancillary devices. Test to be carried out as per CAN/ULC-S524-06.
- .3 Test each signal device and each signal circuit.
- .4 Check the Fire Alarm panel display to ensure zones are shown and actuated correctly. Ensure that each smoke detector is properly annunciated.

- .5 Simulate grounds and breaks on alarm and signaling devices and circuits to ensure proper operation of trouble signals.
- .6 Tests to be carried out by the contractor force and fire alarm technician, in the presence of a representative from the Consulting office. The test shall be complete, submit the test report to the Engineer for approval.
- .7 Verification to include the operation of the monitoring station connections.
- .8 Verification to include a witness of the ventilation system shutdown on fire alarm.
- .9 The Contractor will be responsible for correcting deficiencies in the contractor's work that are reported by the verification agent.
- .10 Fire alarm verifier to certify zone plan drawing. Certification to be included on fire alarm verification report.
- .11 Agent: A team consisting of a professional engineer designer, a licensed electrician installer and verification by a fire alarm company technician (scenario #1 by ULC).
- .12 Contractor to carry the cost of all the parties for the verification in the bid price.

3.12 AS-BUILT DRAWINGS

- .1 Record all wiring, pipe runs and junction box locations on the as built drawings. Include wire gauge, conduit size and junction box size.
- .2 Show all connections and splices on as built drawings.
- .3 As-built drawings to show ladder diagram of operation detailing input signals to programmed output functions for programmed systems.
- .4 As-built drawings to show fire alarm

zoning, device addresses and the location of each field device of the fire alarm system including fault isolation modules, ancillary devices and control panels.

- .5 As-built drawings to show room and corridor numbers (Specific area identification).
- .6 As-built drawings to show wiring diagrams of interconnection of field devices, control units, transponders, annunciators and power supplies external to control units or transponders.
- .7 As-built drawings to show all line voltage branched circuit connections including ancillary connections. Include panel identification, circuit number and over-current size.
- .8 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 ELECTRICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
- .9 Submit completed record drawings with Operating and Maintenance Manuals to Engineer for approval and make corrections as directed.
- .10 Carry the cost of professional drafting on AutoCAD for the As-Built in the bid price.

END OF SECTION
