



Public Works and Government Services Canada

Requisition No: EZ899-151087/A

DRAWINGS & SPECIFICATIONS
for

Creston, BC
Rykerts Port of Entry

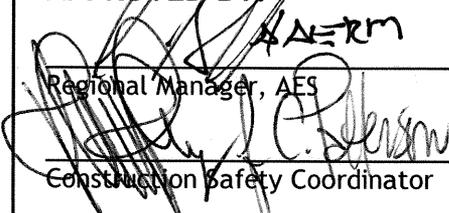
GENERATOR REPLACEMENT

Project No.: R.072471.001
September, 2014

APPROVED BY:

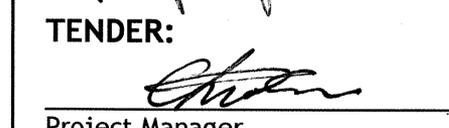

Regional Manager, AES

Oct. 1 / 2014.
Date


Construction Safety Coordinator

2014-09-18
Date

TENDER:


Project Manager

Sep. 18, 2014
Date

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Creston, BC
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A circular professional seal for M. Dezfouli, a Professional Engineer in the Province of British Columbia. The seal includes the name, registration number #31916, and the title 'PROFESSIONAL ENGINEER'. A handwritten signature is written over the seal, and the date 'Sept. 22 / 2014' is written below it.

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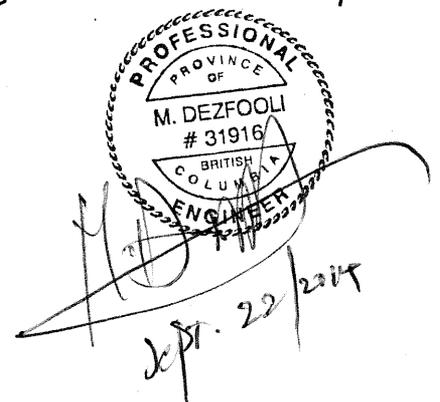
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DRAWINGS

Bound Separately

E1	EXISTING SITE PLAN, NEW SITE PLAN, AND DETAILS
E2	EXISTING ELECTRICAL DISTRIBUTION DIAGRAM AND NEW ELECTRICAL DISTRIBUTION DIAGRAM
E3	STORAGE/ELECTRICAL ROOM PLAN – 2 nd FLOOR, PARTIAL MAIN FLOOR PLAN, NEW SATELLITE DISH MTG. BRACKET DETAIL & PHOTOS

END OF INDEX



1 GENERAL

1.1 CODES

- .1 Perform work to CURRENT Codes, Construction Standards and Bylaws, including Amendments up to the TENDER closing date.

1.2 DESCRIPTION OF WORK

- .1 Work under this Contract is to take place at CBSA Rykerts Port of Entry near Creston, B.C. as shown on electrical drawings.
- .2 Work to be performed under this Contract includes, but is not limited to, the following items covered further in the Contract documents:
 - .1 Replace the emergency power generator and transfer switch.
 - .2 Revise the power distribution.
 - .3 Provide commissionaire Services.
 - .4 Supply and install miscellaneous items as shown on Drawings E1 to E3.
 - .5 Excavation and backfill.
 - .6 Removal of existing generator, generator shed and concrete pad.
- .3 "Green" requirements:
 - .1 Use materials/products containing highest percentage of recycled and recovered materials practicable – consistent with maintaining cost effective satisfactory levels of completion.
 - .2 Adhere to waste reduction requirement for reuse or recycling of waste materials, thus diverting materials from landfill.

1.3 CONTRACT DOCUMENTS

- .1 The Contract documents, drawings and specifications are intended to complement each other, and to provide for and include everything necessary for the completion of the Work.
- .2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the Work.

1.4 DIVISION OF SPECIFICATIONS

- .1 The specifications are subdivided in accordance with the current 6-digit National Master Specifications System.
- .2 A division may consist of the Work of more than 1 subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the Work rests solely with the Contractor.
- .3 In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.

1.5 TIME OF COMPLETION

- .1 Complete the project, facility ready for use within four (4) months after Contract Award.

1.6 HOURS OF WORK

- .1 Schedule the power interruptions and cutovers from 1 a.m. to 4 a.m.

1.7 WORK SCHEDULE

- .1 Carry on Work as follows:
 - .1 Within 10 working days after Contract Award, provide a schedule showing anticipated progress stages and final completion of the work within the time period required by the Contract documents. Indicate the following:
 - .1 Submission of shop drawings, product data, MSDS sheets and samples.
 - .2 Commencement and completion of work of each section of the specifications or trade for each phase as outlined.
 - .3 Final completion date within the time period required by the Contract documents.
 - .2 Do not change approved Schedule – without notifying Departmental Representative.
 - .3 Interim reviews of work progress based on work schedule will be conducted as decided by Departmental Representative and schedule updated by Contractor in conjunction with and to approval of Departmental Representative.

1.8 COST BREAKDOWN

- .1 Before submitting the first progress claim, submit a breakdown of the Contract lump sum prices in detail as directed by the Department Representative and aggregating Contract price. After approval by Departmental Representative cost breakdown will be used as a basis for progress payments.

1.9 CODES, BYLAWS, STANDARDS

- .1 Perform work in accordance with the National Building Code of Canada (NBC) 2010 and other indicated Codes, 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.

1.10 DOCUMENTS REQUIRED

- .1 Maintain 1 copy 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 2010.
- .13 Current construction standards of workmanship listed in technical Sections.
- .14 Project Safety Plan.

1.11 REGULATORY REQUIREMENTS

- .1 Obtain and pay for – Building and electrical permits, Certificates, Licenses and other permits required by regulatory municipal, provincial or federal authorities to complete the work.
- .2 Provide inspection authorities with plans and information required for issue of acceptance certificates.
- .3 Furnish inspection certificates in evidence that the work installed conforms to the requirements of the authority having jurisdiction.

1.12 CONTRACTOR'S USE OF SITE

- .1 Use of site:
 - .1 Exclusive and complete for execution of work as defined within area as indicated on drawings E1, E2 and E3.
 - .2 Assume responsibility for assigned premises for performance of this work.
 - .3 Be responsible for coordination of all work activities on site, including the work of other contractors engaged by the Departmental Representative.
- .2 Do not unreasonably encumber site with material or equipment.
- .3 Request the storage / work space and obtain approval prior to occupying the space.

1.13 EXAMINATION

- .1 Examine site and be familiar and conversant with existing conditions likely to affect work.
- .2 Provide photographs of surrounding properties, objects and structures liable to

be damaged or be the subject of subsequent claims.

1.14 EXISTING SERVICES

- .1 Where work involves breaking into or connecting to existing services, carry out work at times directed by the authorities having jurisdiction.
- .2 Contractor shall repair all damaged services due to this construction.

1.15 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space, and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain his approval for actual location.
- .4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by the Departmental Representative and/or as specified.

1.16 CUTTING AND PATCHING

- .1 Cut existing surfaces as required to accommodate new work.
- .2 Remove items so shown or specified.
- .3 Do not cut, bore, or sleeve load-bearing members unless noted otherwise.
- .4 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.
- .5 Fit work airtight to pipes, sleeves, ducts and conduits.
- .6 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture.
- .7 Making good is defined as matching construction and finishing materials and the adjacent surfaces such that there is no visible difference between existing and new surfaces when viewed from 1.5 metres in ambient light, and includes painting the whole surface to the next change in plane.

1.17 SETTING OUT OF WORK

- .1 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .2 Provide devices needs to lay out and construct work.
- .3 Supply such devices as templates required to facilitate Departmental Representative's inspection of work.

1.18 ACCEPTANCE OF SUBTRADES

- .1 Each trade shall examine surfaces prepared by others and job conditions which may affect his work, and shall report defects to Departmental Representative. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

1.19 QUALITY OF WORK

- .1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.
- .2 The workmanship, erection methods and procedures to meet minimum standards set out in the National Building Code of Canada 2010 and Construction Standards.
- .3 In cases of dispute, decisions as to standard or quality of work rest solely with the Department Representative, whose decision is final.

1.20 WORKS COORDINATION

- .1 Coordinate work of subtrades:
 - .1 Designate one person to be responsible for review of contract documents and shop drawings and managing coordination of Work.
- .2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.
 - .1 Provide each subcontractor with complete plans and specifications for Contract, to assist them in planning and carrying out their respective work.
 - .2 Develop coordination drawings when required, illustrating potential

interference between work of various trades and distribute to affected parties.

- .1 Pay particularly close attention to overhead work and within or near to building structural elements.
 - .2 Identify on coordination drawings, building elements, services lines, rough-in points and indicate location services entrance to site.
 - .3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.
 - .4 Publish minutes of each meeting.
 - .5 Plan and coordinate work in such a way to minimize quantity of service line offsets.
 - .6 Submit copy of coordination drawings and meeting minutes to Departmental Representative for information purposes.
- .3 Submit shop drawings and order of prefabricated equipment or rebuilt components only after coordination meeting for such items has taken place.
- .4 Work cooperation:
- .1 Ensure cooperation between trades in order to facilitate general progress of Work and avoid situations of spatial interference.
 - .2 Ensure that each trade provides all other trades reasonable opportunity for completion of Work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work.
 - .3 Ensure disputes between subcontractors are resolved.
- .5 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor's failure to coordinate Work.
- .6 Maintain efficient and continuous supervision.

1.21 APPROVAL OF SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 In accordance with Section 01 33 00, submit the requested drawings, product data, MSDS sheets and samples indicated in each of the technical Sections.
- .2 Allow sufficient time (2 weeks) for each of the following:

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GENERAL INSTRUCTIONS

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- .1 Review of product data.
- .2 Approval of shop drawings.
- .3 Review of re-submission.

1.22 EXISTING SERVICE INTERRUPTIONS

- .1 Contractor shall request and receive a written approval prior to any existing service interruptions.

1.23 SECURITY ESCORT

- .1 General requirements
 - .1 Security escort is required when accessing any space inside of buildings on CBSA property. The contractor's personnel must be within direct line of site of a security escort at all times when working inside the building.
 - .2 Security escort shall be provided by Commissionaires BC.
 - .3 Public Works and Government Services Canada (Canada) shall set up direct contract with Commissionaires BC. The Contractor is responsible for costs of all security escorts and shall reimburse Canada these costs throughout the project.
 - .4 The Contractor shall book Commissionaires directly with Commissionaires BC. Book as many Commissionaires as required to satisfy the requirements of (.1) above. Notify the Departmental Representative all booking and cancellations.
 - .5 Book Commissionaires in advance as much as possible. Canada shall not be responsible if Commissionaires are not available due to late booking. A minimum callout of 4 hours is required. Any cancellations shall be made 24 hours in advance.
- .2 Contract Rate
 - .1 Contact Commissionaires BC or visit <http://www.commissinaires.bc.ca> for information related to charge out hourly rates for regular federal work by Commissionaires BC applicable to the location of this project.

1.24 PROJECT MEETINGS

- .1 Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

1.25 TESTING AND INSPECTIONS

- .1 Particular requirements for inspection and testing to be carried out by testing service or laboratory approved by the Departmental Representative are specified under various sections.
- .2 The Contractor will appoint and pay for the services of testing agency or testing laboratory as specified, and where required for the following:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Testing, adjustment and balancing of electrical equipment and systems.
- .3 Where tests or inspections by designated testing laboratory reveal work is not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as the Departmental Representative may require to verify acceptability of corrected work.
- .4 Contractor shall furnish labour and facilities to:
 - .1 Notify Departmental Representative in advance of planned testing.
- .5 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .6 Pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.
- .7 The Departmental Representative may require, and pay for, additional inspection and testing services not included in Paragraph 1.25.1.
- .8 Provide Department Representative with 2 copies of testing laboratory reports as soon as they are available.
- .9 Ensure that work to be inspected is complete at the time of inspection and in accordance with the Contract documents. Additional inspections required due to the incomplete work or poorly executed work, as judged by the Departmental Representative, as well as additional design or remedial work caused by deviations from these drawings, may be charged to the Contractor.
- .10 A minimum 48 hours notice shall be given to the Departmental Representative by the Contractor for any inspection to be carried out.

1.26 AS-BUILT DOCUMENTS

- .1 The Departmental Representative will provide 2 sets of drawings, 2 sets of specifications, 2 copies of the original AutoCAD 2010 files and sufficient photos in CD to show the as-built conditions for "as-built" purposes.
- .2 As work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings and shop drawings as changes occur.

1.27 CLEANING

- .1 Daily conduct cleaning and disposal operations. Comply with local ordinances and anti-pollution laws.
- .2 Ensure cleanup of the work areas each day after completion of work.
- .3 On completion of the work, remove all temporary buildings and offices, site sign, all debris, rubbish, etc., clean-up site and leave same neat and tidy to the satisfaction of the Departmental Representative.
- .4 In preparation for interim and final inspections:
 - .1 Examine all sight-exposed interior and exterior surfaced and concealed spaces.
 - .2 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces, including glass and other polished surfaces.
- .5 Use cleaning materials and methods in accordance with instructions of the manufacturer of the surface to be cleaned.

1.28 DUST CONTROL

- .1 Provide temporary dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of work and public. Maintain and relocate protection until such work is complete.

1.29 ENVIRONMENTAL PROTECTION

- .1 Prevent extraneous materials from contaminating air beyond construction area, by providing temporary enclosures during work.
- .2 Do not dispose of waste or volatile materials into water courses, storm or sanitary sewers.

- .3 Ensure proper disposal procedures in accordance with all applicable territorial regulations.

1.30 MATERIALS DISPOSAL

- .1 All material designated to be removed will become the property of the Contractor and will be disposed of in an environmentally acceptable manner so that they neither become a menace to marine navigation nor a nuisance to the public on adjacent or any other property.
- .2 Unless otherwise specified, all existing material to be replaced or renewed will be disposed of in accordance with .1 above.

1.31 SYSTEM OF MEASUREMENT

- .1 The metric system of measurement (SI) will be employed on this Contract.

1.32 FAMILIARIZATION WITH SITE

- .1 Before submitting tender, bidders are required to visit site – as indicated in tender documents and become familiar with all conditions likely to affect the cost of the work.

1.33 SUBMISSION OF TENDER

- .1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and inspected the site, and is fully conversant with all conditions.

2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 11 55 General Instructions.
- .2 Section 01 77 00 Closeout Procedures

1.2 ADMINISTRATIVE

- .1 Submit to Department Representative submittals listed for review. Submit promptly and in orderly sequence 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 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Review submittals prior to submission to Departmental Representative. 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.
- .5 Notify Departmental Representative in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .6 Verify field measurements and affected adjacent Work are coordinated.
- .7 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative review of submittals.
- .8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .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 Submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of British Columbia, Canada where required as indicated in the specification Sections and/or drawings.

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SUBMITTAL PROCEDURES

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- .3 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.
 - .4 Allow 14 days for Departmental Representative's review of each submission.
 - .5 Adjustments made on shop drawings by Department Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
 - .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Department Representative in writing of any revisions other than those requested.
 - .7 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.
 - .8 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.
 - .9 After Departmental Representative review, distribute copies.
 - .10 Submit one reproducible transparency of shop drawings for each requirement requested in specification Sections and as Department Representative may reasonably request.
 - .11 Submit the number of copies of shop drawings and/or product data sheets or brochures for requirements request in specification Sections which contractor requires for distribution plus copies which will be retained by the Departmental Representative and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
 - .12 Submit electronic copy of test reports for requirements requested in specification Section sand as requested Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 1 year of date of contract award for project.

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- .13 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
 - .14 Submit electronic copy of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
 - .15 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Department Representative.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
 - .16 Submit electronic copy of Operation and Maintenance Data for requirements requested in specifications Sections and as requested by Department Representative.
 - .17 Delete information not applicable to project.
 - .18 Supplement standard information to provide details applicable to project.
 - .19 If upon review by Departmental Representative, 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.
 - .20 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that PWGSC approves detail design inherent

in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting all requirements of construction and Contract Documents.

- .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of all sub-trades.

1.4 SAMPLES

- .1 Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Department Representative site office.
- .3 Notify Departmental Representative 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 Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative 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.

1.5 PROGRESS PHOTOGRAPHS

- .1 Submit progress photographs.

1.6 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

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SUBMITTAL PROCEDURES

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2 PRODUCTS

2.1 NOT USED

.1 Not Used.

3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 GENERAL

1.1 REFERENCES

- .1 Government of Canada.
 - .1 Canada Labour Code - Part II.
 - .2 Canada Occupational Health and Safety Regulations.
- .2 National Building Code of Canada (NBC):
 - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 Canadian Standards Association (CSA) as amended:
 - .1 CSA Z797-2009 Code of Practice for Access Scaffold.
 - .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes.
 - .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures.
- .4 Fire Protection Engineering Services, HRSDC:
 - .1 FCC No. 301, Standard for Construction Operations.
 - .2 FCC No. 302, Standard for Welding and Cutting.
- .5 American National Standards Institute (ANSI):
 - .1 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.
- .6 Province of British Columbia::
 - .1 Workers Compensation Act Part 3-Occupational Health and Safety.
 - .2 Occupational Health and Safety Regulation.

1.2 RELATED SECTIONS

- .1 Refer to the following current NMS sections as required:
 - .1 Submittals procedures: Section 01 33 00

1.3 WORKERS' COMPENSATION BOARD COVERAGE

- .1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.
- .2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 COMPLIANCE WITH REGULATIONS

- .1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.
- .2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 SUBMITTALS

- .1 Submit to Departmental Representative submittals listed for review in accordance with Section 013300.
- .2 Work affected by submittal shall not proceed until review is complete.
- .3 Submit the following:
 - .1 Health and Safety Plan.
 - .2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.
 - .3 Copies of incident and accident reports.
 - .4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
 - .5 Emergency Procedures.
- .4 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 5 days after receipt of the plan. Revise the

- plan as appropriate and resubmit to Departmental Representative.
- .5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.
 - .6 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
 - .1 Be construed to imply approval by the Departmental Representative.
 - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
 - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 RESPONSIBILITY

- .1 Assume responsibility as the Prime Contractor for work under this contract.
- .2 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable Federal, Provincial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.7 HEALTH AND SAFETY COORDINATOR

- .1 The Health and Safety Coordinator must:
 - .1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.
 - .2 Be responsible for implementing, daily enforcing, and monitoring the sitespecific Health and Safety Plan.
 - .3 Be on site during execution of work.

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1.8 GENERAL CONDITIONS

- .1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
- .2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
 - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.

1.9 PROJECT/SITE CONDITIONS

- .1 Work at site will involve contact with:
 - .1 Rod Robinson, 250-424-5513.
- .2 Provide electrical lock-out procedures when working with electricity and safety harness when working at height.

1.10 REGULATORY REQUIREMENTS

- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.
- .2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

1.11 WORK PERMITS

- .1 Obtain specialty permit[s] related to project before start of work.

1.12 FILING OF NOTICE

- .1 The General Contractor is to file Notice of Project with Provincial authorities prior to beginning of work.
- .2 Provide copies of all notices to the Departmental Representative.

1.13 HEALTH AND SAFETY PLAN

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
- .2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:
 - .1 Primary requirements:
 - .1 Contractor's safety policy.
 - .2 Identification of applicable compliance obligations.
 - .3 Definition of responsibilities for project safety/organization chart for project.
 - .4 General safety rules for project.
 - .5 Job-specific safe work, procedures.
 - .6 Inspection policy and procedures.
 - .7 Incident reporting and investigation policy and procedures.
 - .8 Occupational Health and Safety Committee/Representative procedures.
 - .9 Occupational Health and Safety meetings.
 - .10 Occupational Health and Safety communications and record keeping procedures.
 - .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
 - .3 List hazardous materials to be brought on site as required by work.
 - .4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
 - .5 Identify personal protective equipment (PPE) to be used by workers.
 - .6 Identify personnel and alternates responsible for site safety and health.

- .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.14 EMERGENCY PROCEDURES

- .1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
 - .1 Designated personnel from own company.
 - .2 Regulatory agencies applicable to work and as per legislated regulations.
 - .3 Local emergency resources.
 - .4 Departmental Representative [site staff].
- .2 Include the following provisions in the emergency procedures:
 - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
 - .2 Evacuate all workers safely.
 - .3 Check and confirm the safe evacuation of all workers.
 - .4 Notify the fire department or other emergency responders.
 - .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
 - .6 Notify Departmental Representative [site staff].

- .3 Provide written rescue/evacuation procedures as required for, but not limited to:
 - .1 Work at high angles.
 - .2 Work in confined spaces or where there is a risk of entrapment.
 - .3 Work with hazardous substances.
 - .4 Underground work.
 - .5 Work on, over, under and adjacent to water.
 - .6 Workplaces where there are persons who require physical assistance to be moved.
- .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
- .5 At least once each year, emergency drills must be held to ensure awareness and effectiveness of emergency exit routes and procedures, and a record of the drills must be kept.
- .6 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

1.15 HAZARDOUS PRODUCTS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
 - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00.
 - .2 In conjunction with Departmental Representative schedule to carry out work during "off hours" when tenants have left the building.

1.16 ELECTRICAL SAFETY REQUIREMENTS

- .1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.

- .1 Before undertaking any work, coordinate required energizing and deenergizing of new and existing circuits with Departmental Representative.
- .2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.17 ELECTRICAL LOCKOUT

- .1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.
- .2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.
- .3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

1.18 OVERLOADING

- .1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

1.19 SCAFFOLDING

- .1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2009 and B.C. Occupational Health and Safety Regulations.

1.20 FIRE SAFETY AND HOT WORK

- .1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.
- .2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

1.21 FIRE SAFETY REQUIREMENTS

- .1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and

- remove from site on a daily basis.
- .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.22 FIRE PROTECTION AND ALARM SYSTEM

- .1 Fire protection and alarm systems shall not be:
 - .1 Obstructed.
 - .2 Shut off.
 - .3 Left inactive at the end of a working day or shift.
- .2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.
- .3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

1.23 UNFORESEEN HAZARDS

- .1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing.

1.24 POSTED DOCUMENTS

- .1 Post legible versions of the following documents on site:
 - .1 Health and Safety Plan.
 - .2 Sequence of work.
 - .3 Emergency procedures.
 - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
 - .5 Notice of Project.
 - .6 Floor plans or site plans.
 - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.

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- .8 Workplace Hazardous Materials Information System (WHMIS) documents.
- .9 Material Safety Data Sheets (MSDS).
- .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
- .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.25 MEETINGS

- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.26 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.
- .3 The Departmental Representative may issue a "stop work order" if noncompliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order".

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Progressive cleaning.
- .2 Final cleaning.

1.2 PRECEDENCE

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.3 RELATED SECTIONS

- .1 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2 Section 01 77 00 - Closeout Procedures.

1.4 REFERENCE STANDARDS

- .1 Canadian Construction Documents Committee (CCDC)
 - .1 CCDC 2-2008, Stipulated Price Contract.

1.5 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.
- .2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Department Representative. Do not burn waste materials on site, unless approved by Department Representative.
- .3 Clear snow and ice from access to building, remove from site.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site 1 container for collection of waste materials and debris.
- .6 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .7 Remove waste material and debris from site at end of each working day.

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CLEANING

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- .8 Dispose of waste materials and debris off site.
- .9 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
- .10 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .11 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .12 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .13 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.6 FINAL CLEANING

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and equipment.

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- .8 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .9 Remove dirt and other disfiguration from exterior surfaces.
- .10 Sweep and wash clean paved areas.
- .11 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1 GENERAL

1.1 SECTION INCLUDES

- .1 Text, schedules and procedures for systematic Waste Management Program for construction, deconstruction, demolition, and renovation projects, including:
 - .1 Diversion of Materials.
 - .2 Waste Audit (WA).
 - .3 Waste Reduction Workplan (WRW).
 - .4 Demolition Waste Audit (DWA).
 - .5 Materials Source Separation Program (MSSP).

1.2 RELATED SECTIONS

- .1 Section 01 33 00 Submittals Procedures.

1.3 REFERENCES

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.4 DEFINITIONS

- .1 Demolition Waste Audit (DWA): Relates to actual waste generated from project.
- .2 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .3 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .4 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .5 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .6 Separate Condition: Refers to waste sorted into individual types.

- .7 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.
- .8 Waste Audit (WA): Detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill.
- .9 Waste Reduction Workplan (WRW): Written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.

1.5 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
 - .1 Waste Audit.
 - .2 Waste Reduction Workplan.
 - .3 Material Source Separation Plan.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
 - .1 Submit 2 copies of completed Waste Audit (WA).
 - .2 Submit 2 copies of completed Waste Reduction Workplan (WRW).
 - .3 Submit 2 copies of Materials Source Separation Program (MSSP) description.
- .3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.
 - .1 Failure to submit could result in hold back of final payment.
 - .2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled or disposed of.
 - .3 For each material reused, sold or recycled from project, include amount and the destination.

- .4 For each material land filled or incinerated from project, include amount in tonnes of material and identity of landfill, incinerator or transfer station.

1.7 WASTE AUDIT (WA)

- .1 Conduct WA prior to project start-up.
- .2 Prepare WA.
- .3 Record, on WA, extent to which materials or products used consist of recycled or reused materials or products.

1.8 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare WRW prior to project start-up
- .2 WRW should include but not limited to:
 - .1 Destination of materials listed.
 - .2 Deconstruction/disassembly techniques and sequencing.
 - .3 Schedule for deconstruction/disassembly.
 - .4 Location.
 - .5 Security.
 - .6 Protection.
 - .7 Clear labelling of storage areas.
 - .8 Details on materials handling and removal procedures.
 - .9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.
- .3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .4 Describe management of waste.

1.9 DEMOLITION WASTE AUDIT (DWA)

- .1 Prepare DWA prior to project start-up.
- .2 Complete DWA.
- .3 Provide inventory of quantities of materials to be salvaged for reuse, recycling, or disposal.

1.10 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials.
- .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated materials in areas which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to approved and authorized recycling facility.
- .8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.
 - .1 Ship material to site operating under Certificate of Approval.
 - .2 Materials must be immediately separated into required categories for reuse or recycling.

1.11 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Unless specified otherwise, materials for removal become Contractor's property.

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CONSTRUCTION/DEMOLITION WASTE MANAGEMENT AND DISPOSAL

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- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Protect surface drainage, mechanical and electrical from damage and blockage.
- .7 Separate and store materials produced during dismantling of structures in designated areas.
- .8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.
 - .3 Provide waybills for separated materials.

1.12 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
- .4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

1.13 USE OF SITE AND FACILITIES

- .1 Execute Work with least possible interference or disturbance to normal use of premises.
- .2 Maintain security measures established by existing facility.

1.14 SCHEDULING

- .1 Coordinate Work with other activities at site to ensure timely and orderly progress of Work.

2 PRODUCTS

2.1 NOT USED

- .1 Not Used

3 EXECUTION

3.1 APPLICATION

- .1 Do Work in compliance with WRW.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

END OF SECTION

1 GENERAL

1.1 SECTIONS INCLUDES

- .1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 PRECEDENCE

- .1 For Federal Government projects, Division 1 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.3 INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an Inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative's Inspection.
- .2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested and are fully operational.
 - .4 Certificates required by Electrical Inspector have been submitted.
 - .5 Operation of systems have been demonstrated to Owner's personnel.
 - .6 Work is complete and ready for Final Inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Department Representative complete outstanding items and request reinspection.

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CLOSEOUT PROCEDURES

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2 PRODUCTS

2.1 NOT USED

.1 Not Used.

3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

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CAST-IN-PLACE
CONCRETE
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1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 74 19 Construction/Demolition Waste Management and Disposal.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 1751-[99], Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.24-[M90], Multicomponent, Chemical-Curing Sealing Compound.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1-[00], Concrete Materials and Methods of Concrete Construction.
 - .2 CAN/CSA-A23.2-[00], Methods of Test for Concrete.
 - .3 CAN/CSA-A3000-[98]-A5-[98], Portland Cement.
 - .4 CAN/CSA-G30.5-[M1983(R1998)], Welded Steel Wire Fabric for Concrete Reinforcement.
 - .5 CAN/CSA-G30.18-[M92(R1998)], Billet-Steel Bars for Concrete Reinforcement.

1.3 SUBMITTALS

- .1 Shop Drawings
 - .1 Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and all necessary details of reinforcing.
 - .2 Submit drawings showing formwork and falsework design to: CAN/CSAA23.1.

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- .3 Drawings to bear stamp and signature of qualified professional engineer registered or licensed in Province of British Columbia, Canada.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Ensure emptied containers are sealed and stored safely.
- .5 Use trigger operated spray nozzles for water hoses.
- .6 Designate cleaning area for tools to limit water use and runoff.

2 PRODUCTS

2.1 MATERIALS

- .1 Portland cement: to CAN/CSA-A3000-A5, Type 10.
- .2 Other concrete materials: to CAN/CSA-A23.1.

2.2 MIXES

- .1 Proportion concrete in accordance with CAN/CSA-A23.1.
- .2 Minimum compressive strength at 28 MPa as specified by Departmental Representative.
- .3 Nominal maximum size of coarse aggregate: to CAN/CSA-A23.1.
- .4 Slump: to CAN/CSA-A23.1.
- .5 Air content: concrete to contain purposely entrained air in accordance with CAN/CSA-A23.1, Table 10.
- .6 Admixtures: to CAN/CSA-A23.1.

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CAST-IN-PLACE CONCRETE

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3 EXECUTION

3.1 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1.

3.2 INSERTS

- .1 Cast in sleeves, ties, slots, anchors, reinforcement, frames, conduit, bolts, waterstops, joint fillers and other inserts required to be built-in. Sleeves and openings greater than 100 mm x 100 mm not indicated, must be approved by Departmental Representative.

3.3 SITE TOLERANCES

- .1 Concrete floor slab finishing tolerance in accordance with CAN/CSA-A23.1.

3.4 FIELD QUALITY CONTROL

- .1 Concrete testing: to CAN/CAS-A23.2 by testing laboratory designed and paid for by Contractor.

END OF SECTION

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FIRESTOPPING

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1 GENERAL

1.1 REFERENCES

- .1 Underwriter's Laboratories of Canada (ULC)
- .2 ULC-S115-1995, Fire Tests of Firestop Systems.

1.2 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

1.3 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

1.4 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

2 PRODUCTS

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended.
 - .2 Firestop system rating: 1 hour.
- .2 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.
- .3 Service penetration firestop components: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

3 EXECUTION

3.1 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

- .3 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to a neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.3 INSPECTION

- .1 Notify Departmental Representative when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 SCHEDULE

- .1 Firestop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Edge of floor slabs at curtain wall and precast concrete panels.
 - .3 Top of fire-resistance rated masonry and gypsum board partitions.
 - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .7 Openings and sleeves installed for future use through fire separations.

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FIRESTOPPING

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- .8 Around mechanical and electrical assemblies penetrating fire separations.
- .9 Rigid ducts: greater than [129 cm²]: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

3.5 CLEAN UP

- .1 Remove excess materials and debris and clean adjacent surfaces immediately after application.
- .2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

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1 GENERAL

1.1 SECTION INCLUDES

- .1 This Section covers items common to Sections of Division 26. This section supplements requirements of Section 01 11 55.

1.2 CODES AND STANDARDS

- .1 Do complete installation in accordance with the latest CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1-M1987 except where specified otherwise.

1.3 SCOPE OF WORK

- .1 The scope of Work covered by these specifications and drawings covers the complete fit-up of the project area including but not limited to:
 - .1 Emergency power generator,
 - .2 Power distribution system,
 - .3 Coordination with "FortisBC",
 - .4 Transfer switch,
 - .5 Circuit breakers,
 - .6 Raceways,
 - .7 Cables and wiring,
 - .8 Grounding and bonding,
 - .9 Labeling,
 - .10 All necessary attachments, brackets and braces for mounting and supporting equipment,
 - .11 All necessary materials, labour, apparatus and tools to complete the installation,

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1.4 CARE, OPERATION AND START-UP

- .1 Instruct Departmental Representative and operating personnel in the operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.5 VOLTAGE RATINGS

- .1 Operating voltages: to CAN3-C235-83.
- .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.

1.6 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
- .4 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.
- .5 Furnish Certificates of Acceptance from Electrical Inspection Department on completion of work to Departmental Representative.

1.7 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 01 11 55 - General Requirements.
- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from

Electrical Inspection Department.

- .3 Factory assemble control panels and component assemblies.

1.8 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.9 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follows:
 - .1 Nameplates:
 - .1 Lamicaid 3 mm thick plastic engraving sheet, white face, black core, mechanically attached with self tapping screws.

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Wording on nameplates to be approved by Departmental Representative prior to manufacture.
- .3 Allow for average of twenty-five (25) letters per nameplate and label.
- .4 Identification to be English.

- .5 Nameplates for junction and pull boxes to indicate system and/or voltage characteristics.

1.10 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

1.11 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.12 MANUFACTURERS AND CSA LABELS

- .1 Visible and legible, after equipment is installed.

1.13 LOCATION OF OUTLETS

- .1 Locate outlets as indicated on drawings.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .3 Locate light switches as indicated on drawings.

1.14 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

1.15 LOAD BALANCE

- .1 Measure phase current to panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

1.16 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

1.17 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The Work of this division to be carried out by a Contractor who holds a valid Master Electrical contractor license as issued by the Province that the work is being constructed.
- .3 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .4 Insulation resistance testing.
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Check resistance to ground before energizing.
- .5 Carry out tests in presence of Departmental Representative.
- .6 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .7 Submit test results for Departmental Representative's review.

1.18 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

1.19 PREMIUM TIME FOR SERVICE INTERRUPTIONS

- .1 There is no power, security, voice/data interruptions during the regular hours. Allow premium time in the week nights to disrupt existing services.
- .2 Obtain prior written approval from Departmental Representative before any service interruptions.

1.20 RECORD DRAWINGS AND MAINTENANCE MANUALS

- .1 Submit 3 CDs and 3 hardcopies of the record drawings in Autocad format after Departmental Representative's approval.
- .2 Submit 3 sets of maintenance manuals.

1.21 SEISMIC BRACING

- .1 All new and relocated equipment / panels shall be seismic braced per NBC 2010.

1.22 FIRESTOPPING

- .1 Install fire stopping in new and existing penetrations through fire rated walls and floors.
- .2 Fire stopping material to match fire rating of walls and floors.

2 PRODUCTS

2.1 NOT USED

- .1 Not used.

3 EXECUTION

3.1 PROPOSED WORK SEQUENCE

- .1 Submit gantt chart and shop drawings.
- .2 Remove existing non-functional 20kW propane generator and all associated wiring in the existing U/G duct that originate from inside the building (to free up the U/G duct for new wiring installation).
Note: Coordinate with Departmental Representative regarding use of temporary generator currently available on site and confirm how the temporary generator is to be

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connected to building loads during construction. Existing Teck cable from generator to transfer switch may need to be re-routed and temporarily re-installed to accommodate connection of temporary generator to panel 'C' in case of any power outage. Allow for provision of a temporary manual transfer switch if required.

- .3 Remove concrete pad for the existing generator and shed.
- .4 Install new U/G ducts, JB at the base of Fortis BC pole and concrete pad for new generator.
- .5 Remove existing transfer switch and all associated wiring in Elec/Storage Room.
- .6 Install all necessary new conduit and wiring both inside and outside the building without any disruption to the existing distribution system, i.e. leave existing distribution system unchanged until the final change-over.
- .7 Install new generator and transfer switch and test for correct operation.
- .8 Coordinate with Fortis BC for removal of existing wiring through CT cabinet and installation of new wiring.
- .9 Coordinate with Departmental Representative and make final changes to the distribution system at night when facility is closed. Test and commission generator and transfer switch. Ensure power is restored to the distribution system by morning before facility is opened.
- .10 Any additional testing and commissioning that may be required shall be scheduled to be performed at the following night.

Note: In planning a sequence of work for this projec, the priority has to be given to installation of new U/G ducts and concrete pad before start of snow fall season.

3.2 FORTIS BC COORDINATION

- .1 Submit the electrical permits and inspector's approval to Fortis BC if required.
- .2 Coordinate all work related to CT cabinet with Fortis BC.
- .3 Provide commissionaire for Fortis BC's access to the electrical room

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of chemically crosslinked thermosetting polyethylene material rated RW90.

2.2 TECK CABLE

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.

- .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: polyvinyl chloride material.
- .7 Fastenings:
 - .1 One hole malleable iron straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 3000 mm centers.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 Watertight, approved for TECK cable.

2.3 ARMoured CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Type: flame retardant jacket over thermoplastic armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.
- .5 Connectors: Spin on watertight.

3 EXECUTION

3.1 INSTALLATION OF BUILDING WIRES

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WIRES AND CABLES

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.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

.2 In underground conduit systems in accordance with Section 26 05 44.

3.2 INSTALLATION OF TECK CABLE

.1 Group cables wherever possible on channels.

3.3 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

- .1 This Section covers items common to Sections of Division 26. This Section supplements requirements of Division 01.

1.2 REGULATORY REQUIREMENTS

- .1 Restraints shall meet the requirements of the National Building Code, and B.C. Building Code.
- .2 All electrical equipment that is new or being relocated is to be seismically restrained.

1.3 SEISMIC RESTRAINT DESIGN AND INSPECTION

- .1 Arrange and pay for the services of a professional engineer registered in the province of B.C. "Seismic Engineer" who shall provide all required engineering services related to seismic restraints of the equipment.
- .2 The Seismic Engineer shall provide assistance to the contractor during the course of the equipment install if necessary.
- .3 The Seismic Engineer shall inspect the completed seismic installation and shall submit a letter to the departmental representative stating that the complete seismic installation is installed in accordance with the seismic engineers drawings and it complies with all regulatory requirements.

1.4 SUBMITTALS

- .1 Submit shop drawings of all restraining devices, including details of attachments to the structure, either tested in an independent testing laboratory or approved by a B.C. registered professional Engineer.

1.5 SCOPE OF WORK

- .1 Provide restraint for electrical all equipment, including generator, transfer switch, and all other related electrical equipment, to prevent injury or hazard to persons and equipment and to retain equipment in its normal position in the event of an earthquake.
- .2 Provide all seismic restraint related hardware, including bolts and anchors, from point of attachment to equipment through to and including attachment to structure.
- .3 It is the entire responsibility of equipment manufactures to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

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SEISMIC RESTRAINTS

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2 PRODUCTS

2.1 GENERAL

- .1 Provide anchor bolts, straps and other mounting materials as specified by Seismic Engineer.

3 EXECUTION

3.1 INSTALLATION

- .1 Carry out all seismic restraint works on electrical equipment as per the recommendations of the Seismic Engineer and in accordance with all regulatory requirements.
- .2 Co-ordinate the work with other trades as required.

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2 Section 26 05 02 - Common Work Results - Electrical.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837-1989(R1996), Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA International)

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.1 EQUIPMENT

- .1 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .2 Insulated grounding conductors: green, type RW 90.

- .3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

3 EXECUTION

3.1 INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories. Reconnect all existing ground connections.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .8 Install separate ground conductor to outdoor lighting standards and underground wiring.

3.2 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list.
 - .1 Switchgear
 - .2 Main electrical service
 - .3 Generator.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 02 - Common Work Results - Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

END OF SECTION

1 GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 - Submittal Procedures.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Fold up metal banding, flatten and place in designated area for recycling.

2 PRODUCTS

2.1 JUNCTION AND PULL BOXES

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.2 EXTERIOR JUNCTION BOXES

- .1 All exterior junction boxes shall be Rigid PCC type.

3 EXECUTION

3.1 JUNCTION AND PULL BOX INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.2 IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 02 - Common Work Results - Electrical.

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JUNCTION AND PULL BOXES

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- .2 Install size 2 identification labels indicating system name, voltage and phase.

END OF SECTION

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1 GENERAL

1.1 REFERENCES

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

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 120 V outlet boxes for 120 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

- .4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

2.3 CONDUIT BOXES

- .1 Rigid PVC boxes with mounting feet for surface wiring of exterior mounted switches and receptacles.

2.4 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

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 debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18-98, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 45-M1981 (R1992), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-1977 (R1999), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985 (R1999), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-M1984 (R1999), Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3-M91 (R1999), Flexible Nonmetallic Tubing.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

2 PRODUCTS

2.1 CONDUITS

- .1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .2 Rigid steel conduit: to CSA C22.2 No. 45, galvanized steel, threaded.
- .3 Rigid PVC conduit.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Channel type supports for two or more conduits at 3 m oc.
- .3 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Set screws connectors and couplings for EMT. Cast type metal connectors and couplings are not permitted.
- .2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

2.4 FISH CORD

- .1 Polypropylene.

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 Use rigid steel conduit on outside installations where indicated.
- .3 Use electrical metallic tubing (EMT) where indicated.
- .4 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .5 Minimum conduit size for lighting and power circuits 21 mm.
- .6 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .7 Mechanically bend steel conduit over 21 mm dia.
- .8 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

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- .9 Install fish cord in empty conduits.
 - .10 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
 - .11 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on surface channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel. Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.

3.4 WIRE IN CONDUIT

- .1 All wiring shall be in conduit unless otherwise indicated.

END OF SECTION

1 GENERAL

1.1 REFERENCES

- .1 CSA C22.1-2012 Canadian Electrical Code, Part 1.

1.2 RELATED WORK

- .1 Section 01 11 55 – General Instructions.
- .2 Section 26 05 02 – Common Work Results – Electrical.
- .3 Section 26 05 21 – Wire and Cables 0 – 1000 V.
- .4 Section 26 05 34 – Conduits, Fastenings and Fittings.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

2 PRODUCTS

2.1 NOT USED

- .1 Not used.

3 EXECUTION

3.1 INSTALLATION

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables in ducts.
- .3 Install multiple cables in ducts simultaneously.

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- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
 - .5 Use specified rope to pull cables into ducts.
 - .6 Before pull cables into ducts and until cables are properly terminate, seal end of cables with moisture seal tape.
 - .7 After installation of cables, seal duct ends with duct seal compound.
 - .8 Provide pull string in all ducts for future use.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests of each type of cable and system as indicated.
- .2 Remove and replace entire length of cable if cable fails to meet any test criteria.

END OF SECTION

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DIESEL ELECTRIC GENERATING UNITS APPENDIX A – TECHNICAL DATA FORM

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1 GENERAL

1.1 SECTION INCLUDES

- .1 Technical data form Appendix A required in both Section 26 32 10 - Diesel Electric Generating Units - Liquid Cooled.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 32 10 - Diesel Electric Generating Units - Liquid Cooled.

1.3 TECHNICAL DATA FORM SUBMITTAL

- .1 Submit technical data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Co-ordinate with Section 26 32 10 - Diesel Electric Generating Units - Liquid Cooled.

1.4 DIESEL ENGINE

- .1 Make and type: [_____].
- .2 Speed: [_____] r/min.
- .3 Continuous mechanical power NTP rating: [_____] kW.
- .4 Continuous mechanical power site rating: [_____] kW.
- .5 Cycles: [_____].
- .6 No. of cylinder: [_____].
- .7 Cylinder arrangement: [_____].
- .8 Bore and stroke: [_____] mm x [_____] mm.
- .9 Piston speed: [_____] m/s.
- .10 Total displacement of clinders: [_____] cm³.
- .11 BMEP at rated output: [_____] kPa.
- .12 Naturally aspirated or supercharges: [_____].

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- .13 Make and type of turbo charger (if turbo charged): [_____].
- .14 Cyclic irregularity: [_____].
- .15 Make and type of governor: [_____].

1.5 FUEL SYSTEM

- .1 Make and type of fuel system: [_____].
- .2 Fuel consumption at ½ load: [_____] l/h.
- .3 Fuel consumption at 3/4 load: [_____] l/h.
- .4 Fuel consumption at 4/4 load: [_____] l/h.
- .5 Number of fuel filters: [_____].
- .6 Recommended fuel oil: [_____].

1.6 LUBRICATING OIL SYSTEM

- .1 Lubricating oil cooler:
 - .1 Make and type: [_____].
 - .2 Capacity oil: [_____] l/min.
 - .3 Capacity water: [_____] l/min.
 - .4 Inlet oil temperature: [_____] degrees C.
 - .5 Outlet oil temperature: [_____] degrees C.
- .2 Engine driven oil pump:
 - .1 Type: [_____].
 - .2 Capacity: [_____] l/min.
 - .3 Type of drive: [_____].
- .3 Pre-lubricating oil pump (where supplied):
 - .1 Pump make and type: [_____].

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- .2 Capacity: [] l/min.
- .3 Motor make and type: [].
- .4 Motor power: [] IW.
- .5 Motor voltage and phase: [] V.
- .6 Motor speed: [] r/min.
- .4 Filters:
 - .1 Make and type: [].
 - .2 Number: [].
- .5 Lubricating oil:
 - .1 Total capacity of system: [l].
 - .2 Recommended type of lubricating oil: [].
 - .3 Recommended SAE viscosity number at 0 degrees C: [].
 - .4 Recommended SAE viscosity number at 20 degrees C: [].
 - .5 Recommended SAE viscosity number at 40 degrees C: [].
 - .6 Recommended operating temperature: [] degrees C.
 - .7 Recommended operating pressure: [] kPa.
 - .8 Lubricating oil consumption at rated output: [] l/kW/h.

1.7 COOLING SYSTEM

- .1 Coolant
 - .1 Capacity: [].
 - .2 Recommended operating temperature: [] degrees C.
- .2 Engine driven circulating pump:
 - .1 Make and type: [].
 - .2 Capacity: [] l/min.

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- .3 Type of drive: [_____].
- .3 Jacket heater:
 - .1 Make and type: [_____].
 - .2 Wattage: [_____] W.
 - .3 Voltage and phase: [_____] V.
 - .4 Thermostat make and type: [_____].
- .4 Heater circulating pump (where supplied):
 - .1 Pump make and type: [_____].
 - .2 Pump capacity: [_____] l/min.
 - .3 Motor power: [_____] kW (bhp).
 - .4 Motor voltage and phase: [_____].
 - .5 Motor speed: [_____] r/min.
- .5 Radiator:
 - .1 Capacity: [_____].
 - .2 Radiator fan power: [_____] kW (bhp).
 - .3 Radiator fan speed: [_____] r/min.
 - .4 Number and type of belts: [_____].
 - .5 Air required for cooling: [_____] m³ /min.
 - .6 Radiator fan motor voltage and phase: [_____] V.

1.8 EXHAUST SYSTEM

- .1 Silencer make and type: [_____].
- .2 Silencer dimensions: [_____].
- .3 Exhaust pipe size: [_____].

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.4 Exhaust rate of flow and temperature at silencer:

.1 Inlet for 100% load: [] m³ /min.

.2 Inlet for 75% load: [] m³ /min.

.3 Inlet for 50% load: [] m³ /min.

.5 Pyrometer make and type (where supplied).

.6 Number of switch points.

1.9 AIR INTAKE SYSTEM

.1 Make and type of air cleaner: [].

.2 Air required for combustion: [] m³ /min.

.3 Air required for cooling (where required): [] m³ /min.

1.10 STARTING SYSTEM

.1 Electric start

.1 Starting motor:

.1 Make and type: [].

.2 Voltage: [] V.

.3 Breakaway current at 0 degrees C: [] A.

.4 Breakaway current at 40 degrees C: [] A.

.5 Cranking current at 0 degrees C: [] A.

.6 Cranking current at 40 degrees C: [] A.

.2 Battery

.1 Make and type: [].

.2 Nominal voltage: [] V.

.3 Number of cells: [].

.4 Capacity: [] Ah.

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- .5 Discharge rate: [] h.
- .3 Battery charger
 - .1 Make and type: [].
 - .2 Voltage - float: [] V.
 - .3 Voltage - equalizer: [] V.
 - .4 Maximum current: [] A.

1.11 GENERATOR

- .1 Alternator
 - .1 Make and type: [].
 - .2 Model: [].
 - .3 Phase and wire: [].
 - .4 Power factor: [].
 - .5 Voltage: [] V.
 - .6 Current: [] A.
 - .7 kVA and kW: [], [].
 - .8 Speed: [] r/min.
 - .9 Guaranteed efficiencies at rated power factor for:
 - .1 100% load: [] %.
 - .2 75% load: [] %.
 - .3 50% load: [] %.
 - .10 Wave form deviation: [].
- .2 Exciter
 - .1 Make and type: [].

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- .2 Model: [_____].
- .3 Voltage: [_____] V.
- .4 kW: [_____].
- .5 Filed resistance at 20 degrees C: [_____] ohms.
- .3 Voltage regulator
 - .1 Make and type: [_____].
 - .2 Input power:
 - .1 Voltage: [_____] V.
 - .2 Current: [_____] A.
 - .3 Frequency: [_____] Hz.
 - .4 Phase: [_____].
 - .3 Input sensing:
 - .1 Voltage: [_____] V.
 - .2 Frequency: [_____] Hz.
 - .3 Phase: [_____].
 - .4 Output power:
 - .1 Nominal voltage: [_____] V dc.
 - .2 Forcing voltage: [_____] V dc.
 - .3 Current (max. continuous): [_____] A dc.
 - .4 Forcing current (maximum): [_____] A dc.
- .4 Engine/generator coupling
 - .1 Make and type: [_____].

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1.12 TRANSFER SYSTEM

- .1 Make: [_____].
- .2 Type: [_____].
- .3 Voltage rating: [_____] V.
- .4 Current rating:
 - .1 Continuous: [_____] A.
 - .2 Maximum interruption: [_____].
- .5 Control voltage:
 - .1 Closing coil: [_____].
 - .2 Tripping coil: [_____].

1.13 ENGINE - GENERATOR -TRANSFER CONTROLLER

- .1 Make and type: [_____].

1.14 BUSSING

- .1 Rated current: [_____].
- .2 Short circuit capacity: [_____].
- .3 Rated voltage: [_____].

1.15 DIMENSIONS AND WEIGHTS

- .1 Overall unit length: [_____] m.
- .2 Overall unit width: [_____] m.
- .3 Overall unit height: [_____] m.
- .4 Total weight of generator: [_____] kg.
- .5 Total weight of engine: [_____] kg.
- .6 Generator stator weight: [_____] kg.

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- .7 Generator rotor weight: [] kg.
- .8 Radiator weight: [] kg.
- .9 Total weight of unit: [] kg.
- .10 Weight of heaviest item to be lifted by crane: [] kg.
- .11 Head room required for removal of piston and connecting rod: [] m.

2 PRODUCTS

2.1 NOT USED

- .1 Not used.

3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1 GENERAL

1.1 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

2 PRODUCTS

2.1 SWITCHES

- .1 20 A, 120 V, single pole, double pole, three-way, four-way switches to: CSA-C22.2, No.55 and CSA – C22.2, No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea molded housing.
 - .4 Suitable for back and side wiring.
 - .5 White toggle.
- .3 Toggle operated fully rated for fluorescent lamps, and up to 80% of rated capacity of motor loads.

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2.2 GFCI RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:
 - .1 Urea molded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and riveted grounding contacts.
 - .6 White color.
 - .7 Integral "Test" and "Reset" Pushbuttons.
- .2 Other receptacles with ampacity and voltage as indicated.

2.3 COVER PLATES

- .1 Stainless steel cover plates for wiring devices.
- .2 Weatherproof coverplates for exterior mounted devices as indicated.

3 EXECUTION

3.1 INSTALLATION

- .1 Switches:
 - .1 Install single pole throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 – Common Work Results – Electrical.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

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- .2 Mount receptacles at height in accordance with Section 26 05 02 – Common Work Results - Electrical.
- .3 Cover Plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

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1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 19 – Construction/Demolition Waste Management And Disposal.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include time-current characteristics curves for breakers with ampacity of 100 A and over.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction/Demolition Waste Management And Disposal.
- .2 Collect and separate plastic paper packaging and corrugated cardboard in accordance with Waste Management Plan.

2 PRODUCTS

2.1 BREAKERS GENERAL

- .1 Bolt-on moulded case circuit breaker: quick-make quick-break type, for manual and automatic operation with temperature compensation for 40 C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times currents rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Circuit breakers to have symmetrical rms interrupting capacity rating as noted on drawings.
- .6 All new circuit breakers in existing panelboards to match existing.

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2.2 THERMAL MAGNETIC BREAKERS

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

3 EXECUTION

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.
- .2 Update existing panelboard schedules with added or revised circuit breakers with new type written schedules.

END OF SECTION

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1 GENERAL

1.1 SECTION INCLUDES

- .1 Operation test and check required for acceptance in both Section 26 32 10 - Diesel Electric Generating Units (Liquid Cooled).

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 32 10 - Diesel Electric Generating Units (Liquid Cooled).

1.3 TEST SUBMITTAL

- .1 Submit Factory Test in accordance with Section [01 33 00 - Submittal Procedures].
- .2 Co-ordinate with Section 26 32 10 - Diesel Electric Generating Units (Liquid Cooled).

1.4 GENERAL

- .1 Supplier: [_____].
- .2 Spec no.: [_____].
- .3 Order no.: [_____].
- .4 Requisition no.: [_____].
- .5 Tender file no.: [_____].
- .6 Site file: [_____].
- .7 Unit serial no.: [_____].
- .8 Destination: [_____].
- .9 Against material specification and shop drawings:
 - .1 Complies: [_____].
 - .2 Does not comply: [_____].
 - .3 Not checked: [_____].

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.10 Against specified performance:

.1 Tested OK: [_____].

.2 Tested not OK: [_____].

.3 Not tested: [_____].

1.5 ENGINE AND ACCESSORIES

.1 Engine:

.1 Make and type: [_____].

.2 Model: [_____].

.3 Serial No.: [_____].

.4 Speed: [_____] rpm.

.5 Cycles: [_____].

.6 No. of cylinders: [_____].

.7 Cylinder arrangement: [_____].

.8 Bore and stroke: [_____] mm x [_____] mm.

.9 kW [_____] @ ntp.

.10 Governor: make and type: [_____].

.11 Base plate, including anchor bolt holes location: [_____].

.12 Aspiration: natural/pressure: [_____].

.13 Engine wiring: [_____].

.2 Fuel system:

.1 Make and type: [_____].

.2 Number of filters: [_____], make and type: [_____].

.3 Recommended fuel oil: [_____].

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- .4 Pumps: [_____].
- .5 Injectors: [_____].
- .6 Transfer pump: [_____].
- .7 Lines and fittings: [_____].
- .3 Lubricating oil system:
 - .1 Lubricating oil cooler:
 - .1 Make and type: [_____].
 - .2 Filters:
 - .1 Number: [_____].
 - .2 Make and type: [_____].
 - .3 Gauges:
 - .1 Number: [_____].
 - .2 Make and type: [_____].
 - .4 Lubricating oil:
 - .1 Total capacity: [_____].
 - .2 Recommended oil: [_____].
 - .3 Recommended operating temperature: [_____].
 - .4 Recommended operating pressure: [_____].
 - .5 Drain valve: [_____].
 - .6 Lines and fittings: [_____].
 - .7 Leaks: [_____].
- .4 Exhaust system:
 - .1 Silencer: make and type: [_____].
 - .2 Exhaust pipe size: [_____].

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-
- .3 Silencer and fittings: [_____].
 - .4 Manifold guard: [_____].
 - .5 Air intake system:
 - .1 Air cleaner: make and type: [_____].
 - .2 Air required for combustion: [_____] m³ /min.
 - .3 Turbo charger: make and type: [_____].
 - .6 Cooling system:
 - .1 Make: [_____].
 - .2 Fan: number [_____], type of belts: [_____].
 - .3 Radiator capacity: [_____].
 - .4 Air required for cooling: [_____].
 - .5 Engine heater: make and type [_____], wattage: [_____].
 - .6 Aquastat: make and type [_____].
 - .7 Thermostat: open [_____], close: [_____].
 - .8 Drains: valves [_____], leaks [_____].
 - .9 Gauges: make and type [_____].
 - .7 Ventilating system:
 - .1 Motors: number [_____], make and type [_____].
 - .2 Louvres: number [_____], make and type [_____].
 - .3 Dampers: number [_____], make and type [_____].
 - .4 Thermostat: make and type [_____].
 - .5 Transformer: make and type [_____].

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.6 Auxiliary potentiometer:

- .1 Construction: [_____].
- .2 Dimensions: [_____].
- .3 Operation: [_____].
- .4 Linkage: [_____].
- .5 Wipers: [_____].

.8 Starting system:

.1 Starting motor:

- .1 Make and type: [_____].
- .2 Voltage: [_____].
- .3 F.L. Amps: [_____].
- .4 Serial no.: [_____].

.2 Battery:

- .1 Make and type: [_____].
- .2 Nominal volts: [_____].
- .3 No. of cells: [_____].
- .4 A.H. capacity: [_____].
- .5 Cables: [_____].

.3 Battery charger:

- .1 Make and type: [_____].
- .2 DC Volts - float: [_____], DC Volts - equalize: [_____].
- .3 Equalize time: [_____].
- .4 DC Amps: [_____].
- .5 AC Volts: [_____].

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- .6 AC Amps: [_____].
- .7 Serial no.: [_____].
- .9 Vibration isolators:
 - .1 Make and type: [_____].
 - .2 Spring cap: [_____].
- .10 Flexible couplings:
 - .1 Make and type: [_____].
- .11 Other accessories:
 - .1 Make and type/contact arrangement: [_____].
 - .2 Fuel rack solenoid (FRS): [_____].
 - .3 Speed switch (SS): [_____].
 - .4 Low oil pressure switch (LOPS): [_____].
 - .5 High coolant temperature switch (HCTS): [_____].
 - .6 Engine control switch (45): [_____].
- .12 Associated instruction books and sheets, parts books and drawings:
 - .1 Tool kit: [_____].
 - .2 Spare parts: [_____].

1.6 GENERATOR AND CONTROLS

- .1 Alternators:
 - .1 Make and type: [_____].
 - .2 Frame: [_____].
 - .3 Model: [_____].
 - .4 Serial no.: [_____].

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- .5 Phase and wire: [] PF, [] Volts, [] Amps, []
KVA, [] kW, [] Speed, [] Cycles.
- .6 Alt. field amps: [].
- .7 Temp. rise: [].
- .8 Bearing: front [], rear [].
- .9 Junction box: [].
- .10 Signs: DOT number [], warning [], air gap [],
terminals [].
- .2 Exciter:
 - .1 Make and type: [].
 - .2 Model: [].
 - .3 Serial no. [].
 - .4 Volts: [] kW, [] Amps.
 - .5 Field Amps: [], field winding: [].
 - .6 Temperature rise: [].
 - .7 Brushless/brush/static: [].
- .3 Voltage regulator:
 - .1 Make and type: [].
 - .2 Serial no.: [].
- .4 Regulator accessories:
 - .1 EFR/EFT: [].
 - .2 VAR: [].
 - .3 Transformers: [].
 - .4 Change-over SW: [].
 - .5 Current boost: [].

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.6 Overload and short circuit test: [_____].

.5 Associated instruction books and sheets, parts books and drawings:

.1 [_____].

1.7 CONTROL PANEL AND COMPONENTS

.1 Control panel:

.1 Dimensions: [_____].

.2 Weight: [_____].

.3 Construction: [_____].

.4 Wiring: [_____].

.5 Transport Canada (TC) at sign: [_____].

.2 Transfer switch:

.1 Make and type: [_____].

.3 Overcurrent relay:

.1 Make and type: [_____].

.4 Meters:

.1 Make and type: [_____].

.2 Scale and accuracy: [_____].

.3 Ammeter: [_____].

.4 Voltmeter: [_____].

.5 Elapsed time meter: [_____].

.6 Hz meter: [_____].

.7 kW meter: [_____].

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- .5 Transformers: [_____].
- .1 Fuses: [_____].
- .6 Engine - generator - transfer controller:
 - .1 Make and type: [_____].
- .7 Associated instruction books and sheets, parts books and drawings:
 - .1 [_____].

1.8 INSTRUMENT CONTROL SETTINGS

- .1 High coolant temperature switch (HCTS): [_____].
- .2 Low oil pressure switch (LOPS): [_____].
- .3 Overspeed switch (SS High): [_____].
- .4 Cranking output switch (SS Low): [_____].
- .5 Normal supply overcurrent: timed [_____], inst. [_____].
- .6 Emergency supply overcurrent: timed [_____], inst. [_____].
- .7 Normal supply voltage limits: [_____].
- .8 Emergency supply voltage limits: [_____].
- .9 Frequency limits: [_____].
- .10 Time delay settings:
 - .1 Crank delay: [_____].
 - .2 Restart: [_____].
 - .3 Bypass: [_____].
 - .4 Anticipated fail: [_____].
 - .5 Engine start: [_____].
 - .6 Emergency to normal: [_____].

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.7 Dead bus: [_____].

.8 Cool down: [_____].

1.9 REGULATION

.1 Dot no.: [_____].

.2 Date: [_____].

<u>Load</u>		<u>Voltage</u>		<u>Frequency</u>	
Amps	kW	Level	Response	Level	Response

.3 Resistances:

.1 Stator winding:

.1 Phase A: cold [_____], hot [_____].

.2 Phase B: cold [_____], hot [_____].

.2 Rotor winding: cold [_____], hot [_____].

.3 Exciter field winding: cold [_____], hot [_____].

.4 Field rheostat: cold [_____], hot [_____].

.4 Voltage regulation:

.1 Maximum [_____]%, steady state [_____]%, 24 hour drift [_____]%.

.5 Speed reduction:

.1 Maximum [_____]%, steady state [_____]%, 24 hour drift [_____]%.

.6 Voltage adjustment ranges:

.1 With regulator rheostat: [_____].

.2 With field rheostat: [_____].

.7 Governor adjustment ranges:

.1 Speed changer: [_____].

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- .2 Speed droop: [_____].
- .8 Cold start - full load application:
 - .1 Time since run: [_____].
 - .2 Lube oil temp: [_____].
 - .3 Fuel oil temp: [_____].
 - .4 Water temp: [_____].
 - .5 Generator iron temp: [_____].
 - .6 Room temp: [_____].
 - .7 Level of voltage overshoot: [_____].
 - .8 Level of frequency overshoot: [_____].
 - .9 Time to steady state: Volt [_____], Frequency [_____].
 - .10 Time load applied from start: [_____].
 - .11 Transient levels: volts [_____], Frequency [_____], Amps [_____].
 - .12 Time to settled levels: Volts [_____], Frequency [_____], Amps [_____].
 - .13 Settled levels: Volts [_____], Frequency [_____], Amps [_____].

1.10 COUPLING ALIGNMENT

- .1 [_____].

1.11 MISCELLANEOUS

- .1 Manuals:
 - .1 Received: [_____] copies.
 - .2 Distributed: [_____] copies, [_____] site (with cabinet), [_____] copies [_____] region, [_____] copies, [_____] site maintenance, [_____] copies, [_____] headquarters.

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- .2 Shipping:
 - .1 Crate: [_____].
 - .2 No. of pieces: [_____].
 - .3 Dimensions: [_____].
 - .4 Weight: [_____].
 - .5 Valuation: [_____].
 - .6 Date: [_____].
 - .7 Carrier: [_____].
- .3 Factory acceptance:
 - .1 Date: [_____].
 - .2 Signature: [_____], TC inspector.

2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

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1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for liquid cooled electric diesel generating unit in a sound alternated enclosure with integral fuel tank.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .3 Section 01 45 00 - Quality Control.
- .4 Section 01 78 00 - Closeout Submittals.
- .5 Section 26 32 12 - Diesel Electric Generating Units Appendix B - Factory Test.
- .6 Section 26 06 31 - Diesel Electric Generating Units Appendix A - Technical Data Form.

1.3 REFERENCES

- .1 Canadian Standards Association, (CSA International)
 - .1 CAN3-Z299.3-85(R1997) (R2002), Quality Assurance Program - Category 3.
- .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-[1997], Reciprocating internal combustion engines - Performance - Part 4: Speed governing.
 - .3 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA MG 1-1998, Motors and Generators.
 - .4 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - March 1998.

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.5 The Society of Automotive Engineers (SAE)

1.4 SYSTEM DESCRIPTION

- .1 Provide automatic, unattended, emergency power supply system consisting of:
 - .1 Liquid cooled low voltage diesel electric generating unit with combined control, transfer and by-pass panel.
 - .2 Power transfer and by-pass panel.
 - .3 Power isolating and by-pass panel.
 - .4 Accessories and equipment specified in this specification.
 - .5 48 hour diesel tank in base for generator operation at 75% full load.
 - .6 Totally enclosed, outdoor type to meet the noise rating of 71 dB at 7 metres.
- .2 Provide design, fabrication, testing, transportation, demonstration and equipment warranty.

1.5 DESIGN REQUIREMENTS

- .1 Design equipment to meet following requirements:
 - .1 Total load: 50 kW at 0.8 PF, 62.5 kVA.
 - .2 Motor load: 10 kW.
 - .3 Largest motor: 5 kW.
 - .4 Voltage: 120 / 240 V.
 - .5 Frequency: 60 Hz.
 - .6 Phase/Wire: Single Phase, 3 Wire.
 - .7 Power factor: 0.8.
 - .8 Load harmonic content: 10% THD.
 - .9 Maximum rotational speed: 1800 rpm.
 - .10 Interrupting capacity: 50 MVA.

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- .11 Duty rating: full load continuous plus 10% overload for 1h in every 12h period.
- .12 Performance: automatic.
- .13 Weekly self test and self diagnosis
- .14 Elevation above sea level: 611 m.
- .15 Ambient temperature: -25° C to 40° C.
- .16 Relative humidity: 60%.
- .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, within 15 seconds for any temperature between -25° C to 40 ° C.
- .3 Use engine manufacturer's standard, published continuous (prime) horsepower rating in assessing engine capacity and derate 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 abnormal or loss of normal voltage: voltage sensing relays to sense hydro supply voltage. If voltage-to-ground on any leg of hydro single phase supply should drop below preset limits for adjustable period of time, close engine start contact and start engine.
 - .2 When emergency supply has reached settled voltage and frequency preset limits transfer switch will transfer load to emergency supply.
 - .3 Continue to supply load until hydro supply returns or set is shut down manually or under failure conditions.
 - .4 On hydro restoration, confirmed by double sensing of voltage above adjustable preset, for time period in excess of three minutes, transfer switch will transfer load to hydro supply. Provide dead bus timer to allow motor starters to drop out and motors to stop prior to connecting to hydro.
 - .5 Adjustable time delay relay to allow engine to run unloaded to cool down and subsequently to shut down, ready for next cycle.
 - .6 Equip engine with key switch with following positions: auto-off-crankstart, key removable in auto position only.
 - .7 Automatic shut down on:

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- .1 Overcranking.
- .2 Overspeed.
- .3 High Engine Temperature.
- .4 Low lubricating oil pressure.
- .5 Over and under frequency.
- .6 Emergency breaker failure.
- .7 Electrical fault lock-out on short circuit and generator over and under voltage.

1.6 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Dimensions and data in metric units and symbols followed by in bracket imperial units and symbols wherever applicable.
- .2 Include following in accordance with Section 26 06 31 - Diesel Electric Generating Units Appendix A - Technical Data Form.
 - .1 Engine: make, model, rating and performance curves.
 - .2 Starter motor, make model.
 - .3 Generator: make, model and rating complete with generator saturation curves, heat damage curves, reactive capability and special data.
 - .4 Voltage regulator: make, model, type.
 - .5 Governor: type, model.
 - .6 Battery: make, type, voltage, capacity.
 - .7 Charger: make, model, input and output rating.
 - .8 Submit general outline drawing of complete assembly showing engine, radiator and generator mounting, exhaust, recirculating and intake air louvre 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

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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 Weight of engine, generator, baseplate, radiator and exhaust silencer.
- .9 Identify exact locations and details where necessary of interconnecting services to permit final engineering by Departmental Representative.
- .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 diagrams.
- .16 Complete bill of materials, including manufacturer's name, catalogue numbers and capacity.
- .3 Lubricating oil system: where oil pump not provided, submit certification to Departmental Representative ensuring oil pump is not required and will not detract from service life of engine.

1.7 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for diesel generating units for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Provide following in English for incorporation into instruction manuals:
 - .1 Complete set of reviewed shop drawings.

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-
- .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.
 - .3 Forward, two weeks prior to factory tests, one copy of instruction manual to Departmental Representative.
 - .4 Forward, within two weeks after factory tests, three copies of instruction

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manuals, with updated drawings, for each unit of different ratings, to Departmental Representative.

- .1 Submit one set of prints along with manuals.

1.8 QUALITY ASSURANCE

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

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Prepare, crate and protect equipment against shipping and storage damage.
- .2 Provide minimum 12.5 mm plywood outer covering single vapour barrier inside.
- .3 Provide minimum 20 mm plywood outer covering with one side finished and double vapour barrier and sufficient dessicant for one year's storage.
- .4 Mount unit and panel on shipping skids with plank floor.
- .5 Each package to have shipping weight, address, dimensions and Department number and brief description of contents stencilled on at least two sides.
 - .1 Staple on outside packing list contained in waterproof envelope.
 - .2 Place copy of packing list inside.
 - .3 Mail additional copies to consignee and to Departmental Representative.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene. corrugated cardboard 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 Departmental Representative.
- .5 Dispose of unused paint material at official hazardous material collections site approved by Departmental Representative.

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- .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 unused lubricating oil and fuel material at official hazardous material collections site approved by Departmental Representative.
- .8 Dispose of unused batteries material at official hazardous material collections site approved by the Departmental Representative.
- .9 Fold up metal banding, flatten and place in designated area for recycling.

1.11 WARRANTY

- .1 For the Work of this Section 26 32 10 - Diesel Electric Generating Units (Liquid Cooled), the 12 months warranty period.

1.12 MAINTENANCE - EXTRA MATERIALS

- .1 For panels provide following:
 - .1 One spare control circuit breaker per rating.
 - .2 Twenty four spare indicating light bulbs per rating.
 - .3 One spare control relay and socket per rating and contact arrangement.
 - .4 One spare contactor operating coil.
 - .5 One set of contacts.
- .2 Provide generator unit with standard set of engine manufacturer's spare parts for one year normal operation 1,000 operating hours. Spares to include:
 - .1 Six fuel filter elements for each type of fuel filter/water separator.
 - .2 Six lubricating oil filter elements.
 - .3 Three air cleaner elements.
- .3 Where metric size nuts and bolts are used, provide one set of sockets complete with ratchet handle and set of combination wrenches, to fit sizes used.
- .4 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.

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1.13 MAINTENANCE - TOOLS

- .1 Supply suitable engine barring device and battery manufacturer's standard set of tools for battery service.
 - .1 Battery service tools to include hydrometer, one plastic bottle for topping up purposes and one insulated battery terminal wrench.
 - .2 Provide complete set of specialized tools required for proper care, adjustment and maintenance of equipment supplied.

2 PRODUCTS

2.1 ASSEMBLY

- .1 Provide following items plus such other items as necessary to make unit 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, Transfer By-pass Panel.

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- .15 Isolating and By-pass Panel.
- .16 Transfer and By-pass Panel.
- .17 Remote annunciator
- .18 Enclosure, sound attenuator and accessories
- .19 Spares and Accessories.

2.2 MOUNTING

- .1 Connect engine flywheel housing rigidly to generator stator housing with SAE adapter.
 - .1 Mount unit on common, heavy duty fabricated steel baseplate.
 - .2 Obtain approval for design and materials of baseplate from engine manufacturer and Departmental Representative.
- .2 Baseplate: rigid material to maintain alignment of engine-generator shafts and frames under shipping, installation and service conditions.
- .3 Install machine engine-generator feet and baseplate sole plates parallel and true.
 - .1 Shims: steel type, installed under generator feet.
- .4 Support baseplate on spring type isolating fixtures from welded side brackets located to support bottom of baseplate 25 mm above supporting floor.
 - .1 Isolators: cast iron housings, complete with levelling bolts, adjustable oil proof snubbers and minimum 6 mm sound pads.
 - .2 Isolation efficiency 95% minimum.
- .5 Determine quantity and location of isolators. Locate each isolator to carry equal proportion of weight and that pressure exerted on floor by each isolator does not exceed 345 kPa.
- .6 Ship isolators loose for installation at project site.

2.3 DIESEL ENGINE

- .1 Full diesel, heavy duty, cold start, liquid cooled, vertical in-line or vee, and

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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.
- .2 Engine: minimum of four 4 cylinders.
- .3 Engine with auxiliary starting aids (e.g., glow plug assist start) not acceptable.
- .4 Equip engine air intakes with dry type heavy 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 and 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 high quality lubricating oil pressure gauge, lubricating oil temperature gauge, tachometer, coolant temperature gauge thermocouple, exhaust pyrometer 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 gauges: 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

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assembly.

- .1 Torsional or other vibration tolerance within 10% above or below rated speed of unit, when operating unloaded or connected to any load within its 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 where applicable.
- .12 Engine control panel complete with:
 - .1 Lubricating oil pressure gauge.
 - .2 Lubricating oil temperature gauge.
 - .3 Coolant temperature 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.

2.4 COOLING AND VENTILATING SYSTEM

- .1 Provide complete cooling and ventilating system for unit.
- .2 Thermostatically control system and maintain coolant, ethylene glycol, within engine manufacturer's tolerance, with unit operating at rated load under specified

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conditions. Cooling system engine mounted radiator type.

.1 Design and supply complete ventilating system 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 Provide multi-fan system suitable for indoor or outdoor installation complete with electrical controls and breaker type combination starters. Starters mounted in control panel. Motor of splash proof enclosure. Provide braided corrugated flexible lines for pipe terminations at radiator

and engine, isolating valves, fittings and pipe for installation of radiators approximately 9 m from front of engine.

.3 Provide drain valves 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, manual potentiometer, damper linkages, low voltage transformer, thermostat, fan motor.

.1 Provide positive seal, zero heat loss louvers.

.5 Ventilating system operation as follows:

.1 Air inlet and outlet damper closed when engine not running.

.2 On engine start, air inlet damper to open.

.3 Inlet damper minimum opening to be set by manual potentiometer.

.4 Thermostat to modulate inlet and outlet dampers to maintain set room temperature.

.5 Fan to start when inlet louvres 90% open adjustable.

2.5 LUBRICATION SYSTEM

.1 Provide full pressure lubricating system complete with duplex filters and oil cooler.

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- .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 15 second time 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.

2.6 FUEL SYSTEM

- .1 Provide complete fuel system including fuel lift pump and duplex filters.
 - .1 Filter elements to be directly replaceable with elements of Canadian manufacture.
- .2 Bring fuel supply and return lines to extreme forward part of baseplate with drop ear elbows. Connect other end of each elbow with 1 m of flexible neoprene hose.
- .3 Provide, loose, approximately 9 m of copper tubing and necessary fittings including two SAE flare union nuts long with half unions for connecting 12 mm gate valves.
- .4 Non-metallic fuel hoses: steel reinforced rubber type with crimped or swaged end fittings.

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- .5 The fuel shall be #2 diesel.
- .6 Fuelling from outside via a locked door.
- .7 The fuel tanks shall be double wall with leak detector and fuel leak alarm.
- .8 The fuel tank shall be with a high level alarm and low level alarm.
- .9 The fuel tank capacity shall store 48 hours of diesel fuel for generator operation at 75% full load.
- .10 All fuel alarms to be connected to the generator annunciator.

2.7 EXHAUST SYSTEM

- .1 Provide complete exhaust system including heavy duty industrial type 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 1.0 m beyond wall.
 - .1 Exhaust tail pipe end at 45 degree angle and terminate in bird screen.
- .2 Arrange exhaust system to suit openings.
 - .1 Where schedule of dimensions does not indicate location of opening, arrange exhaust run best suited to engine.
- .3 Provide exhaust pyrometers located on common exhaust manifold or two pyrometers on separate manifolds.
 - .1 Pyrometer range to include temperature at 110% load.
- .4 Emission standard to be EPA tier 3. The label shall be visible on generator and enclosure.

2.8 JACKET COOLANT HEATER

- .1 Provide engine jacket coolant heaters complete with 20° C to 60° C adjustable immersion type thermostat. Size heaters to maintain coolant at 40° C in an ambient temperature of -25° C.
- .2 Obtain circulation of heated coolant on thermosyphon principle.
 - .1 However, if this does not provide sufficient circulation to avoid hot spots in system, provide electrical motor driven circulating pump to operate

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automatically when heater is energized.

- .2 Motor: 120V single phase splash-proof type complete with breaker type combination starter.
- .3 Starter mounted in control panel.

2.9 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% from no load not to exceed 3 seconds.
 - .5 Frequency: externally adjustable from zero to 5% while engine is running.
 - .6 Class A accuracy.

2.10 STARTING SYSTEM

- .1 Provide complete starting system including cranking starting motor, batteries, battery stand, heavy-duty battery cables and battery charger.
- .2 Provide positive engaging type cranking motor. Cranking motor and flywheel ring gear arrangements which may permit tooth to tooth abutment not acceptable.
- .3 Provide lead acid battery with sufficient capacity in ambient room temperature of 0° C to crank unit at engine 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 current flowing, not less than 1.75 V per cell.
 - .2 Size battery to suit engine and battery manufacturer's published data.

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- .3 Batteries: dry charged, specific gravity of electrolyte 1.220 when fully charged at 27° C.
- .4 Battery termination: bolt-on or study type.
- .5 Protect terminals and exposed electrical connections from accidental short circuit by falling conductive objects on battery.
- .4 Provide battery stand coated with acid resistant paint and fabricated from angle irons with 20 mm plywood bottom and heavy duty casters for ease of movement.
- .5 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 4 m of connecting cord and permanent connectors for connecting to battery terminals.
 - .3 Provide 5 spare fuses inside charger panel.
 - .4 Charger: CSA approved.
- .6 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.
 - .2 Cable length sufficient to allow battery location on either side of engine.
- .7 Fit turbocharged engines with one spring actuated, two stage accumulator per turbocharger to automatically provide pre-start and post run lubrication to turbochargers.

2.11 GENERATOR

- .1 Provide generator, drip proof, single bearing and close coupled to engine with SAE housing:
 - .1 Generator: full amortisseur winding, direct connected brushless exciter with easily removable bolt-on diodes with surge protection.
- .2 Maximum deviation of open circuit terminal voltage waveform not to exceed 5%.
- .3 Provide permanent magnet generator PMG for generator short circuit sustaining capability not less than 2.4 times rated current.

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- .4 Generator winding insulation: Class F; winding temperature rise not to exceed 80° C as measured by resistance in ambient temperature of 40° C.
- .5 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.
- .6 Provide voltage regulation system complete with auto/manual control module.
 - .1 Voltage regulator: capable of withstanding continuous vibration, 15 shock and temperature up to 50° C while maintaining accuracy to plus/minus 1%.
- .7 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.
- .8 Design equipment to minimize radio frequency interference (RFI) under operating conditions.

2.12 PANEL – GENERAL

- .1 Panel: outdoor, free-standing, dead front, metal-enclosed steel 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.

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- .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. Use No.10AWG for CT 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, nonbrittle, unbreakable nylon, size 3,453/0 or equivalent.
 - .1 For current transformer secondary circuits, provide terminals 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 connection not permitted, use terminal blocks.

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2.13 CONTROL PANEL

- .1 Provide control panel for controlling engine generator unit.
- .2 Provide hinged front door and internal sub-panel.
- .3 Provide combined control, transfer and by-pass panel.
- .4 Provide instrument switching and control as listed in bill of material and identified with check mark on drawing as indicated. Electrical connection of components shown in solid lines on drawing.
- .5 Panel dimensions and layout.
- .6 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 power transfer panel.
- .7 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 to No.2/0 AWG.
- .8 Terminal blocks: CSA approved, clamp type, serrated for positive grip and of tough, non-brittle unbreakable nylon material; maximum two wires per terminal block.
 - .1 Use factory made terminal block jumpers wherever necessary.
- .9 Provide circuit breakers for equipment protection: use fuses where breakers are not applicable.
- .10 Provide top and bottom entry for power and control cables. Provide removable bottom plate 0.45 m x 0.15 m.

2.14 ENGINE-GENERATOR TRANSFORMER 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 following features:
 - .1 Five position function selection switch - Reset, Off, Auto, Test No. Load, Test Full Load.
 - .2 Inverse time-voltage sensors for monitoring normal and emergency 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.
- .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.

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- .5 Test Full Load: simulates normal power failure and runs engine generator set under load. If emergency 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.
 - .1 Crank delay preset at 3-20 sec.
 - .2 Restart preset at 15 sec.
 - .3 Bypass preset at 10 sec.
 - .4 Anticipated fail preset at minimum time setting.
 - .5 Engine start preset at 2 sec.
 - .6 EM - normal preset at 20 sec.
 - .7 Dead bus preset at 2 sec.
 - .8 Cool down preset at 5 min.
 - .6 Equip controller with cycle crank provision to crank engine three time 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 emergency 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.

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- .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.
- .8 Operating temperature -25°C to 50°C.

2.15 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 as indicated. Warning sign to say: "Warning. This generator may start at any time." In addition, provide a warning sign inside the enclosure to say: "Hot, Danger".

2.16 FINISHES

- .1 Clean, finish and paint equipment with smooth and durable finish.
 - .1 Use grey gloss: paint inside of panel white gloss in accordance with The Master Painters Institute (MPI) schedule of paint colours.
 - .2 Provide one half pint can of grey gloss paint for touch up.

2.17 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.

2.18 QUALITY CONTROL

- .1 General: before acceptance, 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.

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- .3 Ensure that engine has run in sufficiently prior to load test, test forms completed, system debugged and recorders connected.
- .2 Product examination: complete mechanical and electrical examination to determine compliance with specification and drawings with respect to materials, workmanship, dimensions and marking.
- .3 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.
- .4 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.

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- .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.
- .5 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.
- .6 Load tests: load test the unit for 24h at full rated load and further 1h at 110% rated load 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.

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- .4 Kilowatts.
 - .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.
 - .13 Vibration displacement.
 - .14 Ambient air temperature inside panel with all doors closed.
 - .7 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.
 - .8 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, 900 mm out from block and at height equal to height of block
 - .2 Locate third thermometer over end of exciter on unit centre line, approximately 150 mm above top of exciter.
 - .3 Take thermometer showing lowest temperature to give true ambient air temperature.

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- .4 Adjust temperature to maintain this thermometer at 40° C during heat test.
- .9 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.
- .10 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.
- .11 Hi-pot tests: perform over potential tests on primary and secondary wiring in accordance with NEMA.
- .12 Additional tests: perform tests, consistent with contract, which Departmental Representative 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 Departmental Representative.
 - .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 and be complete with diagrams and description of test results, deficiencies and corrective action.
 - .1 Ensure test data sheets signed by supplier and Departmental Representative.

2.19 ENCLOSURE

- .1 Sound alternated canopy made with high quality 11 gauge steel.
- .2 Heavy duty construction.
- .3 Powder coat finish – green.
- .4 Stainless steel hardware and fasteners.

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- .5 Ultra silent all weather enclosure with rock wool insulation. The sound attenuation shall limit the sound level to 71 dB at 7 meters distance away from the generator.
- .6 Single eye lighting point.
- .7 Emergency stop – inside and outside.
- .8 Door with window to view control panel.
- .9 Internal lighting and heater.
- .10 Flashing red light and buzzer on the outside of generator enclosure to identify generator alarm or trouble.
- .11 Door, latches and locks.
- .12 Self enclosed exhaust system integrated with generator exhaust system.
- .13 Heaters.
- .14 Load center with pre-wiring to all factory-installed AC loads within the generator set.

3 EXECUTION

3.1 FUEL

- .1 Fill up the fuel tank at full capacity prior to substantial completion and after all tests are completed and accepted by Departmental Representative.

3.2 SOUND PRESSURE READING

- .1 Record the sound pressure levels during site commissioning.

3.3 TRAINING

- .1 Allow 4 hours of maintenance and operation training to the building occupants and maintenance staff.

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1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for automatic load transfer equipment which can monitor voltage on all phases of normal power supply, initiate cranking of standby generator unit, transfer loads and shut down standby unit.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 Section 26 05 01 - Common Work Results - Electrical.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN3-C13-M83 (R1998), Instrument Transformers.
 - .2 CSA C22.2 No.5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE.
 - .3 CSA C22.2 No.178-1978(R2001), Automatic Transfer Switches.
- .2 American National Standards Institute (ANSI)/National Electrical Manufacturers Association (NEMA)
 - .1 ANSI/NEMA ICS 2-2000, Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.

1.4 SYSTEM DESCRIPTION

- .1 Breaker type, Automatic Transfer Switch c/w by-pass isolation. Automatic load transfer equipment to:
 - .1 Monitor voltage of single phase normal power supply.
 - .2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage below preset adjustable limits for adjustable period of time.

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- .3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.
- .4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.
- .5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Include:
 - .1 Make, model and type.
 - .2 Load classification:
 - .1 Motor load: 10kW.
 - .2 Restricted use: resistance and general loads, 0.8pf or higher 35kW.
 - .3 Single line diagram showing controls and relays.
 - .4 Description of equipment operation including:
 - .1 Automatic starting and transfer to standby unit and back to normal power.
 - .2 Test control.
 - .3 Manual control.
 - .4 Automatic shutdown.

1.6 CLOSEOUT SUBMITTALS

- .1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Detailed instructions to permit effective operation, maintenance and repair.

- .3 Technical data:
 - .1 Schematic diagram of components, controls and relays.
 - .2 Illustrated parts lists with parts catalogue numbers.
 - .3 Certified copy of factory test results.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene corrugated cardboard 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 Departmental Representative.

2 PRODUCTS

2.1 MATERIALS

- .1 Instrument transformers: to CAN3-C13.
- .2 Contactors: to ANSI/NEMA ICS2.

2.2 CONTACTOR TYPE TRANSFER EQUIPMENT

- .1 Contact Type Transfer Equipment: to CSA C22.2 No.178.
- .2 Two single-phase contactors mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, motor operated, with CSA enclosure.
- .3 Rated: 120 / 240 V, 60Hz, 400 A. 1 Phase 3 wire, solid neutral.
- .4 Main contacts: silver surfaced, protected by arc disruption means.
- .5 Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance from front of panel.

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- .6 Auxiliary contact: silver plated, to initiate emergency generator start-up on failure of normal power.
- .7 Fault withstand rating: 10 kA symmetrical for 3 cycles with maximum peak value of 10 kA.
- .8 Lever to operate switch manually when switch is isolated.
- .9 Solid neutral bar, rated: 400 A.
- .10 Overlapping neutral contacts on contactor type transfer equipment.
- .11 Switchable neutral pole on circuit breaker type equipment.

2.3 CIRCUIT BREAKER TYPE TRANSFER EQUIPMENT

- .1 Circuit Breaker Type Transfer Equipment: to CSA C22.2 No.5.
- .2 Rated: 120 / 240 V, 60Hz, 400 A, 2 wire, solid neutral.
 - .1 Fault withstand rating: 10 kA symmetrical for 3 cycles with maximum peak value of 10 kA.
 - .2 One normal-single phase molded-case circuit breaker with thermal magnetic, mounted on common base, designed for double throw action, motor operated, mechanically held and interlocked, wall mounted CSA enclosure.
 - .3 One emergency - Single phase moulded-case circuit breaker with thermal magnetic trip, motor operated, and interlocked.
 - .4 Circuit breakers:
 - .1 Trip free in closed position.
 - .2 Interrupting rating: 10 kA symmetrical.
 - .5 Dead front construction with access to relays and controls for inspection and maintenance, and manual operating lever for transfer switch.
 - .6 Auxiliary contact: to initiate emergency generator start-up on failure of normal power.
 - .7 Solid neutral bar, rated: 400 A.
 - .8 Overlapping neutral contacts on contractor type transfer equipment.

- .9 Switchable neutral pole on circuit breaker type equipment.

2.4 CONTROLS

- .1 Selector switch -four position ("Test", "Auto", "Manual", "Engine start").
 - .1 Test position - Normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.
 - .2 Auto position - Normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.
 - .3 Manual position - Transfer switch may be operated by manual handle but transfer switch will not operate automatically and engine will not start.
 - .4 Engine start position - Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.
- .2 Control transformers: dry type with 120V secondary to isolate control circuits from:
 - .1 Normal power supply.
 - .2 Emergency power supply.
- .3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:
 - .1 Voltage sensing: 3 phase for normal power and on one phase only for emergency, solid state type, adjustable drop out and pick up, close differential, 2V minimum undervoltage and over voltage protection.
 - .2 Time delay: normal power to standby, adjustable solid state, 5 to 180s 20s to 10 min.
 - .3 Time delay on engine starting to override momentary power outages or dips, adjustable 0 to 60s delay.
 - .4 Time delay on retransfer from standby to normal power, adjustable 20s to 10 min.
 - .5 Time delay for engine cool-off to permit standby set to run unloaded after retransfer to normal power, adjustable 20s intervals to 10 min.
 - .6 Time delay during transfer to stop transfer action in neutral position to prevent fast transfer, adjustable, 5s intervals to 180s.

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- .7 Frequency sensing, to prevent transfer from normal power supply until frequency of standby unit reaches preset adjustable values.
- .4 Solid state electronic in-phase monitor.

2.5 ACCESSORIES

- .1 Pilot lights to indicate power availability normal and standby, switch position, green for normal, red for standby, mounted in panel.
- .2 Plant exerciser: 168h timer to start standby unit once each week for selected interval but does not transfer load from normal supply. Timer adjustable 0-168h in 15 min intervals.
- .3 Auxiliary relay to provide 4 N.O. and 4 N.C. contacts for remote alarms.
- .4 Instruments:
 - .1 Digital true rms, indicating type 2% accuracy, flush panel mounting:
 - .1 Voltmeter: ac, scale 0 to 300 V.
 - .2 Ammeter: ac, scale 0 to 400 A.
 - .3 Frequency meter: scale 55 to 65 Hz.
 - .5 Voltmeter selector switch: rotary, maintained contacts, panel mounting type, round notched handle, four position, labeled "OFF - Phase A - Phase B".
 - .6 Potential transformers - dry type for indoor use:
 - .1 Ratio: 240 to 120.
 - .2 Rating: 240 V, 60Hz, BIL 5 kV.
 - .3 Accuracy rating: B.
 - .7 Ammeter selector switch: rotary, maintained contacts, panel mounting type, designed to prevent opening of current circuits, round notched handle, two position labeled "OFF - Phase A".
 - .8 Current transformers - dry type for indoor use:
 - .1 Ratio: 300 to 5.
 - .2 Rating: 249 V, 60Hz, BIL 5 kV.

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- .3 Accuracy rating: B.
- .4 Positive action automatic short-circuiting device in secondary terminals.

2.6 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Control panel:
 - .1 For selector switch and manual switch: size 4 nameplates.
 - .2 For meters, indicating lights, minor controls: size 3 nameplates.

2.7 SOURCE QUALITY CONTROL

- .1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested in presence of Departmental Representative.
- .2 Notify Departmental Representative 14 days in advance of date of factory test.
- .3 Tests:
 - .1 Operate equipment both mechanically and electrically to ensure proper performance.
 - .2 Check selector switch, in modes of operation Test, Auto, Manual, Engine Start and record results.
 - .3 Check voltage sensing and time delay relay settings.
 - .4 Check:
 - .1 Automatic starting and transfer of load on failure of normal power.
 - .2 Retransfer of load when normal power supply resumed.
 - .3 Automatic shutdown.
 - .4 In-phase monitor operation.

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3 EXECUTION

3.1 INSTALLATION

- .1 Locate, install and connect transfer equipment.
- .2 Check solid state monitors and adjust as required.
- .3 Install and connect battery remote alarms.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Energize transfer equipment from normal power supply.
- .3 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.
- .4 Set selector switch in "Manual" position and check to ensure proper performance.
- .5 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.
- .6 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.
- .7 Repeat, at 1h intervals, 2 times, complete test with selector switch in each position, for each test.

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EXCAVATING, TRENCHING AND BACKFILLING

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1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 117-[95], Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 136-[96a], Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D 422-[98], Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D 698-[00a], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kNm/m³).
 - .5 ASTM D 1557-[00], Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kNm/m³).
 - .6 ASTM D 4318-[00], Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-[88], Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A3000-[98]-A5-[98], Portland Cement.

- .2 CAN/CSA-A23.1-[00], Concrete Materials and Methods of Concrete Construction.

1.3 DEFINITIONS

- .1 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .2 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

1.4 SUBMITTALS

- .1 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Inform Departmental Representative at least 4 weeks prior to commencing Work, of proposed source of fill materials and provide access for sampling.

1.5 QUALITY ASSURANCE

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Ensure emptied containers are sealed and stored safely.

1.7 PROTECTION OF EXISTING FEATURES

- .1 Existing buried utilities and structures:
 - .1 Prior to commencing excavation Work, notify applicable Departmental Representative or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Department Representative or authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.
 - .2 Confirm locations of buried utilities by careful test excavations.
 - .3 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
 - .4 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before re-routing.
 - .5 Record location of maintained, re-routed and abandoned underground lines.
 - .6 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing buildings and surface features:
 - .1 Conduct, with Department Representative, condition survey of existing underground services, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair to approval of Department Representative.
 - .3 Where required for excavation, coordinate the schedule with the Departmental Representative.

2 PRODUCTS

2.1 MATERIALS

- .1 Type 3 fill: selected material from excavation or other sources, approved by Department Representative for use intended, unfrozen and free from rocks larger than [75] mm, cinders, ashes, sods, refuse or other deleterious materials.

3 EXECUTION

3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 STRIPPING OF TOPSOIL

- .1 Commence topsoil stripping after area has been cleared of grasses and removed from site.
- .2 Strip topsoil to depths as directed by Department Representative. Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Department Representative. Stockpile height not to exceed 2 m.
- .4 Dispose of unused topsoil to location as directed by Department Representative.
- .5 Reused topsoil on the shallow trenches.

3.3 STOCKPILING

- .1 Stockpile fill materials in areas designated by Department Representative. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.

3.4 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Construct temporary Works to depths, heights and locations as directed by Department Representative.

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- .2 During backfill operation:
 - .1 Unless otherwise as indicated or as directed by Department Representative remove sheeting and shoring from excavations.
 - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
 - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.
- .3 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .4 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore water courses as indicated and as directed by Department Representative.

3.5 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Submit for Department Representative's review details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in manner not detrimental to public and private property, or any portion of Work completed or under construction.

3.6 EXCAVATION

- .1 Try to excavate and backfill in the same day.
- .2 For trench excavation, unless otherwise authorized by Department Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

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- .3 Keep excavated and stockpiled materials a safe distance away from edge of trench as directed by Department Representative.
- .4 Restrict vehicle operations directly adjacent to open trenches.
- .5 Dispose of surplus and unsuitable excavated material off site.
- .6 Do not obstruct flow of surface drainage or natural watercourses.
- .7 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .8 Notify Department Representative when bottom of excavation is reached.
- .9 Obtain Department Representative approval of completed excavation.
- .10 Remove unsuitable material from trench bottom to extent and depth as directed by Department Representative.

3.7 BACKFILLING

- .1 Do not proceed with backfilling operations until Department Representative has inspected and approved installations.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding [150] mm compacted thickness. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations.
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within [24] hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 20 m.
- .6 Place unshrinkable fill in areas as indicated.
- .7 Consolidate and level unshrinkable fill with internal vibrators.

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3.8 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 19 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Department Representative.
- .2 Replace damaged gravel as directed by Department Representative.
- .3 Reinststate surfaces to elevation which existed before excavation.
- .4 Reinststate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinststate areas affected by Work as directed by Department Representative.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

3.9 REPAIR

- .1 Contractor shall repair all existing infrastructure damaged during the construction.

END OF SECTION