Specifications

for

Natural Gas Generator Installation

at

Toronto Fire Station #212
8500 Sheppard Ave East, Scarborough ON

Issued for Tender

Consultant:	J+B Engineering Inc. 25 Centurian Drive, Suite 201 Markham, Ontario L3R 5N8
Project No.:	210240
Date:	July 6th, 2023

INDEX

1. GENERAL

1.1. General

1.1.1. The following is a general description of the scope of work to complete the natural gas generator installation. For a detailed description of the technical aspects of the work, refer to the specification sections and contract drawings.

1.1.2. Notify and co-ordinate with Owner, Consultant, and Occupants, whenever work will effect operation of the building.

1.1.3. Contractor to ensure there will be no obstruction to the fire route and must coordinate any obstructions of the bay doors with the station captain during the construction work. Onsite parking for the contractor may be limited. If required, contractor may be asked to park off site at no additional cost to the contract.

1.1.4. Contractor to coordinate with the city, EMS, and the fire station captain regarding access during proposed works. Contractor must call into Toronto Fire Service security daily on days the contractor wishes to work onsite to be granted access. Any issues with coordination of site access will not result in additional costs to the contract.

1.1.5. Contractor to repair any disturbed or damaged waterproofing during installation.

1.1.6. Contractor to locate all underground and above ground utilities and structures within vicinity of proposed works (exterior and interior) to minimize disruption during proposed works.

1.1.7. Once the Contract has been awarded, construction shall be carried out in one continuing operation, unless agreed to and approved by the City and Consultant at the time of such request.

1.1.8. The Contractor and his/her Sub-Contractors shall assume full responsibility for their equipment and all materials required for this project and shall store them in a locked secure area at the end of each days work. No equipment or materials shall be left in an open area unprotected at the end of each days work.

1.1.9. It is the Contractor's total responsibility for the overall performance and completion of the Work. Breakdown of Work by trades is for the convenience of the Contractor only. All trades are required to examine all Sections of the Drawings and Specifications. The Consultants assume no responsibility for the division of Work or for any jurisdictional involvement as a result of such divisions.

1.1.10. Work specified in the specification has been divided into technical sections for the purpose of ready reference. Division of work among subcontractors and suppliers is solely the contractor's responsibility and the Contract Administrator assumes no responsibility to act as an arbitrator to establish subcontract limits between sections or divisions of work.

1.1.11. Prior to Tender submission examine the sites and surrounding areas and be fully informed as to the conditions and limitations under which the work has to be executed. Additional costs will not be entertained with respect to conditions which could reasonably have been ascertained by an inspection of the site prior to tender closing.

1.1.12. During the Contract duration, the Contractor is responsible to correct immediately, any interruption to essential services caused by his/her work whether they occur during the day or night, (business days or weekend and/or holidays). The maximum response time of two (2) hours is required. Other types of interruptions shall be corrected within 24 (twenty four) hours. Failure to respond within the specified time period shall render the Contractor responsible for payment of all changes incurred by the Owner when a third party has to be called to perform the necessary work.

1.1.13. Contractor to provide a 2 year full parts and labor warranty on all workmanship and equipment.

1.1.14. Contractor shall engage Enbridge within five business days of issuance of a Purchase Order for the natural gas station/regulator upgrades. Project delays due to inadequate/delayed coordination with Enbridge will not be accepted. Contractor to pay Enbridge directly for the natural gas station/regulator upgrades. Direct costs for the Enbridge upgrades will be taken from the cash allowance.

1.1.15. All coordination costs (Enbridge, ESA, THES, TFS, EMS, etc…) is to be included in the base bid. No coordination costs or markup will be accepted as contract extras.

1.2. Interpretation of Drawings and Specifications

1.2.1. In the event of any inconsistency or conflict in the contents of the documents, the drawings shall take precedence.

1.2.2. Dimensions on drawings when witnessed by lines and arrow points, shall take precedence over measurements by scale.

1.2.3. Larger scale drawings shall take precedence over those of smaller scale. Supplementary drawings and specifications supersede previous drawings and specifications.

1.2.4. Words, phrases and abbreviations that have a well-known technical or trade meaning shall have that meaning in these specifications and drawings.

1.2.5. In case of discrepancy between the drawings and specifications, figure dimensions on the drawings shall govern, except where the dimension depends on the dimension of a specified product in which case the dimensions of the product shall govern.

1.2.6. All cases of discrepancy shall be referred to the Consultant who shall make decisions in writing. The decisions shall be consistent with the evident meaning and intention of the drawings and specifications and the above paragraphs.

1.2.7. The location of undimensioned fixtures, outlets, conduits, piping, etc., is shown approximate. The Contractor shall confirm actual location(s) to suit job conditions as approved by the Consultant.

1.2.8. Dimensions provided on Contract Drawings and Schedules are approximate. Contractor is to verify dimensions.

1.3. Scope of work

This work shall include, but not necessarily be limited to the short summary below:

1.3.1. Labour, material and equipment to complete work of Contract in conformity with Contract Documents and Construction Schedule.

1.3.2. Permits, inspections, tests, and systems verifications. Demolition, relocation, and removal of existing equipment and services to complete Work.

1.3.3. Delivery, receiving, inspection at time of delivery, unloading, and hoisting of materials and equipment.

1.3.4. Clean-up of materials and garbage on daily basis or as directed, and removal of unused equipment/materials from site.

1.3.5. The contractor shall install a new natural gas life safety generator equipped as per the latest approved CSA standard C282 "Emergency Electrical Power Supply for Buildings" (battery warmer, enclosure heater, enclosure lighting, enclosure panelboard, etc…). The electrical scope of work includes the installation of the standby generator, associated power and control equipment, and the reconnection of the existing building loads to the new generator as shown in the drawing package.

1.3.6. Building temporary power is not anticipated to be required by the contractor during the time of reconnection from existing power distribution system to new power distribution system (less than 4 hour outage). Contractor must provide city PM 10 business day advance notice of any power outages so that temporary power can be arranged at an additional cost if the fire chief deems it necessary to maintain operation at the fire station during the time of reconnection.

1.3.7. Disconnect, remove and/or relocate all existing services and/or equipment and reconnect where necessary.

1.3.8. All disturbed areas are to be restored to match existing conditions or better.

1.3.9. The contractor shall build new generator pad including bollards as specified in the contract drawings complete with restoration of surfaces. The restoration of surfaces indicated on the contract drawings include any disturbed landscape areas.

1.3.10. The contractor shall provide and install all equipment indicated in the contract drawings. The contractor shall set up and commission all systems and provide ready to operate power distribution and life safety emergency power supply system capable to operate under all applicable standards and regulatory requirements. The generator equipment includes but is not limited to the following:

- New natural gas powered generator c/w weatherproof sound rated enclosure. The initial startup of the Gas Generator to be performed by the Generator Manufacturer;

- New monitoring and protection systems for generator operation including remote generator annunciator in the fire hall radio/watch room;

- Connection of the new generator to the existing fire alarm panel (use spare zones) c/w all required programing and updating of labels on remote annunciator(s) for the new connections as required.

- Contractor to retain a manufacturer-authorized service provider to perform an inspection, preventative maintenance including cleaning/lubrication/adjustments of the existing ASCO double bypass ats. The authorized service provider shall also commission the ats with once connected to the new generator system to ensure proper operation of the complete system.

- New led emergency lighting units in the new generator enclosure and in the electrical room around the existing transfer switch to provide a minimum lighting level of 50 lux for 2 hours as per CSA 282.

- Provide and install three new 4' led strip fixtures the existing main electrical room and three new 4' led strip fixtures the existing generator room as a replacement for the existing lighting fixtures within these rooms. Light fixtures locations & height shall be adjusted to suit the new equipment installations/layout.

- Equipment supplier to provide appropriate device settings for all new equipment. Contractor to coordinate with equipment supplier and is responsible for all field verifications required for the supplier to provide the appropriate device settings / coordination.;

1.3.11. The contractor shall supply and install updated lamacoid labels and updated panel schedules for all existing/new electrical equipment impacted by this construction within the electrical room / area of work.

1.3.12. Electrical contractor to provide power and controls as required by mechanical trade.

1.3.13. The contractor shall provide and install complete natural gas piping system for generator from Enbridge modified gas station. The contractor shall pay for and coordinate the installation of the Enbridge modified gas station directly with Enbridge to ensure minimal disruption to the facility.

1.3.14. The contractor shall supply and install fire stopping materials and penetration seals to maintain the required fire-resistance rating of existing/new walls and structures.

1.3.15. The contractor shall remove and dispose of the old Generator and all associated lovers/accessories/systems not being reused. The old generator room shall be cleaned out and repurposed as a general storage room. The contractor shall maintain the existing heater in the room. Refer to the drawing package for the complete demolition scope. Confirm with the City the disposed equipment prior to its removal.

1.4. Working Hours

1.4.1. Normal working hours are from 7:00 a.m. to 4:00 p.m. Monday to Friday.

1.4.2. All noisy and/or odorous work must be completed outside of normal working hours,

1.4.3. Shutdown of services will not be permitted without the approval of Toronto Fire Services and must have a minimum of ten (10) days' notice. Toronto Fire Services the right to stop any disruptive work and request to have this work completed at a different time at no extra cost.

1.5. Commencement and completion Date.

1.5.1. The start date of this contract is immediately upon receipt of purchase order, following the award of the contract. Award is conditional on all approvals, bonding, and insurance being in place. Continuous and progressive operation shall be carried out until the work is completed. The date of substantial performance for construction shall be 24 weeks from the date of the purchase order, and the deemed completion date shall be 29 weeks from the date of the purchase order.

1.5.2. The contractor shall be responsible to provide all the forces necessary to complete the scope of work within the specified period. Any delay work will be subject to penalty as per the liquidated damages clauses noted on Section 5A.

1.6. Record Drawings and As Built Drawings:

1.6.1. Maintain a complete up-to-date set of record drawings and specifications on site throughout the duration of the project.

1.6.2. The project close out documents (including three (3) hard copies of Operation and Maintenance Manuals and CAD as-built drawings) must be submitted by the contractor and accepted by the City of Toronto Project Manager before the certificate of Substantial Performance can be issued by the consultant.

1.7. Reference Material

1.7.1. Maintain a complete up-to-date set of record drawings and specifications on site throughout the duration of the project.

1.7.2. City Policy for Construction Renovation Waste Diversion

END OF SECTION

1. GENERAL

1.1. SECTION INCLUDES

1.1.1. Coordination Work with all Trades.

1.1.2. Scheduled Project Meetings.

1.2. RELATED SECTIONS

1.2.1. Section 01320 - Construction Schedule.

1.2.2. Section 01330 – Submittal Procedures.

1.3. COORDINATION

1.3.1. Coordination of all work between Trades as required to facilitate mutual progress and to prevent conflict between parts of the work.

1.3.2. Ensure that each Trade makes known to the Contractor and other Trades any conditions required to execute its work, its sequence of work requiring cooperative location and installation by other Trades.

1.3.3. Pay cost of extra work caused by and make up time lost as a result of failure to provide on time cooperation, information or items to be fixed or built in.

1.3.4. Cooperate with all inspection companies representatives and all site servicing crews, e.g. natural gas supply company, in the performance of their duties.

1.4. PROJECT MEETINGS

1.4.1. Schedule and administer regular project meetings throughout progress of Work as determined by Project Manager.

1.4.2. Prepare agenda for meetings.

1.4.3. Distribute written notice of each meeting stating time and place to Project Manager, Subcontractors and/or other persons whose presence is required.

1.4.4. Provide physical space and make arrangements for meetings.

1.4.5. Preside at meetings.

1.4.6. Record minutes. List persons attending. Include all proceedings and decisions taken and instructions issued or required. Identify action by parties.

1.4.7. Reproduce and distribute typed copies of minutes within seven days after each meeting and transmit to meeting participants and affected parties not in attendance. Project Manager shall receive two copies.

1.5. PRE-CONSTRUCTION/PRE-AWARD MEETING

1.5.1. The Contractor is responsible for ensuring that his Project Manager and Site Supervisor attend the Pre-Construction/Pre-Award Meeting as outlined in the Agenda.

1.5.2. Agenda to include following:

1.5.2.1. Appointment of official representative of Owner and Contractor who will be responsible as a team for safe construction execution.

1.5.2.2. Review the Work scope.

1.5.2.3. Prepare the detailed construction schedule by Contractor on Owner-specified project scheduling software. Contractor to review schedule with Owner's representative.

1.5.2.4. Review Owner safety policies/issues/expectations.

1.5.2.5. Review the role of each team participant.

1.5.2.6. Review all safety, health, security, environmental issues and concerns and preventative, protective means of minimizing risk or hazard.

1.5.2.7. Review provincial acts and regulations.

1.6. ON-SITE DOCUMENTS

1.6.1. Maintain at job site, a minimum of one copy each of the following:

1.6.1.1. Contract drawings.

1.6.1.2. Specifications.

1.6.1.3. Addenda.

1.6.1.4. Reviewed shop drawings.

1.6.1.5. Change orders.

1.6.1.6. Other modifications to Contract.

1.6.1.7. Field test reports.

1.6.1.8. Copy of approved Work schedule.

1.6.1.9. Manufacturers' installation and application instructions.

1.7. PROGRESS REPORTS

1.7.1. Weekly Construction Report: The Contractor is responsible for submitting, on a weekly basis to the Project Manager, the Weekly Construction Report on the Weekly Construction Report Form.

1.7.2. Weekly Safety Report: The Contractor is responsible for submitting, on a weekly basis to the Project Manager, the Weekly Safety Report on The Weekly Safety Report Form. The Tool Box Meeting Reporting Sheet is to be complete and attached to the Weekly Safety Report when Tool Box Meetings are held.

1.7.3. Project Schedule: Contractor to update Project Schedule on a weekly basis and review with Project Manager.

END OF SECTION

1. GENERAL

1.1. Construction Schedule

1.1.1 Within ten days of Contract award, submit a proposed schedule showing dates for:

1.1.1.1 Shop drawings, material lists and samples, and deliveries.

1.1.1.2 Commencement and completion of the Work of each section in working days.

1.1.1.3 Commencement and completion dates of the total contract work.

1.1.1.4 Total number of weeks of construction.

1.1.2 At the request of the Consultant, provide a labour "breakdown", showing:

1.1.2.1 Total work force,

1.1.2.2 Categories of workmen, and

1.1.2.3 Daily hours of work.

1.1.3 Provide updated work schedules at the project meetings. These shall show individual major activities on a week-by-week basis.

1.1.4 Interim reviews of Work progress will be conducted by the Consultant, and the schedule will be updated by the Contractor and Consultant.

1.1.5 As requested, provide narrative reports to define:

1.1.5.1 Problem areas, anticipated delays, and their impact on the schedule,

1.1.5.2 Corrective action recommendation and their effects, and

1.1.5.3 The effects of changes on the schedules of others.

1.1.6 The Contractor will be held responsible for any delays of final completion which were within his control.

1.1.7 If the Contractor makes default or delay in commencing or diligently executing the work to the satisfaction of the Owner, the Consultant may, after suitable written notice, take the work out of the contractor's hands, and may employ such means as he sees fit to complete the Work. Any excess in cost which the Owner may incur in order to have the work completed as indicated, will be recoverable from the original Contractor in default.

END OF SECTION

1. GENERAL

1.1. Section Includes

1.1.1. Documents, Certificates and Transcripts.

1.2. Related Sections

1.2.1. Section 01310 - Project Management and Coordination.

1.2.2. Section 01320 - Construction Progress Documentation.

1.2.3. Section 01340 - Shop Drawings, Product Data, Samples.

1.2.4. Section 01450 - Quality Control.

1.2.5. Section 01705 - Health and Safety.

1.2.6. Section 01780 - Closeout Submittals.

1.3. Before Commencement of Work

1.3.1. Obtain the documents listed under this heading and supply to Project Manager within the time stipulated in the Specification, or if not so stipulated, before issue of the first Certificate.

1.3.2. Insurance Policies required under General Conditions of Contract Article Insurance Requirements.

1.3.3. Certificates of good standing from the Worker's Compensation Board for the Contractor.

1.3.4. Shop Drawing Schedule.

1.3.5. Permits required for work of Division 15 - Mechanical Trades and Division 16 - Electrical Trades.

1.3.6. Permits for temporary structures, hoists, etc.

1.3.7. Contractor signed Clearance Certificate as acceptance of Owner's Work Control Procedures - see Section 01705 – Supplementary Conditions

1.3.8. Construction Schedule.

1.4. Documents and Action Required During Progress of Contract

1.4.1. Perform the action and/or obtain the documents listed under the heading and supply to the Project Manager, within the time stipulated in the Specification or, if not so stipulated, as soon as possible following Project Manager's request.

1.4.1.1. Progress Payment Certificate accompanied by Progress Invoice.

1.4.1.2. Periodic Work Observation.

1.4.1.3. Documents specified under Section 01340 and Section 01450.

1.4.1.4. Any permits required from Authorities having jurisdiction enabling Owner to occupy the work (or part thereof) prior to substantial performance of the Contract.

1.4.1.5. Record Drawings:

1.4.1.5.1. Project Manager will provide two sets of white prints for record drawing purposes. Obtain "as-built" drawings from Trades and consolidate in a manner to the satisfaction of the Project Manager.

1.4.1.5.2. Maintain project "as-built" record drawings and record accurately significant deviations from Contract Documents caused by site conditions and changes ordered.

1.4.1.5.3. Mark "as-built" changes in red coloured ink.

1.4.1.5.4. Record following information:

1.4.1.5.4.1. Depth of various elements of foundation in relation to finished floor level.

1.4.1.5.4.2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvement, including but not limited to: - exact location of connections from off-site services - exact location of water and sanitary sewer tie-ins - exact location of natural gas line on site at property line - exact location of product piping - exact location of tank top elevation of each storage tank - exact location and elevation of each yard conduit e.g. conduit to yard lights, pumps, canopy and intercom.

1.4.1.5.4.3. Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.

1.4.1.5.4.4. Field changes of dimension and detail.

1.4.1.5.4.5. Changes made by Change Order or Supplementary Instructions.

1.4.1.6. At completion of project and prior to final inspection, neatly transfer "as-built" notations to second set and submit both sets to Project Manager or duly authorized Engineering Consultant.

1.4.1.7. Clearly mark each of the Project record Drawings, "Project Record Copy".

1.4.1.8. Final completion of Project Record Drawings shall be a condition precedent to the issuance of Project Manager's final payment certificate.

1.5. Documents and Action Required at Completion

1.5.1. Perform the action and/or obtain the documents listed under this heading during the Lien Act period following the issue of the Notice of Completion and Certificate of Acceptance. Delivery of these documents is a condition precedent to the issue of a

Certificate for Payment of Holdback Monies, Article 6, of the General Conditions of the Contract.

1.5.1.1. Certificate of Good Standing from the Worker's Compensation Board for the Contractor and all Subcontractors.

1.5.1.2. Operations and Maintenance Data Manual as called for in Section 01780.

1.5.1.3. Record Drawings as specified in this Section.

1.5.1.4. Operating and Maintenance Instructions and Brochures:

1.5.1.4.1.Mechanical.

1.5.1.4.2.Electrical.

1.5.1.5. Inspection Certificates required by Provincial, Municipal and other Authorities having jurisdiction.

1.5.1.6. Provide Owner with extra materials for future maintenance use, as specified in Trade Sections of the Specification.

END OF SECTION

1. GENERAL

1.1. Section Includes

1.1.1. Shop drawings, product data and samples.

1.2. Related Sections

1.2.1. Section 01320 - Construction Schedule

1.2.2. Section 01330 – Submittal Procedures.

1.2.3. Section 01450 - Quality Control.

1.2.4. Section 01780 - Operations and Maintenance Data.

1.3. Administrative

1.3.1. As soon as possible after award of Contract but prior to submission of the first application for payment, prepare and submit to Project Manager for comment, a schedule establishing dates for the submission and return of Shop Drawings.

1.3.2. Submit to Project Manager Shop Drawings, Product Data and Samples, listed for review and specified in separate Sections, with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

1.3.3. Work affected by submittal shall not proceed until review is complete.

1.3.4. Shop Drawings or diagrams which do not bear the Project Manager's signature, shall not be used for construction.

1.3.5. Present shop drawings, product data, samples and mock-ups in SI Metric units.

1.3.6. Where items or information is not produced in SI Metric units converted values are acceptable.

1.3.7. Submission and subsequent review of Shop Drawings constitute a service and does not entitle the supplier or subcontractor to the right to remuneration until the materials are supplied and installed on the Site in accordance with the Contract.

1.3.8. Keep one reviewed copy of each submission on site.

1.4. Shop Drawings

1.4.1. The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor, Subcontractor, Supplier or Distributor to illustrate details of a portion of Work.

1.4.2. Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which

adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

1.4.3. Allow 15 days for Project Manager's review of each submission exclusive of inter-office transmittal and mail periods.

1.4.4. Accompany submissions with transmittal letter containing:

1.4.4.1. Date.

1.4.4.2. Project title and number.

1.4.4.3. Contractor's name and address.

1.4.4.4. Name and address of:

1.4.4.4.1.Subcontractor.

1.4.4.4.2.Supplier.

1.4.4.4.3.Manufacturer.

1.4.4.5. Details of appropriate sections of the Specification or drawing number as applicable.

1.4.5. Submit Shop Drawings to Authorities having jurisdiction and obtain approval.

1.4.6. On Shop Drawings for fire rated assemblies show required fire rating and ULC design numbers.

1.4.7. Submit Shop Drawings in the form requested on a minimum of six white prints. Provide two additional prints for structural, mechanical and electrical items. After review, the Project Manager will retain one white print and return the others to the Contractor. On completion of the revisions, one complete set of new white prints of Shop Drawings used for construction shall be supplied to the Project Manager, unless otherwise specified. No corrections or other changes shall be made on the original prints, but on the original transparency for reprinting and issue.

1.4.8. Any equipment installed without approved Shop Drawings where requested shall be removed at Contractor's expense if required by Project Manager.

1.4.9. The review of shop drawings by the Project Manager is for the sole purpose of ascertaining conformance with general concept. This review shall not mean that the Project Manager 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. 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.

1.5. Product Data

1.5.1. Certain Specification Sections specify that manufacturer's standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data will be accepted in lieu of Shop Drawings.

1.5.2. The above will be accepted if they conform to the following:

1.5.2.1. Delete information which is not applicable to project.

1.5.2.2. Supplement standard information to provide additional information applicable to project.

1.5.2.3. Show dimensions and clearances required.

1.5.2.4. Show performance characteristics and capacities.

1.5.2.5. Show wiring diagrams and controls.

1.5.2.6. Add to standard sheet the Project identification data.

1.6. Samples

1.6.1. Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.

1.6.2. Where colour, pattern or texture is critical, submit full range of samples.

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

1.7. Contractor's Responsibility

1.7.1. Check and certify as correct Shop Drawings, Product Data and Samples prior to submission.

1.7.2. Verify:

1.7.2.1. Field measurements.

1.7.2.2. Field construction criteria.

1.7.2.3. Catalogue numbers and similar data

1.7.3. Coordinate each submittal with requirements of work and Contract Documents.

1.7.4. Notify Project Manager in writing at time of submission of any deviations in submittal from requirements of Contract Documents.

1.7.5. Stamp, initial or sign each Drawing, certifying approval of submission, verification of field dimensions and measurements and compliance with Contract Documents.

1.7.6. After Project Manager's review, distribute copies as follows.

1.7.6.1. Job site file (2 copies).

1.7.6.2. Record documents file.

1.7.6.3. Subcontractors

1.7.6.4. Suppliers.

1.7.6.5. Fabricator.

1.7.6.6. Authorities having jurisdiction, where required by Codes and/or By-laws, i.e. structural steel and sprinklers.

1.7.6.7. Data book where applicable.

1.7.7. Distribute samples as directed by the Project Manager.

1.7.8. Ensure that all samples are approved by authorities having jurisdiction, supplier for correct application in Project, and other parties such as Owner, in time to permit approval prior to ordering of quantity delivery to site.

END OF SECTION

1. GENERAL

1.1. Associations

1.1.1. AASHTO - American Association of State Highway and Transportation Officials, 444 N Capitol Street N.W., Suite 249, Washington, D.C., U.S.A. 20001 URL http://www.aashto.org

1.1.2. ACEC Association of Consulting Engineers of Canada, 130 Albert Street, Ottawa, ON. K1P 5G4 URL http://www.acec.ca

1.1.3. ANSI - American National Standards Institute, 11 West 42nd Street, New York, New York, U.S.A. 10036 URL http://www.ansi.org

1.1.4. ASHRAE -American Society of Heating, Refrigeration and Air-Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, Georgia, U.S.A. 30329 URL http://www.ashrae.org

1.1.5. ASTM - American Society for Testing and Materials, 100 Barr Harbor Drive West, Conshohocken, Pennsylvania 19428-2959 URL http://www.astm.org

1.1.6. AWMAC - Architectural Woodwork Manufacturers Association of Canada, 516 4 Street West, High River, Alberta T1V 1B6 URL http://www.awmac.com

1.1.7. AWPA -American Wire Producer's Association, 6232 Roudsby, Alexandria, VA U.S.A. 22315-5285 URL http://www.awpa.org

1.1.8. CCA Canadian Construction Association,75 Albert St., Suite 400 Ottawa, Ontario, K1P 5E7 URL http://www.cca-acc.com

1.1.9. CCDC Canadian Construction Documents Committee, Refer to ACEC, CCA, CSC or RAIC

1.1.10. CITC Canadian Institute of Timber Construction, 200 Cooper Street, Ottawa, Ontario K2P 0G1

1.1.11. CGA - Canadian Gas Association, 20 Eglinton Avenue West, Suite 1305, Toronto, Ontario M4R 1K8 URL http://www.cga.ca

1.1.12. CGSB - Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 URL http://w3.pwgsc.gc.ca/cgsb

1.1.13. CISC - Canadian Institute of Steel Construction, 201 Consumers Road, Suite 300, Willowdale, Ontario M2J 4G8 URL http://www.buildingweb.com/CISC

1.1.14. CLA -Canadian Lumbermen's Association, 27 Goulburn Avenue, Ottawa, Ontario, K1N 8C7 URL http://www.cla.ca.ca

1.1.15. CNLA -Canadian Nursery Landscape Association, RR #4, Stn. Main, 7856 Fifth Street, Milton, Ontario. L9T 2X8 URL http://www.canadanursery.com

1.1.16. CRCA - Canadian Roofing Contractors Association, 155 Queen Street, Suite 130C, Ottawa, Ontario K1P 6L1 URL http://www.roofingcanada.com

1.1.17. CSA - Canadian Standards Association International, 178 Rexdale Blvd., Toronto, Ontario M9W 1R3 URL http://www.csa-international.org

1.1.18. CSC - Construction Specifications Canada, 100 Lombard Street, Suite 200, Toronto, Ontario M5C 1M3 URL http://www.csc-dcc.ca

1.1.19. CSDFMA - Canadian Steel Door and Frame Manufacturing Association One Yonge Street, Suite 1400, Toronto, Ontario M5E 1J9

1.1.20. CSPI - Corrugated Steel Pipe Institute, 201 Consumers Road, Suite 306, Willowdale, Ontario M2J 4G8

1.1.21. CSSBI - Canadian Sheet Steel Building Institute, 652 Bishop St. N., Unit 2A, Cambridge, Ontario N3H 4V6 URL http://www.cssbi.ca

1.1.22. CUFCA Canadian Urethane Foam Contractor's Association

1.1.23. CWC - Canadian Wood Council, 1400 Blair Place, Suite 210, Ottawa, Ontario K1J 9B8 URL http://www.cwc.ca

1.1.24. EC - Environment Canada, Conservation and Protection, Ottawa, Ontario KIA 0H3 URL http://www.ec.gc.ca

1.1.25. EEMAC - Electrical and Electronic Manufacturers' Association of Canada, 5800 Explorer Drive, Suite 200, Mississauga, Ontario L4W 5K9 URL http://www.electrofed.ca

1.1.26. EIMA EIFS Industry Manufacturer's Association, 3000 Corporate Center Drive, Suite 270, Morrow, Georgia U.S.A. 30260 URL http://www.eifsfacts.com

1.1.27. FCC - Fire Commissioner of Canada, Place du Portage, Phase II, 165 rue Hotel de Ville, Hull Quebec K1A 0J2 URL http://www.hrdc-drhc.gc.ca

1.1.28. MPI - The Master Painters Institute, 4090 Graveley Street, Burnaby, BC V5C 3T6 URL http://www.paintinfo.com

1.1.29. NABA - National Air Barrier Association, 400-283 Bannatyne Avenue, Winnipeg, Manitoba R3B 3B2

1.1.30. NEMA - National Electrical Manufacturers Association,1300 N. 17th Street, Suite 1847, Rosslyn, Virginia 22209 URL http://www.nema.org

1.1.31. NFPA - National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101Quincy, Massachusetts, U.S.A. 02269-9101 URL http://www.nfpa.org

1.1.32. NLGA - National Lumber Grades Authority, 406 First Capital Place, New Westminster, B.C. V3M 6G2

1.1.33. NRC - National Research Council, Montreal Road, Ottawa, Ontario K1A 0S2 URL http://www.nrc.gc.ca

1.1.34. RAIC Royal Architectural Institute of Canada, 55 Murray Street, Suite 330, Ottawa, Ontario, K1N 5M3 URL http://www.raic.org

1.1.35. SCC - Standards Council of Canada, 200 Albert Street, Suite 2000, Ottawa, Ontario K1P 6N7 URL http://www.scc.ca

1.1.36. TTMAC - Terrazzo, Tile and Marble Association of Canada, 30 Capston Gate, Unit 5 Concord, Ontario L4K 3E8 URL http://www.ttmac.com

1.1.37. UL - Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, Illinois, U.S.A. 60062 URL http://www.ul.com

1.1.38. ULC - Underwriters' Laboratories of Canada, 7 Crouse Road, Toronto, Ontario M1R 3A9 URL http://www.ulc.ca

END OF SECTION

1. GENERAL

1.1. Section Includes

1.1.1. Inspection and testing, administrative and enforcement requirements.

1.1.2. Tests and mix designs.

1.1.3. Mill tests.

1.1.4. Equipment and system adjust and balance.

1.2. Related Sections

1.2.1. Section 01350 - Submittals.

1.2.2. Section 01340 - Shop Drawings, Product Data, Samples.

1.2.3. Section 01610 - Basic Product Requirements.

1.2.4. Section 01780 - Closeout Submittals

1.3. Quality Control

1.3.1. Provide a system of quality control to ensure that the minimum standards specified herein are attained.

1.4. Inspection

1.4.1. Bring to the attention of the Project Manager any defects in the works or departures from the Contract Documents which may occur during construction. The Project Manager will decide upon corrective action and state his recommendations in writing.

1.4.2. The Project Manager's general review during construction and inspection by independent inspection and testing agencies are both undertaken to inform the Owner of the Contractor's performance and shall in no way augment the Contractor's quality control or relieve him of contractual responsibility.

1.5. Appointment and Payment

1.5.1. Unless otherwis e specified, the Project Manager may appoint an Inspection and Testing Agency on behalf of the Owner to carry out the inspection and testing specified in various sections of the Specifications.

1.5.2. Where so specified, payment for the services of the Inspection and Testing Agency will be made by the Owner.

1.5.3. The Contractor shall be responsible for and pay for the following:

1.5.3.1. Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.

1.5.3.2. Inspection and testing performed exclusively for the Contractor's convenience.

1.5.3.3. Testing, adjusting and balancing of conveying systems, mechanical and electrical equipment and systems.

1.5.3.4. Mill tests and certificates of compliance.

1.5.3.5. Tests specified to be carried out by Contractor.

1.5.3.6. Additional tests specified in paragraph 1.5.4.

1.5.4. Where tests or inspections by designated testing laboratory reveal work not in accordance with Contract requirements, Contractor shall pay costs for additional inspections or tests as maybe required to verify acceptability of corrected work.

1.6. Access to Work

1.6.1. Allow Project Manager and inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

1.6.2. Co-operate to provide reasonable facilities for such access.

1.6.3. Notify appropriate agency and Project Manager in advance of requirement for tests, shop fabrication, field erection and other phases of the Work in order that attendance arrangements can be made.

1.6.4. Failure to meet these requirements may be cause for the Project Manager to classify the work as defective.

1.7. Procedures

1.7.1. Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

1.7.2. Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7.3. Furnish labour and facilities to make good all work disturbed by inspections and testing.

1.7.4. Pay all costs in connection with Contractor's related work.

1.7.5. Pay costs for uncovering and make good work that is covered before required inspection and testing is completed and approved.

1.8. Rejected Work

1.8.1. Where factual evidence exists that defective workmanship has occurred or that work has been carried out incorporating defective materials, the Project Manager may have tests, concrete cores, inspections or surveys performed, analytical calculation of structural strength made and the like in order to help determine whether the work must be replaced. Tests, inspections or surveys carried out under these circumstances will be made at the Contractor's expense, if the work proves defective.

1.8.2. All testing shall be conducted in accordance with the requirements of the Provincial Building Code, except where this would, in the Project Manager's opinion, cause undue

delay or give results not representative of the rejected material in place. In this case, the tests shall be conducted in accordance with the standards given by the Project Manager.

1.8.3. Materials or workmanship which fail to meet specified requirements may be rejected whenever found at any time prior to final acceptance of the work regardless of previous inspection. If rejected, defective materials or work incorporating defective materials or workmanship shall be promptly removed and replaced or repaired to the satisfaction of the Project Manager, at no expense to the Owner.

1.9. Tests and Mix Designs

1.9.1. Furnish test results and mix designs as may be requested.

END OF SECTION

1. GENERAL

1.1. Section Includes

1.1.1. Temporary utilities.

1.1.2. Temporary barriers and enclosures.

1.2. Installation and Removal

1.2.1. Provide temporary utilities controls in order to execute work expeditiously.

1.2.2. Remove from site all such work after use.

1.3. Access

1.3.1. Provide and maintain access roads, sidewalks, ramps, stairs, ladders and other such means of access to the Work as may be required.

1.4. Temporary Heating and Ventilation

1.4.1. Provide temporary heating required during construction period, including attendance, maintenance and fuel.

1.4.2. Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

1.4.3. Provide temporary heat and ventilation in enclosed areas as required to:

1.4.3.1. Facilitate progress of Work.

1.4.3.2. Protect Work and products against dampness and cold.

1.4.3.3. Prevent moisture condensation on surfaces.

1.4.3.4. Provide ambient temperatures and humidity levels for storage, installation and curing of materials.

1.4.3.5. Provide adequate ventilation to meet health regulations for safe working environment.

1.4.3.6. Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

1.4.4. Maintain temperatures of minimum 15 degrees C in areas where construction is in progress.

1.4.5. Protect floor by approved means for an area 1500mm beyond the heating unit on all sides. Take care in servicing and refueling the unit to ensure that no damage by staining results to finished floors.

1.4.6. Where frost might penetrate floor slabs, footings or any parts of the building not specifically designed to withstand frost penetration, provide temporary heat or adequate protection by means of straw or insulation during freezing weather.

1.5. Temporary Power and Light

1.5.1. Provide and pay for temporary power during construction for temporary lighting and operating of power tools for the use of all Trades.

1.5.2. Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.

1.5.3. Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors is adequate for the type of work being performed.

1.6. Fire Protection

1.6.1. Provide and maintain temporary fire protection equipment during performance of Work as required by governing codes, regulations and bylaws.

1.6.2. Burning rubbish and construction waste materials is not permitted on site.

1.7. Hoardings and Barricades

1.7.1. Erect and maintain fencing and barricades in accordance with the requirements of the Authority having jurisdiction and as directed by the Owner to protect the public and workmen from injury.

1.7.2. Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.7.3. Provide all necessary temporary weathertight security enclosures, doors, fastenings and keys. The building shall be properly closed and locked at nights, Sundays, holidays and other occasions when the work is not in progress.

1.7.4. Provide all wind and weather barriers and enclosures and heat required for workmen and materials so that work and steady progress of the job shall continue at all times.

1.8. Utility Costs

1.8.1. Costs for electricity, water, heating fuel including natural gas and heating oil, consumed during construction shall be borne by the Contractor, unless specified otherwise.

END OF SECTION

1. GENERAL

1.1. Section Includes

1.1.1. Product quality, availability, storage, handling, protection, and transportation.

1.1.2. Manufacturer's instructions.

1.1.3. Quality of Work, coordination and fastenings.

1.1.4. Existing facilities.

1.2. Related Sections

1.2.1. Section 01450 - Quality Control.

1.3. Reference Standards

1.3.1. Within text of specifications, reference may be made to reference standards contained in Section 01420 References.

1.3.2. Conform to these standards, in whole or in part as specifically requested in specifications.

1.3.3. If there is question as to whether any product or system is in conformance with applicable standards, Project Manager reserves right to have such products or systems tested to prove or disprove conformance.

1.3.4. The cost for such testing will be born by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.3.5. Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

1.4. Quality

1.4.1. Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.

1.4.2. Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

1.4.3. Should any dispute arise as to quality or fitness of products, decision rests strictly with Project Manager based upon requirements of Contract Documents.

1.4.4. Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

1.4.5. Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.5. Availability

1.5.1. Prior to commencement of Work, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Project Manager of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

1.5.2. In event of failure to notify Project Manager at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Project Manager reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.6. Storage, Handling and Protection

1.6.1. Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

1.6.2. Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

1.6.3. Store products subject to damage from weather in weatherproof enclosures.

1.6.4. Store cementitious products clear of earth or concrete floors, and away from walls.

1.6.5. Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

1.6.6. Store sheet materials, lumber, etc. on flat, solid supports and keep clear of ground. Slope to shed moisture.

1.6.7. Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

1.6.8. Remove and replace damaged products at own expense and to satisfaction of Project Manager.

1.6.9. Touch-up damaged factory finished surfaces to Project Manager's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.7. Transportation

1.7.1. Pay costs of transportation of products required in performance of Work.

1.7.2. Transportation cost of products supplied by Owner will be paid for by Owner. Unload, handle and store such products.

1.8. Manufacturer's Instructions

1.8.1. Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

1.8.2. Notify Project Manager in writing, of conflicts between specifications and manufacturer's instructions, so that Project Manager may establish course of action.

1.8.3. Improper installation or erection of products, due to failure in complying with these requirements, authorizes Project Manager to require removal and re-installation at no increase in Contract Price or Contract Time.

1.9. Quality of Work

1.9.1. Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Project Manager if required Work is such as to make it impractical to produce required results.

1.9.2. Do not employ anyone unskilled in their required duties. Project Manager reserves right to require dismissal from site, workers deemed incompetent or careless.

1.9.3. Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Project Manager, whose decision is final.

1.10. Co-ordination

1.10.1. Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

1.10.2. Be responsible for coordination and placement of openings, sleeves and accessories.

1.11. Concealment

1.11.1. In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

1.11.2. Before installation, inform Project Manager if there is interference. Install as directed by Project Manager.

1.12. Remedial Work

1.12.1. Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

1.12.2. Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.13. Location of Fixtures

1.13.1. Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

1.13.2. Inform Project Manager of conflicting installation. Install as directed.

1.14. Fastenings

1.14.1. Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

1.14.2. Prevent electrolytic action between dissimilar metals and materials.

1.14.3. Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

1.14.4. Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

1.14.5. Keep exposed fastenings to a minimum, space evenly and install neatly.

1.14.6. Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.15. Fastenings - Equipment

1.15.1. Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

1.15.2. Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

1.15.3. Bolts may not project more than one diameter beyond nuts.

1.15.4. Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.16. Powder Activated Tools

1.16.1. The use of powder activated fasteners is prohibited without the written authorization of the Project Manager.

1.16.2. Where such authority is given, it will be for low velocity type powder activated fasteners and for horizontal application only.

1.16.3. The manufacturer of the equipment selected shall send a representative to the site to demonstrate the equipment prior to its use, and this representative shall make periodic inspections to ensure compliance with instructions issued by him and correct application of material. In all cases a shield shall be used where fasteners are to be applied to concrete. The use of fasteners in precast concrete is to be avoided if possible as there is an increased tendency to shatter surfaces.

1.16.4. Fasteners shall be not nearer than 63mm to the edge of any cast-in-place formed concrete member.

1.16.5. Under no circumstances shall such fasteners be used on concrete members less than 75mm in thickness.

1.16.6. Such fasteners shall not be used in areas where corrosion can take place, for instance due to high humidity or condensation.

1.16.7. Generally use support anchorage of cast-in-place type set into concrete forms prior to pouring of concrete, or self-drilling type. When drilling upward, use jig to hold drill steady and plumb.

1.16.8. Provide pull-out tests on anchors, or otherwise test to ensure anchorage is sufficient for the particular application including a minimum safety factor of seven. Provide evidence of such tests if requested.

1.16.9. Submit samples of proposed anchoring or hanging devices with technical data and test data.

1.17. Protection of Work in Progress

1.17.1. Prevent overloading of any part of building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of Project Manager.

1.18. Existing Utilities

1.18.1. When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, or pedestrian and vehicular traffic.

1.18.2. Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

END OF SECTION

1. GENERAL

1.1. RELATED SECTIONS

1.1.1. Section 01350 - Submittals.

1.2. REFERENCES

1.2.1. Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.2.2. Canadian Standards Association (CSA)

1.2.2.1. CSA S350-M1980, Code of Practice for Safety in Demolition of Structures.

1.2.2.2. Provincial Occupational Health and Safety Regulations.

1.2.2.3. Federal legislation pertaining to WHMIS (Worksite Hazardous Materials Information System).

1.2.2.4. Provincial Workers' Compensation Acts.

1.3. OVERVIEW - SAFETY AND LOSS CONTROL

1.3.1. The philosophy in regards to safety and loss control is as follows:

1.3.1.1. The health and safety of employees are of paramount importance in the conduct of our business.

1.3.1.2. Risks inherent in all operations must be managed to prevent occupational injuries and illness.

1.3.1.3. All levels of management are responsible and are held accountable for providing a safe work environment with proper equipment, procedures, training and programs.

1.3.1.4. All employees must accept their responsibility to comply with health and safety legislation and with established rules and procedures. Employees are expected to work in a manner which safeguards themselves and co-workers.

1.3.1.5. We expect excellence in health and safety performance to be achieved through the support and active participation of all employees.

1.3.2. Contractor shall develop its own equivalent philosophy statements.

1.3.3. Contractor is required to develop and administer its own safety program.

1.4. RULES AND REGULATIONS

1.4.1. From time to time, dependent on certain conditions and/or circumstances, a requirement may arise for the Contractor to provide a Safety Method Statement prior to a specified

task being commenced. In such an event the Contractor would be required to co-operate fully with such requirements.

1.4.2. Proper and reasonable care must be taken to protect the Work, property and personnel of Contractor, Owner and others against accident or injury. The entire Work is the responsibility of Contractor who will be held accountable for all damage or injury that may occur to the Work or to individuals or property to the extent required by law and the Contract Documents until the Work is formally accepted by the Owner.

1.4.3. Contractor's and its sub-contractor's personnel found impaired on the job due to intoxication or the influence of drugs shall be subject to instant dismissal.

1.4.4. Employees of Contractors or of its sub-contractors performing work on a project site shall not be less than eighteen (18) years of age.

1.5. PROTECTIVE EQUIPMENT

1.5.1. It shall be the responsibility of Contractor to furnish all tools and equipment necessary to carry out the work safely. Contractor is responsible for all maintenance, service and supplies for its equipment.

1.5.2. Contractor shall provide and maintain all barricades, guard fences and temporary warning lights at all places subject to traffic in accordance with governing safety regulations.

1.5.3. All Contractor's and sub-contractor's employees working on a site (outside) must wear a hard hat. Contractor shall have 5 extra hard hats on site at all times for visitors to the site.

1.5.4. The wearing of CSA approved Grade II footwear is mandatory. This excludes any steel toed running shoes.

1.5.5. All employees of Contractor and sub-contractor shall wear or use such personal protective clothing, equipment or devices as necessary for a worker's protection from the particular hazard to which the worker may be exposed.

1.5.5.1. All workers are to wear long pants.

1.5.5.2. All workers are to wear a shirt.

1.5.5.3. All workers are to wear gloves when handling rough materials.

1.5.6. The Contractor's employees shall wear adequate eye protection when welding, sandblasting, grinding and chipping.

1.5.7. Workers require hearing protection when exposed for a significant period of time (10 minutes) to noise in excess of 85 dBa.

1.5.8. All workers subject to the hazard of falling more than 3 metres shall wear an approved safety harness secured to the structure unless the Contractor is engaged in connecting structural members of a skeleton structure.

1.5.9. Life jackets shall be worn where appropriate.

1.5.10. In a situation where combustible gases or vapour can accumulate (i.e working in or around existing tanks) there may be a periodic verification with an appropriate

monitoring device (Combination Gas Monitor) prior to commencement of work and in some case during the work according to need.

1.5.11. Enclosed spaces such as a storage tank must be monitored with an Oxygen deficiency Monitor to ensure adequate oxygen supply prior to the entrance by workers. This is in addition to the other safety precautions required for this type of work.

1.5.12. Contractor shall have on the project site at all times, one 10lbs fire extinguisher available to all personnel. Contractor shall ensure each welding machine is equipped with one 20lbs minimum capacity dry chemical fire extinguisher. In addition, Contractor shall supply one 30lbs minimum capacity dry chemical fire extinguisher at the point of welding, grinding or cutting operation if it is remote from the machine. Extinguishers shall be maintained in good operating condition.

1.6. PREVENTIVE/PRECAUTIONARY PROCEDURES.

1.6.1. The area where work is being done by the Contractor shall be barricaded from access by the Public with snow fencing. The Construction Sign with the following message will be clearly displayed:

CONSTRUCTION AREA.
HARD HAT AND SAFETY SHOE AREA.
NO SMOKING AREA.

1.6.2. Contractor's Work Sites must be kept clean and free of equipment and debris which may create fire hazard, pollution concern or personnel hazard. Unless specified otherwise, waste materials shall be removed by the Contractor and placed in disposal containers.

1.6.3. It is important that all areas where workers are present or circulating be adequately illuminated.

1.6.4. The Contractor shall use precaution when working on electrical equipment by isolating all electrical lines prior to servicing.

1.6.5. The Contractor shall isolate and blank the product lines when doing hot work on all such lines.

1.6.6. All underground structures shall be identified by the Contractor prior to start of job with particular emphasis on electrical lines and gas lines, whose accidental rupture could cause serious injury. The Contractor must use extreme care during mechanical excavation to avoid damage to underground operating facilities. Hand probing shall be used in proximity to known obstructions.

1.6.7. Particular attention should be given to the removal and disposal of old tanks. Removal of flammable vapours and liquids is required prior to disposal.

1.6.8. The Contractor shall shore all excavations in compliance with Provincial O H & S Regulations.

1.6.9. All excavations deeper than 150mm shall be barricaded. All excavations greater than 300mm deep (especially area of tank installation) shall be barricaded with snow fencing. Also when doing island or apron work, this area will be secured by snow fencing.

1.6.10. The Contractor shall minimize the use of ladders and minimize the use of scaffolding. If ladders are used for continuous access they should be tied off.

1.6.11. When using scaffolding above a height of 2400mm the scaffolding shall have guardrails and kick plates. Scaffolding is to be used whenever removing a building overhang.

1.6.12. The Contractor must identify any precautions he will be required to take in avoiding the hazards of overhead electrical lines.

1.6.13. Use of cranes should have an experienced operator for overhead work and a signalman.

1.6.14. Welding ground returns must be placed on the material being welded and closely adjacent of the arc, unless an alternative system has been approved by the Project Manager.

1.7. COMMUNICATIONS/WORK FOLLOW-UP/TRAINING

1.7.1. Safety policies/issues will be discussed at the pre-construction/pre-award Meeting (see Section 01310).

1.7.2. On a weekly basis Contractor representative shall conduct "tool box" meeting(s) with all Contractor employees to discuss safety concerns, safety promotion tapes, etc. Expected duration is 15 - 30 minutes. The Owner shall assist by providing statistical data, potential safety topics. Action items generated from this meeting shall be followed up immediately. A copy of the minutes of each meeting (handwritten) indicating attendees, topic(s) discussed, follow-up actions, shall be given to the Project Manager.

1.7.3. On a regular basis the Contractor representative shall conduct Work Site safety job observations. All unsafe acts or unsafe conditions shall be corrected immediately.

1.7.4. On a regular basis the Owner's representatives shall conduct job observations of the Work Site using the Job Site Inspection Checklist and bring to the attention of the Contractor representative any unsafe concerns. Where warranted , the Owner representative shall stop any or all Contractor activity on the Work Site until unsafe conditions or unsafe procedures are rectified to the satisfaction of the Owner.

1.7.5. The Contractor shall do a qualification check-out and subsequent job observation to ensure new workers have the necessary skills and knowledge.

1.7.6. Contractor shall provide safety training for all workers on an as-needed basis to include:

1.7.6.1. Rules and regulations.

1.7.6.2. Potential work hazards.

1.7.6.3. Safe work methods.

1.7.6.4. Responsibility for safety.

1.7.6.5. Use and care of personal protective equipment.

1.7.6.6. Others as a unique job situation may require.

1.8. INCIDENTS AND INJURIES

1.8.1. Procedures for emergencies must be established with the Owner before Contractor proceeds with any work on the Work Site.

1.8.2. Within 24 hours of occurrence of any of the following, a Marketing Incident Report Form must be submitted to the Owner's representative:

1.8.3. Disabling Injury.

1.8.4. Personal Injuries which result in lost time extending beyond the day of the accident.

1.8.5. Medical Aid - personal injuries which require medical treatment - no lost time beyond the day of the incident. N.B. If complications develop at a later date which result in lost time a follow-up report will be required reclassifying the incident as a lost time.

1.8.6. First Aid - any one time treatment or subsequent observation of minor scratches, cuts, burns, splinters, which do not require medical care.

1.8.7. Vehicle Accidents - all accidents involving vehicles used for the construction activity.

1.8.8. Fires - all fires regardless of size or resulting damage - either to Owner facilities or to the Contractor facilities or the facilities of others.

1.8.9. Property Damage - stationary structures - buildings - surface piping (manifolds, overhead piping, etc) – tanks - buried pipelines - vessels - etc, includes Owner's, Contractor's and others.

1.8.10. Equipment Damage - rotating equipment - pumps - compressors - drivers - crawler equipment - cranes - excavating equipment etc, includes Owner's, Contractor's and others.

1.8.11. Material Losses - theft of construction materials - materials damaged in transit - material losses due to poor quality control of the work etc.

1.8.12. Business Interruptions - any and all unplanned construction incidents which result in production losses -schedule disruption/delays - financial losses to Owner, etc.

1.8.13. Security - all security violations which occur as a result of the unauthorized action of Contractor and/or employees working under his direct or indirect supervision (third party).

1.8.14. Near Accidents - all unplanned events which did not result in any losses whereby losses were only avoided by luck.

1.8.15. Other - all other incidents, which are not classified, which resulted in losses to Owner, Contractor and others.

END OF SECTION

1. GENERAL

1.1. Section Includes

1.1.1. Progressive cleaning.

1.1.2. Final cleaning.

1.2. Related Section

1.2.1. Section 01770 - Closeout Procedures.

1.3. Project Cleanliness

1.3.1. Conduct cleaning and disposal operations to comply with local ordinances, anti-pollution laws, and recommendations of Construction Safety Association, and local authorities having jurisdiction.

1.3.2. Maintain project grounds and public sidewalks in tidy condition, free from accumulation of waste products and debris. Do not allow rubbish to accumulate in work under construction or on roofs.

1.3.3. Provide on-site containers for collection of waste materials and debris.

1.3.4. Prevent accumulation of wastes which create hazardous conditions.

1.3.5. Vacuum clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.

1.3.6. Store volatile waste in covered metal containers, and remove from premises at end of each working day.

1.3.7. Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.

1.3.8. Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

1.3.9. Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.3.10. Cleaning operations shall include those areas used for temporary site access or used on a temporary basis to facilitate the Work.

1.4. Final Cleaning

1.4.1. Upon completion of construction and/or repair, and prior to final acceptance of the work, remove grease, paint spots, dirt, dust stains, labels, fingerprints and other foreign matter from interior and exterior surfaces of the work.

1.4.2. Leave all surfaces in a new, perfectly clean and unsoiled condition.

1.4.3. Remove waste products and debris and leave the Work broom clean and suitable for occupancy to the Project Manager's approval.

END OF SECTION

1. GENERAL

1.1. Section Includes

1.1.1. Administrative procedures preceding preliminary and final inspections of Work.

1.2. Related Sections

1.2.1. Section 01740 – Cleaning and Waste Managament.

1.2.2. Section 01780 - Operations and Maintenance Data.

1.3. Inspection and Declaration

1.3.1. 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.

1.3.1.1. Notify Project Manager in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

1.3.2. Request Project Manager's Inspection.

1.3.2.1. Project Manager's Inspection: Project Manager and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

1.3.3. Completion: submit written certificate that following have been performed:

1.3.3.1. Work has been completed and inspected for compliance with Contract Documents.

1.3.3.2. Defects have been corrected and deficiencies have been completed.

1.3.3.3. Equipment and systems have been tested, adjusted and balanced and are fully operational.

1.3.3.4. Certificates required by Authorities having jurisdiction have been submitted.

1.3.3.5. Operation of systems have been demonstrated to Owner's personnel.

1.3.3.6. Work is complete and ready for Final Inspection.

1.3.4. Final Inspection: when items noted above are completed, request final inspection of Work by Project Manager and Contractor. If Work is deemed incomplete by Project Manager, complete outstanding items and request re-inspection.

1.3.5. Declaration of Substantial Performance: when Project Manager considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.

1.3.6. Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty

period and commencement of lien period unless required otherwise by lien statute of Place of Work.

1.3.7. Final Payment: When Project Manager consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. If Work is deemed incomplete by Project Manager, complete outstanding items and request re-inspection.

1.3.8. Payment of Holdback: After issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback amount in accordance with General Conditions of the Contract.

END OF SECTION

1. GENERAL

1.1. Section Includes

1.1.1. As-built Drawings.

1.1.2. Equipment and systems.

1.1.3. Product data, materials and finishes, and related information.

1.1.4. Operation and maintenance data.

1.1.5. Warranties and bonds.

1.2. Related Sections

1.2.1. Section 01310 - Shop Drawings, Product Data, Samples.

1.2.2. Section 01450 - Quality Control.

1.2.3. Section 01770 - Closeout Procedures.

1.3. Submission

1.3.1. Prepare instructions and data by personnel experienced in maintenance and operation of described products. Submit one completed copy to consultant and one copy to owner for review.

1.3.2. On Substantial Performance of the Work, submit to the Project Manager, final copies of Operations Data and Maintenance Manuals: two hard copies as well as two electronic copies on USB drives.

1.4. Format

1.4.1. Organize data in the form of an instructional manual.

1.4.2. Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm (8 1/2 x 11) with spine and face pockets.

1.4.3. Cover: Identify binder with typed or printed title 'Operations Data and Maintenance Manual'; list title of project, date and identify subject matter of contents.

1.4.4. Arrange content by applicable sections of work to parallel Project Specification break-down.

1.4.5. Provide tabbed fly leaf for each separate Section, protected with celluloid covers fastened to hard paper dividing sheets.

1.4.6. Text: Manufacturer's printed data, or typewritten data.

1.4.7. Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.5. Contents

1.5.1. Table of Contents to include the following:

1.5.1.1. Title of project and date of submission.

1.5.1.2. Names, addresses, and telephone numbers of Consultant and Contractor, with name of responsible parties.

1.5.1.3. Schedule of products and systems, indexed to content of volume.

1.5.2. For each product or system:

1.5.2.1. List of names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

1.5.3. Maintenance instruction for finished surface and materials.

1.5.4. Copy of hardware and paint schedules.

1.5.5. Description, operation and maintenance instructions for equipment and systems, including complete list of equipment and parts list. Indicate name plate information such as size, make, capacity and serial number.

1.6. As-Built Drawings

1.6.1. Provide As-Built Drawings (Record Drawings) with submission of Operations Data and Maintenance Manuals. Contractor to provide two hard copies as well as two electronic copies on USB drives.

1.7. Guarantees, Warranties and Bonds

1.7.1. Show name and address of Project.

1.7.2. Indicate duration of Warranty, what is being guaranteed and what remedial action will be taken under guaranty.

1.7.3. Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

1.7.4. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

1.7.5. Verify that documents are in proper form, contain full information, and are signed and sealed by the Contractor.

1.7.6. Neatly type lists and notes. Use clear drawings, diagrams or manufacturer's literature.

1.7.7. Include one complete set of final approved Shop Drawings (bound separately) indicating corrections and changes made during fabrication and installation.

END OF SECTION

1. GENERAL

1.1. Protection

1.1.1. Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities, paving and structures. Make good damage resulting thereto to the approval of the Project Manager and at no cost to the Owner. Make good any damage due to inadequate bracing, improper compaction of backfill at no cost to the Owner. Maintain carefully all bench marks, and other reference points. If disturbed or destroyed, replace as directed by a registered Land Surveyor at no cost to the Owner.

1.1.2. Provide protection and heating as necessary where the bearing surface is in danger of freezing before concrete is poured.

1.1.3. Do not load vehicles employed in the cartage of materials beyond rated limits, nor in such a manner as to cause s pillage. Promptly remove spillage and tire tracking on public property. Alert drivers to the right of way of pedestrians and other vehicular traffic at exit from the Site.

1.1.4. Protect existing features in accordance with Section 01510 - Temporary Facilities and Controls.

2. PRODUCTS

2.1. Materials

2.1.1. Type A and Type B fill: properties to meet the following requirements:

2.1.1.1. Type A: clean, angular, crushed, pit run or screened stone from approved source, free from shale, clay and friable materials and organic matter.

2.1.1.2. Type B: clean, natural river sand and gravel material, free from silt, clay, loam, friable or soluble materials and organic matter.

2.1.1.3. .Gradations to be within limits specified to sieve sizes to CAN/CGSB-8.1.

2.1.1.4. Table:

SIEVE DESIGNATION	PERCENT PASSING:	
	Type A	Type B
75 mm	n/a	100
37.5 mm	100	n/a
25 mm	n/a	50-100
19 mm	95-100	n/a
16 mm	75-100	n/a
12 mm	57-83	n/a
4.75 mm	37-61	20-100
1.4 mm	12-32	10-100
0.425 mm	8-23	n/a
0.297 mm	n/a	5-90
0.075 mm	5-10	4-30

2.1.2. No organic material, rubble, trash, boulders or other debris will be allowed as fill material in any usage.

3. EXECUTION

3.1. Preparation

3.1.1. Carefully examine Site including access to Site.

3.1.2. Establish the extent and nature of materials which may be necessary to remove and the amount of the fill to provide the required grades.

3.1.3. Consult Utilities to ascertain location of services. Promptly notify Project Manager if uncharted services are uncovered during excavation. Cap services to the approval of the Utilities affected.

3.1.4. Provide independent and suitable located concrete bench marks for elevation control and selected grid line references. Provide detailed line and grade staking for elements of the earth work.

3.1.4.1. Do all excavations required for the Work.

3.1.4.2. Excavate to depth required for footings and underbed. Base of footings and foundation shall not be less than 1200 mm below finished grade nor less than 450 mm below original grade. Existing fill material must be surface compacted before additional fill, or fill under paving are placed.

3.1.4.3. Footings and granular underbeds shall not rest on undisturbed earth or compacted existing fill as noted in .2 above, Excavations carried too low shall be filled with 20 MPa min. concrete at no additional expense to the Owner. Obtain prior approval for lowering footing.

3.1.4.4. Trim bottom of excavations and obtain approval of the Project Manager and authorities having jurisdiction before placing concrete or granular material.

3.1.4.5. Do not place concrete on frozen ground. Protect ground and/or bottom of excavation to prevent freezing with suitable insulation materials.

3.2. Pumping and Drainage

3.2.1. Keep excavation free from water until concrete is poured, pump out and remove any free water and do not allow water to accumulate in the excavations.

3.3. Backfilling

3.3.1. Do not proceed with backfilling operations until Project Manager has inspected and approved installations. Do not backfill at ambient temperatures below 0 degrees C. without approval. Temporary backfilling not permitted. Be responsible for damage to buried services due to backfilling.

3.3.2. Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

3.3.3. Do not use backfill material which is frozen or contains ice, snow or debris.

3.3.4. Fill locations:

3.3.4.1. Use Type A fill under interior concrete slabs on grade to a minimum compacted depth of 200 mm. Use Type A fill under all exterior concrete slabs on grade to a minimum compacted depth of 150 mm.

3.3.4.2. Use Type B fill at interior walls, trenches and the like.

3.3.5. Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

3.3.6. Properly roll, tamp or otherwise consolidate in place each layer of backfill to 100% of S.P.M.D.D. Maintain fill within 2% of its optimum moisture content. If fill is too dry, dampen it with water to obtain the water content required. If the fill is too wet, aerate it.

3.3.7. After backfilling and compaction is completed, scarify surface to a uniform depth sufficient to eliminate depressions and irregularities.

3.3.8. Over excavated trenches or trenches in rock or shale shall be filled with 20 mm crushed stone. Do not use water for consolidation during backfilling.

3.4. Compaction

3.4.1. Do not compact any material containing frost. Compact until the required density is achieved (100% S.P.M.D.D.).

3.4.2. Fill hollows and depressions which develop under compaction with matching backfill material.

3.4.3. Compact backfill by means of vibratory type equipment capable of achieving the desired degree of compaction. Use manually operated vibratory tampers. Make good any damage to the structure due to compaction and settlement of fill. Report damage to foundation promptly to Project manager.

3.4.4. Compact Type A fill to 100% Standard Proctor Max. Dry Density.

3.4.5. Compact Type B fill to 95% Standard Proctor Dry Density.

3.4.6. Make good any damage caused by uncompacted backfill at no cost to the Owner.

3.5. Grading

3.5.1. Grade so that water will drain away as per approved Grading Plan.

END OF SECTION

1. GENERAL

1.1. Related Sections

1.1.1. Section 02315 - Excavating, Backfilling and Grading.

1.1.2. Section 03300 - Cast-in-Place Concrete.

1.2. References

1.2.1. Canadian Standards Association (CSA)

1.2.1.1. CAN/CSA-A23.1-94, Concrete Materials and Methods of Concrete Construction.

1.2.1.2. CSA O151-M1978, Canadian Softwood Plywood.

1.2.1.3. CAN/CSA-S269.3-M92, Concrete Formwork.

1.2.2. Council of Forest Industries of British Columbia (COFI)

1.2.2.1. COFI Exterior Plywood for Concrete Formwork.

2. PRODUCTS

2.1. Materials

2.1.1. Formwork materials:

2.1.1.1. Wood and wood product formwork materials to CSA-O151 and CAN/CSA-A23.1.

2.1.2. Form ties:

2.1.2.1. Removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.

2.1.3. Form stripping agent:

2.1.3.1. Colourless mineral oil, non-toxic, non-staining, free of kerosene, and compatible with the permanent finish coating of the concrete surface.

3. EXECUTION

3.1. Fabrication and Erection

3.1.1. Verify lines, levels and centres before proceeding with formwork and ensure dimensions agree with drawings.

3.1.2. Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.

3.1.3. Design and install forms and shores so as to carry the load of the fresh concrete plus any additional loads which may be applied without settlement and lateral displacement.

3.1.4. Align form joints and make watertight. Keep form joints to minimum. Where concrete will be exposed place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

3.1.5. Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

3.1.6. Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.

3.1.7. Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.

3.2. Removal of Formwork

3.2.1. Leave formwork in place until concrete has attained sufficient strength to sustain its own weight in addition to any temporary or permanent load which may be placed on it during construction.

END OF SECTION

1. GENERAL

1.1. Related Sections

1.1.1. Section 03100 - Concrete Forms and Accessories.

1.1.2. Section 03350 - Concrete Finishing.

1.1.3. Section 02821 - Chain Link Fences and Gates.

1.2. References

1.2.1. Canadian Standards Association (CSA)

1.2.1.1. CAN/CSA-A5-93, Portland Cement.

1.2.1.2. CAN/CSA-A23.1-94, Concrete Materials and Methods of Concrete Construction.

1.2.1.3. CAN/CSA-A23.2-94, Methods of Test for Concrete.

1.3. Work Installed but Supplied by Others

1.3.1. Anchors, bolts, hangers, sleeves, ties, inserts and other items required to be cast into concrete are to be supplied by applicable trades.

1.4. Delivery, Handling and Storage

1.4.1. Store materials in accordance with CAN/CSA-A23.1-94.

1.5. Protection

1.5.1. Forms shall not be removed before a minimum of 48 hours.

1.5.2. Cars and light trucks may be allowed on slabs 96 hours after pouring of slabs is completed.

1.5.3. Protect green concrete from heavy loads or blows for a minimum of seven days.

1.5.4. Protect all exposed concrete work from staining and/or physical damage to structural integrity or finish.

1.5.5. Replace damaged work which cannot be repaired or restored to the Project Manager's approval.

2. PRODUCTS

2.1. Materials

2.1.1. Portland cement: to CAN/CSA-A5-93 Type 10 Normal unless specified otherwise.

2.1.2. Supplementary cementing materials: to CAN/CSA-A23.5.

2.1.3. Water: Potable to CAN/CSA-A23.1.

2.1.4. Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density.

2.1.5. Air entraining admixture: to ASTM C 260-94.

2.1.6. Chemical admixtures: to ASTM C 494-92. Project Manager to approve accelerating or set retarding admixtures during cold and hot weather placing.

2.1.7. Pozzolanic mineral admixtures: to CAN3-A266.3.

2.1.8. Concrete retarders: to ASTM C 494 water based, low VOC, solvent free. Do not allow moisture of any kind to come in contact with the retarder film.

2.1.9. Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents capable of developing minimum compressive strength of 50 MPa at 28 days.

2.1.10. Premoulded joint fillers: Bituminous impregnated fiber board: to ASTM D 1751.

2.1.11. Joint sealer/filler for sawn control joints: grey, to CAN/CGSB-19.24-M90, Type 1, Class B. Black, cold applied, to CAN/CGSB-19.20-M87, Type 1.

2.1.12. Fly ash not permitted.

2.1.13. Ready-mixed concrete: to CAN/CSA-A23.1 and the requirements of these specifications.

2.2. Concrete Mixes

2.2.1. All concrete exposed to foot traffic in its final condition shall have a cement content of not less than 290kg/cu.m. without water-reducing admixtures or not less than 262 kg/cu.m. with water-reducing admixtures.

2.2.2. Size of coarse aggregates shall be not more than 20 mm and not less than 10 mm.

2.2.3. Water/cement ratio shall not exceed the values indicated in Table 7 for Class C exposure of CAN/CSA-A23.1-94.

2.2.4. Concrete shall be designed to prevent segregation and excessive bleeding. For on-site mixing of concrete submit mix designs for approval. Provide any necessary evidence that the mix designs will provide the desired properties.

2.2.5. Determine concrete strengths from standard cylinders, sampled, cured and tested at 28 days in accordance with CAN/CSA-A23.2-94.

2.2.6. Refer to drawings or elsewhere in the Specifications for strength of concrete required for various locations, but in all cases, the minimum 28 day strength shall be not less than the following:

2.2.6.1. Skim slab, concrete for backfilling purposes: 15 MPa

2.2.6.2. .Concrete for foundations: 20 MPa

2.2.6.3. Exterior concrete slabs, sidewalks and curbs: 30 MPa

2.2.6.4. .All other concrete: 25 MPa

2.2.7. .Concrete is to have the following slumps at the point of placing:

	Minimum	Maximum
2.2.7.1. Footings:	100mm	50mm
2.2.7.2. Foundation walls, reinforced concrete walls, beams, slabs (except as otherwise provided herein):	100mm	50mm
2.2.7.3. Slabs on grade and structural slabs exposed to pedestrian traffic and/or weather:	75mm	25mm

2.3. Admixtures

2.3.1. Admixtures will be permitted only to correct a definite deficiency in mixture or to make correct placement requirements as recommended by the Testing Laboratory and approved by the Project Manager.

2.3.2. Approval will be withdrawn for the use of admixture, if during the course of the work, concrete performance appears unsatisfactory.

2.3.3. Accelerating admixtures may be used subject to written approval in cold weather. If approved, the use of admixture will not relax the cold weather placement requirements of CAN/CSA-A23.1. The use of calcium chloride will not be permitted.

2.3.4. Set-retarding admixtures may be used subject to approval during hot weather to allow for proper finishing of concrete.

2.3.5. For all concrete exposed to weather provide 7% (+/- 1%) air entrainment.

3. EXECUTION

3.1. Preparation

3.1.1. Obtain Project Manager's approval before placing concrete. Provide 48 hours notice prior to placing of concrete.

3.1.2. Ensure that footing excavations and skim slabs are free of frost or water before placing concrete. If a sump is required for pumping water from the excavation, excavate it outside the area of footing. Remove any wet or disturbed soil just prior to placing concrete.

3.1.3. Before placing concrete, check that all forms are rigid and structurally safe, and that all reinforcing steel, formwork, sleeves, anchor bolts and other items are installed in accordance with the drawings and Specifications. Ensure that all trades have checked the security and location of all components required in the concrete by these trades.

3.1.4. Ensure reinforcement and inserts are not disturbed during concrete placement.

3.1.5. Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

3.1.6. Do not place load upon new concrete until authorized by Project Manager.

3.2. Construction

3.2.1. Do cast-in-place concrete work in accordance with CAN/CSA-A23.1. Tolerances shall conform to Article 10 of CAN/CSA-A23.1.

3.2.2. Sleeves and inserts.

3.2.2.1. No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by Project Manager.

3.2.2.2. Set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Project Manager.

3.2.2.3. Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Project Manager before placing of concrete.

3.2.2.4. Check locations and sizes of sleeves and openings shown on drawings.

3.2.2.5. Set all frames in concrete.

3.2.3. Anchor bolts.

3.2.3.1. Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

3.2.3.2. With approval of Project Manager, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to be minimum 25mm larger in diameter than bolts used.

3.2.3.3. Protect anchor bolt holes from water accumulations, snow and ice build-ups.

3.2.3.4. Set bolts and fill holes with shrinkage compensating grout.

3.2.4. Grout under base plates and/or beam bearing plates and bearing surface of foundations and/or masonry walls using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area. Use a shrinkage compensating grout in accordance with manufacturer's instructions.

3.3. Slabs on Grade

3.3.1. Install adjustable screed supports after reinforcing is placed.

3.3.2. Immediately prior to placing concrete, moisten base material to reduce absorption of moisture from the concrete.

3.3.3. Place concrete and screed level to indicated elevations.

3.3.4. Use 13 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 13mm of finished slab surface unless indicated otherwise.

3.3.5. Provide 13 mm expansion joints in slabs-on-grade at a maximum of 4.5 m except as otherwise instructed by the Project Manager. Tool edges to a rounded section of approximately 3 mm radius. Seal joints with a two part polysulphide sealant.

3.3.6. Provide saw-cut or formed control joints in slabs-on-grade inside the building at maximum spacings of 4.5 m. Locate control joints in consultation with the Project Manager. Seal joints with specified filler material.

3.4. Control Joints

3.4.1. In floors, form control joints as detailed. Where diamond shaped or other isolation joints are shown to be constructed around columns or piers, place after the floor has been concreted and saw-cuts have been made.

3.4.2. Saw-cut joints shall extend into the slab one-fourth of the slab thickness. Take care that control joints are sawn with in 24 hours after finishing the concrete and ensure that the sawing will not tear or damage the concrete surface. Fill joints with joint filler in accordance with manufacturer's instructions.

3.5. Construction Joints

3.5.1. Where construction joints are required in locations not shown on drawings, locate in consultation with Project Manager.

3.5.2. Provide shear keys in all construction joints, unless agreed otherwise for specific locations by the Project Manager. Normally form keys from 50 mm x 100 mm material. Depth of keys shall total approximately 1/3 of the depth of the member. In deep members, use two or more keys.

3.6. Cold Weather Specifications

3.6.1. All snow and ice must be removed before depositing concrete on any surface. Calcium chloride shall not be used as a de-icing agent in the forms.

3.6.2. Concrete shall not be placed on or against any surface that is at a temperature less than 5 deg.C.

3.6.3. When outside mean daily air temperature, during the necessary curing period is 0 to +5 deg.C. protection will include covering plus adequate insulation, for a minimum of three days.

3.6.4. When outside mean daily air temperature is below 0 deg.C. during the necessary curing period, protection will include suitable enclosure plus supplementary heat.

3.6.5. If air temperature is below 5 deg.C. or will be within 24 hours, the temperature of concrete before placing should be above 15 deg.C. but below 27 deg.C.

3.6.6. When enclosures are heated by internal combustion heaters, the exhaust gases must be vented directly outside to prevent CO2 from weakening the concrete during the first 36 hours. Dry heat not permissible.

3.6.7. Salt chemicals or other materials to prevent freezing not to be used unless special permission obtained.

3.6.8. Equipment for heating concrete after placing must be in operation before pouring the concrete. The temperature must be maintained above 10 deg.C. for a minimum period of 72 hours if subsequent ambient conditions are conducive to continued curing (i.e. outside mean daily temperature between 5 deg.C. and 25 deg.C. otherwise the heating will continue for a period of seven days from final pour.

3.6.9. At the end of the required protection period, the temperature of the concrete shall be reduced gradually at a rate not exceeding 10 deg.C. per day until the outside air temperature has been reached.

3.7. Slump of Concrete

3.7.1. Slump tests shall be taken in conjunction with sampling of concrete for cylinder tests. If the Inspector from the Testing Laboratory reports to the Contractor's representative that the slump is excessive, the Contractor shall remove the balance of that concrete from the site without further instructions.

3.7.2. If the Project Manager suspects that the slump of the concrete is excessive and so instructs the Contractor, the latter shall carry out additional slump tests in the presence of the Project Manager. No further concrete shall be placed until the test is carried out. Concrete with excessive slump shall be removed from site. Provide slump testing equipment on the site, readily available for this testing.

3.7.3. Slump tests shall be carried out following the requirements of CSA Method of Test A23.2.5C.

3.8. Depositing

3.8.1. Unless otherwise agreed by the Project Manager, consolidate all concrete including slabs-on-grade in place by means of internal vibrators. Use the largest vibrator consistent with the type and location of concrete being placed. Vibrators shall be in accordance with CAN/CSA-A23.1-94.

3.8.2. Apply vibrators systematically and at such spacing that the zones of influence overlap. Do not over-vibrate.

3.8.3. Keep one spare vibrator for every three vibrators in use, in case of breakdown.

3.9. Curing

3.9.1. Protect and cure concrete in such a manner as to prevent evaporation of moisture from the concrete and injury to the surface.

3.10. Treatment of Formed Surfaces

3.10.1. Repair honeycomb areas of "as-formed" concrete not exposed in the finished work. No additional treatment is required. Do all work in accordance with CAN/CSA-A23.1-94.

3.11. Defective Concrete

3.11.1. Excessive honeycomb or embedded debris in any concrete shall deem it defective. Remove and replace defective concrete.

3.12. Patching

3.12.1. Unless instructed otherwise by the Project Manager, patch imperfections when concrete is green as follows:

3.12.1.1. Chip down edges perpendicular to the surface.

3.12.1.2. Wet the area and brush on 1:1 cement-sand grout.

3.12.1.3. Patch with 1:2 cement-sand mortar with 10% hydrated lime.

3.13. Field Quality Control

3.13.1. Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Project Manager in accordance with CAN/CSA-A23.1 and Section 01450 - Quality Control.

3.13.2. Owner will pay for costs of tests as specified in Section 01450 - Quality Control. Where additional tests are required because of materials or workmanship not meeting specified requirements, the cost of such tests will be borne by this Trade.

3.13.3. Project Manager will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

3.13.4. Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.

3.13.5. The Contractor shall supply all necessary samples to the Testing Laboratory for testing. Supply additional labour required to assist the Testing Laboratory in making such tests. The cost of this material and labour shall be borne by this Trade.

3.13.6. Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

END OF SECTION

1. GENERAL

1.1. Related Section

1.1.1. Section 03300 - Cast-in-Place Concrete.

1.2. References

1.2.1. CSA-A23.1- 94, Concrete Materials and Methods of Concrete Construction.

1.2.2. CAN/CGSB-19.24, Multicomponent, Chemical Curing Sealing Compound.

1.2.3. ASTM C309-74, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

1.3. Qualification

1.3.1. Execute the work of this Section only by a subcontractor who has adequate equipment and skilled tradesmen to perform it expeditiously, and is known to have been responsible for satisfactory installations similar to the specified, during a period of at least the immediate past 5 years.

1.4. Product Data

1.4.1. Submit product data in accordance with Section 01 33 23 - Shop Drawings, Product Data, Samples.

1.4.2. Include application instructions for concrete hardener and curing compound.

1.4.3. Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 00 7319 - Health and Safety Requirements. WHMIS MSDS acceptable to Human Resources Development Canada - Labour and Health Canada for concrete floor hardeners. Indicate VOC content.

1.5. Cooperation

1.5.1. Ensure that concrete supplied for slabs contains no admixtures which would be incompatible with floor hardener materials or other applied finishes.

1.6. Environmental Requirements

1.6.1. Temporary lighting

1.6.1.1. Minimum 1200W light source, placed 2.5 m above floor surface, for each 40 m^2 of floor being finished.

1.6.2. Electrical power

1.6.2.1. Sufficient electrical power to operate equipment normally used during construction.

1.6.3. Work area

1.6.3.1. Water tight protection against rain and detrimental weather conditions.

1.6.4. Temperature

1.6.4.1. Maintain ambient temperature of not less than 10 °C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.

1.6.4.2. Maintain substrate temperature at 10 °C minimum.

1.6.5. Moisture:

1.6.5.1. Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.

1.6.6. Safety:

1.6.6.1. Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

1.6.7. Ventilation:

1.6.7.1. Ventilate enclosed spaces in accordance with Section 015000 - Temporary Facilities and Controls.

1.6.7.2. Provide continuous ventilation during and after coating application.

2. PRODUCTS

2.1. Materials

2.1.1. Unless specified otherwise, materials shall meet specified requirements of Section 033000 – Cast in Place Concrete.

2.1.2. Non-metallic hardener: premixed, mineral aggregate type, dry shake surface hardener, cement colour 3 parts French Grey, one part Medium Brown.

2.1.3. Curing Sheet: 2 mil polyethylene or waterproof paper.

2.1.4. Curing-Sealing Compound for Interior Slabs: Chlorinated rubber resin formulation to meet specified requirements of CGSB 90-GP-1.

2.1.5. Curing-Sealing Compound for Exterior Slabs: sidewalks and aprons first coat 50% linseed oil (by volume) and 50% varsol (kerosene). Second coat 50% linseed oil (by volume) and 50% naptha or turpentine.

3. EXECUTION

3.1. Examination

3.1.1. Verify that surfaces are ready to receive and maintain concrete finishing to achieve specified installation.

3.2. Installation

3.2.1. The top or final surface of all horizontal concrete shall be finished by one, or more, of the following operations of screeding or floating.

3.2.2. Screeding consists of moving a straight edge or template with a sawing motion along approximately 25 mm diameter pipe screeds. The screeds shall be accurately established on rigid supports at the specified elevation by transit level. Screeding shall be done immediately after consolidation of the concrete to give the surface its approximate shape and elevation. Floors which are to have finishing surface bonded to the base slab shall be subsequently roughened by raking or wire brooming before the concrete has fully hardened.

3.2.3. Floating consists of accurately finishing the concrete surface with a wood float to the elevation or profile shown. Floating shall follow screeding but shall not be started until some stiffening has taken place in the concrete surface.

3.3. Patching and Refinishing

3.3.1. Before completion of project, patch and refinish defective surfaces to match surrounding areas with no discernible variation in appearance.

3.4. Concrete Finish Schedule

3.4.1. Interior floors: Steel Trowel.

3.4.2. Exterior concrete slabs-on-grade and sidewalks: Wood Float with light broom finish.

3.4.3. All exposed areas where formwork has been removed shall be treated as follows:

3.4.3.1. Top of curbs: Wood Float.

3.4.3.2. Balance of all exposed areas: Wood Float.

3.4.3.3. Sealing compound for all exterior slabs, sidewalks and aprons: two weeks after concrete has been poured and surface floated, treat as follows: cover the surface with a mixture of 50% linseed oil (by volume) and 50% varsol (kerosene). Apply with a spray held at 300 mm from the surface. Use 5.5 l/50m2. Allow to dry 24 hours between coats. Apply a second coat using a mixture of 50% linseed oil and 50% naptha or turpentine. Use 4 l/50m2.

3.5. Hardening

3.5.1. Apply floor hardener aggregate at rate of 5 kg/m 2 in accordance with manufacturer's written instructions.

3.5.2. Apply slip resistant coating on floor surfaces as scheduled during trowelling operation. As soon as concrete is firm enough to support weight of workmen and equipment, install 2/3 of required shake evenly. Treat areas adjacent to walls and columns first. Spread evenly in two directions. Do not broadcast from a stationary position. Float shake application promptly. Ensure entire shake application is wetted, and incorporated into slab. Apply second shake application immediately and float as before. Trowel floor as necessary and apply curing compound.

3.6. Protection

3.6.1. Protect finished installation until floor treatment has completely cured. Protect from abrasion from foot or wheeled traffic and from damage caused by spillage of oil or other harmful materials.

END OF SECTION

1. GENERAL

1.1 General

1.1.1 These General Mechanical Requirements – HVAC shall apply to and govern all sections of Division 15 of the Specification.

1.1.2 Division 15 of the specification is an integral part of the contract documents and shall be read accordingly.

1.1.3 Coordinate with other divisions of the specification.

1.1.4 Electrical, mechanical and each trade shall be aware of the work being shown in the set of drawings. Where errors or discrepancies exist, notify consultant at least 5 days before closing date.

1.1.5 The sub-trades shall review the tender with the main contractor to co-ordinate the on-site responsibilities.

1.1.6 Making holes: mech. trade is responsible for making holes up-to and including 200 mm in size (for small pipe penetrations.) For 201 mm and larger, mech. trade shall mark the openings and co-ordinate with the general contractor.

1.1.7 Mechanical contractor shall carry the total controls cost and co-ordinate the work of the controls personnel. Supply and installation of the new motorized dampers, t-stats and required control panel to monitor and control all mechanical equipment and instrumentation directly involved in the new natural gas generator installation.

1.1.8 On any pipe penetrations through roof: prepare proper flashing to allow roof materials to be sealed water-tight.

1.1.9 The specification is divided into divisions of work and a division may consist of the work of more than one subcontractor. The responsibility as to which subcontractor provides labour, materials, equipment and services required to complete the work rests solely with the contractor.

1.2 Summary of the Work & Responsibilities (but not limited to….)

1.2.1 Work to be included by this Division includes the completion of the following work as shown on drawings and as specified herein. Contractors shall provide supervision, labour, materials, equipment, machinery, plant, and items necessary to complete the work.

1.2.2 Work shall be in accordance with the Contract Drawings and Specifications and their intent complete with all necessary components, including those not normally shown or called for, and ready for operation before acceptance.

1.2.3 Where contradictions in Specifications and Contract Drawings are implied include the item or arrangement of better quality, greater quantity, or higher cost in bid price.

1.2.4 Items of equipment may be specified in singular; however, contractors shall provide number of items of equipment as indicated on drawings, and as required for complete systems.

1.2.5 Provide new gas line from existing Enbridge station as shown on the plan and coordinate installation of new Enbridge station. Refer to mechanical plans.

1.2.6 Provide complete, fully tested and operational mechanical systems to meet requirements described herein and in complete accord with applicable codes and ordinances.

1.2.7 Contract Drawings are diagrammatic and approximately to scale unless detailed otherwise. Contract drawings establish scope, material and installation quality and are not detailed installation instructions. The mechanical sub-contractor is allowed certain latitude to pipe and install the equipment using best piping practices to suit the field conditions.

1.2.8 Before submitting Bid, visit and examine the site and report in writing any deficiencies or conflicts between the existing structure and equipment and the new work. No allowances will be made for any difficulties encountered due to any features of the building, which existed up to the time of the bid. If the new access opening is not complete at the time of the field visit, the General Contractor must insure the size of the proposed opening will allow for the removal and installation of all equipment associated with this contract.

1.2.9 Employ tradespersons fully qualified under Federal, Provincial and Municipal regulations pertaining to the licensing and qualifications for the respective trades.

1.2.10 The Contractor is to be registered with TSSA and have a Certificate of Authorization from same to perform the necessary hot tap welding procedures for the Work. The Contractor is to arrange and pay for any inspections required by TSSA for the Work.

1.2.11 Maintain all essential services in full operation during this project.

1.2.12 All work must be completed as per the requirements of the City, Toronto Hydro, ESA and to the satisfaction of all Consulting Engineers

1.2.13 Note that Division 15 shall be responsible for the following work to be coordinated with Division 16 (Electrical).

1.3 Intent of Section

1.3.1 This section covers the following:

.1 Submittals for Mechanical Work.

.2 Equipment supply and installation

.3 Identification of equipment.

.4 General mechanical methods.

.5 Start-up, testing and commissioning.

1.4 This section does not include:

.1 Concrete work for foundations, housekeeping pads, equipment bases, supports and bollards.

.2 Field painting.

.3 Electrical field wiring.

.4 Supply of instrumentation.

1.4.2 This section also covers the removal of existing equipment that is made obsolete by this project but is not currently identified. Remove and dispose of this equipment.

1.4.3 Work shall be in accordance with the Drawings and Specifications and their intent complete with all necessary components, including those not normally shown or called for, and ready for operation before acceptance.

1.4.4 Where contradictions in specifications and drawings are implied obtain ruling from the Contract Administrator. Where ruling is not obtained, include the item or arrangement of better quality, greater quantity, or higher cost in bid price.

1.5 Design and Performance Requirements

1.5.1 Provide mechanical equipment that is designed to have adequate strength, power and capacity for both continuous and intermittent service and have motors and other parts capable of starting and operating under any conditions of loading likely to occur under normal operating conditions.

1.5.2 Material and equipment are to conform to the latest edition of applicable standards in force at the time of tendering. In the case of conflict of these specifications with any standards, the more stringent of the two applies.

1.5.3 Dynamical balance rotating parts to provide smooth operation. Balancing of heating ventilating and air systems shall comply with applicable procedures and standards of the certification sponsoring associations.

1.5.4 Equipment shall be adequately isolated to maintain maximum noise levels as it set in Environment Protection Act.

1.5.5 Furnish safety devices including shear pins, flexible coupling guards, belt guards and other pertinent items with the equipment.

1.5.6 The Contractor and his/her Sub-Contractors shall assume full responsibility for their equipment and all materials required for this project and shall store them in a locked secure area at the end of each days work. No equipment or materials shall be left in an open area unprotected at the end of each days work.

1.5.7 It is the Contractor’s total responsibility for the overall performance and completion of the Work. Breakdown of Work by trades is for the convenience of the Contractor only. All trades are required to examine all Sections of the Drawings and Specifications. The Consultants assume no responsibility for the

division of Work or for any jurisdictional involvement as a result of such divisions. Appropriate sub-trades will be engaged by the Contractor and they will be as follows:

- Electrical (by Prime Contractor)
- Structural Sub-contractor
- Ventilation, generator exhaust etc., Sub-contractor
- Gas line installation Sub-contractor

1.6 Codes and Standards

1.6.1 The work shall accord strictly with all rules, regulations, by-laws and the requirements and interpretations of all authorities having jurisdiction.

1.6.2 Drawings and specifications should not conflict with the above regulations but where there are apparent discrepancies; the Contractor shall notify the Contract Administrator in writing and obtain clarification before proceeding with the work.

1.6.3 Code requirements shall be considered a minimum standard. When materials shown on drawings as indicated in the specifications exceed code requirements, the plans and specifications shall govern.

1.6.4 Provide changes that are required by the "Authorities Having Jurisdiction", as part of the Contract and give immediate notification of such changes to the City Representative.

1.6.5 Work of the Division 15 shall conform to the following Codes, Regulations and Standards including, unless referenced otherwise, latest revisions issued up to date of tender submission.

.1 The Ontario Building Code, Ontario Regulation 413/90 and all amendments.

.2 Installation Code for Natural Gas Burning Appliances and Equipment issued by CGA B149.1 under the National Standard of Canada CAN1-B149.1-05.

.3 Ministry of the Environment.

.4 NFPA 90B with respect to Warm Air Heating and Air Conditioning Systems.

.5 ASHRAE 62 -2010 -- Ventilation for Acceptable Indoor Air Quality.

.6 ASHRAE Guide and Data Books.

.7 SMACNA 'Low Velocity Duct Construction Standards", "High Velocity Duct Construction Standards".

.8 All other Codes, Standards, Regulations referred to in the above documents, adopted by the authorities having jurisdiction and/or

applicable to the work of this Division as shown in the Contract Documents.

1.7 Abbreviations

1.7.1 Generally, the following abbreviations are used in this Division:

AGA	-	American Gas Association
AMCA	-	Air Moving and Conditioning Assoc. Inc.
ANSI	-	American National Standards Institute
ASHRAE		American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	-	American Society of Mechanical Engineers
ASPE	-	American Society of Plumbing Engineers
ASTM	-	American Society of Mechanical Engineers
BFP	-	Backflow Preventer
Btuh	-	British Thermal Units per Hour
BWG	-	British Wire Gauge
CGA	-	Canadian Gas Association
CEMA	-	Canadian Electric Manufacturer's Association
CGSB	-	Canadian Government Specification Board
CI	-	Cast Iron
CSA	-	Canadian Standards Association
DB	-	Dry Bulb or Decibel
^oC	-	Degree Celsius
Dia	-	Diameter
Hp	-	High Pressure or Motor Horsepower
Kg	-	Kilogram
kPa	-	Kilopascal
kw	-	Kilowatt
l/s	-	Litters per Second
mm	-	Millimeter
m^2	-	Square Meter
m/s	-	Meters per Second
BS	-	National Bureau of Standards
NC	-	Noise Criterion as Defined by Graph in ASHRAE
NFPA	-	National Fire Protection Association
No	-	Number
PPM	-	Parts per Million
RPM	-	Revolutions per Minute
SMACNA-		Sheet Metal and Air Conditioning Contractors National Association Inc.
SS	-	Stainless Steel
UL	-	Underwriters'' Laboratories
WG	-	Water Gauge
WP	-	Working Pressure

1.8 Permits, Fee and Inspections

1.8.1 Execute all work in accordance with all applicable rules, bylaws and regulations.

1.8.2 Give all necessary notices, obtain all necessary permits, pay all required fees and furnish any certificates necessary as evidence that the work confirms with the rules and regulations of all authorities having jurisdiction. This includes any reinforcing bar inspection before pouring, concrete sampling, T.S.S.A.

inspections and local City of Toronto permit inspections. Carry out all changes and alterations required by an authorized inspector of any authority having jurisdiction. Advise Contract Administrator of any such changes.

1.9 Examination of Site

1.9.1 Before submitting tenders, the Contractor shall examine the site to determine the conditions which may affect the proposed work. The site visit is to be arranged through the Contract Administrator. No extras will be allowed for failure to properly evaluate conditions which affect the scope of the work included in this contract.

1.10 Contract Drawings

1.10.1 Follow the Contract Drawings to become familiar with all conditions affecting the work, and verify spaces in which the work will be installed. Consider the specifications as an integral part of Drawings which accompany them, read neither drawings nor specifications alone. Any item or subject omitted from one but mentioned and/or indicated in the other is considered properly and sufficiently specified. Mention in the Specifications or indication on the Drawings of equipment, materials, operation or methods, requires provision of the quality noted, the quantity required and the systems complete in every respect.

1.10.2 Where conflict exists between the Sections, Standards and/or Drawings, it shall be referred to the City Contract Administrator for clarification and rectification before any material is purchased or mechanical work commences

1.10.3 The drawings for mechanical work are diagrammatic only, intended to convey the scope of work and indicate general arrangement and approximate location of equipment, piping, etc. Information required for the accurate installation of all Division 15 work shall be obtained from the site.

1.10.4 Do not scale the drawings to determine dimensions, but obtain information for accurate dimensions by site measurements.

1.10.5 Become familiar with the existing conditions and ensure that the tender price includes provisions to make the necessary field reviews and verification of the state of existing equipment.

1.10.6 Misinterpretation of requirements of either drawings or specifications will not relieve Contractor of their responsibility for providing complete systems and components. Work which is indicated, but not completely detailed shall be installed by common practice or as directed by the Contract Administrator.

1.10.7 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions.

1.10.8 Alter, at no additional cost, the location of materials and/or equipment as directed, provided that the changes are made before installation and do not necessitate additional material.

1.10.9 Leave space clear and install work to accommodate future materials and/or equipment as indicated and to accommodate equipment and/or material supplied by other trades.

1.11 Record Drawings

1.11.1 The contractor will be supplied with a clean set of drawings for mark-up during the work. The drawings shall be used to indicate the "As-Built" conditions that resulted from the work. The drawings must be marked up in red pen indicating the changes that where made from the original drawings.

1.11.2 The drawings are to be returned to the City Contract Administrator within two (2) weeks of commissioning and testing of the system so the Consultant can make the necessary changes to the drawings for submission to the City.

1.12 Submittals

1.12.1 Assume responsibility for accuracy of equipment dimensions related to available space and accessibility for maintenance and service, and compliance with codes and inspection authorities. Ensure that working drawings indicate the shipping and working weight of all equipment.

1.12.2 Obtain manufacturer's installation directions to aid in properly executing the work. Submit two copies of such directions to the Contract Administrator prior to installation, for use in inspecting the work.

1.12.3 Bind one complete set of reviewed working drawings in each operating and maintenance instruction manual.

1.12.4 In addition to the requirements, provide As- Built drawings with the following additional information:

.1 Manufacturer's and Supplier's name.

.2 Catalogue model number.

.3 Number identifying item on the drawings and/or in the specifications such as equipment, item number, etc.

.4 Indicate details of construction, accurate dimensions, capacities, weights, noise levels and performance characteristics of equipment or material.

.5 Where applicable, include wiring diagrams or diagrams showing interconnections with work of other sections.

1.12.5 Complete all work in accordance with reviewed shop drawings.

1.13 Operations and Maintenance Manuals

1.13.1 Comply with requirements for operating and maintenance manuals provided by the City.

1.13.2 In addition to the requirements of Submittals, include in the Operations and Maintenance Manuals:

.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation,

maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, the type of lubricants to be used, technical descriptions of items and parts lists. Advertising or sales literature not acceptable.

.3 Performance curves.

.4 Names and addresses of local suppliers for items included in Maintenance Manuals.

.5 Where applicable, a copy of test data.

.6 Recommended spare parts list and unit cost.

1.14 Operation Instructions

1.14.1 Comply with requirements of Start-up, Testing and Commissioning.

1.14.2 Upon completion of testing, provide on-site operating instructions by certified and experienced personnel to the operating/maintenance personnel at their convenience.

1.14.3 Provide these services as necessary to put equipment in operation. Ensure that plant staff, operating/ maintenance are conversant with its care and operation.

1.15 Delivery, Storage and Handling

1.15.1 Carefully pack and crate equipment for shipment. Protect polished and machined metal surfaces from corrosion and damage during shipment. Specially pack electrical equipment to prevent damage by moisture, cover equipment having exposed bearings and glands to exclude foreign matter.

1.16 Workmanship and Materials

1.16.1 Contractor shall employ only certified tradesmen fully qualified and experienced in each area of work required.

1.16.2 Work shall be executed in a professional manner and shall present a completed work appearance as generally accepted in the trade.

1.16.3 All materials shall be new and of the highest quality available, cconstructed and finished in workmanlike manner, suitable for the service intended, and selected and fabricated to best engineering practice.

1.16.4 Install equipment as per the installation details as indicated in the contract documents. Where no specific installation detail is indicated, use appropriate installation detail per the field requirements.

1.16.5 Install concealed pipes neatly and closely to building structure, lined up paralleling and at right angles to building walls. Where required piping is not shown on plans or shown schematically, install piping to conserve head room and interfere as little as possible with free use of space through which they pass.

1.16.6 Maintain head room under all pipes, ducts and equipment.

1.16.7 In general the entire work throughout shall present a neat and clean appearance on completion.

END OF SECTION

1. GENERAL

1.1 General

1.1.1 Provide gas piping system as herein specified and as on the drawings.

1.2 Reference Standards (latest editions)

1.2.1 CAN/CGA-B149.1-M95, Natural Gas Installation Code

1.2.2 The Ontario Gas Utilization Code

1.2.3 The Ontario Energy Act.

1.2.4 Local by-laws and authorities having jurisdiction.

1.3 Description of System

1.3.1 Provide complete gas piping system including meter, regulator, reducing stations, piping, valves, end all connections to equipment, boilers, and water heaters as indicated on plans.

1.4 Qualifications

1.4.1 Use Welders qualified end licensed by Provincial authorities, Furnish welder's qualifications upon request.

1.5 Natural Gas Service and Meter

1.5.1 This Trade shall pay all charges and make all arrangements with the local authorities for a gas service into the building. The gas company shall supply and install a natural gas meter in location shown complete with all required fittings and pressure regulator etc.

1.6 Submittals

1.6.1 Provide shop drawings for the following equipment.

.1 Pressure Reducing Valves

.2 Relief valves

1.7 Approvals

1.7.1 All approvals shall be obtained before any installation proceeds.

2. PRODUCTS

2.1 Piping

2.1.1 Gas piping above ground shall be schedule 40 steel pipe.

2.1.2 Buried gas piping shall be yellow jacket steel pipe or plastic pipe.

2.2 Fittings

2.2.1 All fittings will be 150 lb. black malleable iron. Use screwed fittings for pipe up to 50 mm diameter where acceptable and steel welded fittings for pipe over 50 mm diameter.

2.2.2 Where buried, use socket welded fittings.

2.3 Valves

2.3.1 Use C.S.A. and C.G.A. approved ball, lubricated plug with lever handles.

2.4 Pressure Reducing Valves and Reliefs

2.4.1 Use Fisher CS-400, and CS-800 series regulators with and No. 289H relief valves and vents. Verify size, model and capacity, etc. with equipment manufacturer.

3. EXECUTION

3.1 Piping and Joints

3.1.1 Weld, list, and tag all concealed piping and piping in return air plenums, ceiling spaces and on roof.

3.1.2 Test all piping as per the latest revision of CSA B149.1 Air test shall be maintained for minimum of 1 hour without loss of pressure.

3.1.3 Joints shall be checked with soap and water solution during air test to ascertain any leaks.

3.1.4 All buried piping shall be tested before backfilling.

3.2 Valves

3.2.1 Provide valves at each outlet and connection. Install valves in an accessible location to comply with code.

3.3 Painting

3.3.1 All gas piping, including piping in concealed spaces shall be painted yellow as per the Department of Energy and Resources requirements.

3.3.2 Construction Managers approval shall be obtained before proceeding with painting.

3.4 Relief Valves and Vents

3.4.1 Pipe all relief valves and gas vents to the exterior of the building as detailed on the drawings or as specified.

3.5 Minimum Pipe

3.5.1 Minimum gas pipe, size shall be in compliance with the Gas Utilization Code.

3.6 Equipment Connections

3.6.1 Make connections to all gas fired equipment.

END OF SECTION

1. GENERAL

1.1. General

1.1.1. These General Electrical Provisions shall apply to and govern all sections of Division 16 of the Specification.

1.1.2. Division 16 of the Specification is an integral part of the Contract Documents and shall be read accordingly.

1.1.3. Coordinate with other Divisions of the specification.

1.1.4. All new electrical wiring, equipment, and new local control panels are to be supplied to meet the electrical and environmental classifications of area in which they are to be installed. For areas designated as Class I Division 1 or 2 include appropriate conduit seals, junction boxes, materials, and all other appurtenances as necessary and installation techniques as required by applicable codes and regulations.

1.1.5. All new local control panels in areas not classified as Class I, Division 1 or 2 to be NEMA 3R enclosures, unless indicated otherwise.

1.1.6. All wiring to be in rigid steel conduits or HL Teck Cable unless indicated otherwise in the contract documents, or unless field conditions dictate otherwise and approved by the Consultant.

1.1.7. The Specification is divided into divisions of work and a division may consist of the work of more than one subcontractor. The responsibility as to which subcontractor provides labour, materials, equipment and services required to complete the work rests solely with the Contractor.

1.2. Intent of Section

1.2.1. This section covers the following:

1.2.1.1. Submittals for Electrical Work.

1.2.1.2. Identification of equipment

1.2.1.3. General electrical methods.

1.2.1.4. Start-up, testing and commissioning.

1.3. Codes and Standards

1.3.1. Apply for, obtain and pay for all permits, licenses, inspections, examinations and fees required.

1.3.2. Arrange for inspection and any testing of all work by the Authorities having jurisdiction over the work. On completion of the work, present to the Owner the final unconditional certificate of approval of the Inspection Authorities.

1.3.3. Comply with the requirements of the latest edition of the applicable CSA Standards, and Ontario Electrical Safety Code, the requirements of the

Authorities, Federal, Provincial and Municipal Codes, the applicable Standards of the underwriters' Association and all other authorities having jurisdiction. These codes and regulations constitute an integral part of these Specifications. In case of conflict, the codes take precedence over the Contract Drawings. In no instance reduce the standard established by the drawings and specifications by applying any of the codes referred to herein.

1.3.4. Before starting any work, submit the required number of copies of drawings and specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the Contract, but notify the Consultant immediately of such changes for proper processing of these requirements. Prepare and furnish any additional drawings, details for information as may be required.

Workmanship and Materials

1.3.5. Contractor shall employ only certified tradesmen fully qualified and experienced in each area of work required.

1.3.6. Work shall be executed in a professional manner and shall present a completed work appearance as generally accepted in the trade.

1.3.7. All materials shall be new and of the highest quality available and must bear CSA approval. Where there is no alternative to supplying equipment or material which is not CSA certified, the Contractor shall be responsible for obtaining special approval from Inspection Authorities at his own cost.

1.3.8. Install equipment as per the installation details as indicated in the contract documents. Where no specific installation detail is indicated, use appropriate installation detail per the field requirements. Installation details are included as an appendix to the Specifications.

Contract Drawings

1.3.9. Follow the Contract Drawings to become familiar with all conditions affecting the work, and verify spaces in which the work will be installed.

1.3.10. The drawings for electrical work are performance drawings, diagrammatic, intended to convey the scope of work and indicate general arrangement and approximate location of apparatus, fixtures and approximate sizes and location of equipment and outlets. The drawings do not show architectural and structural details.

1.3.11. Do not scale the drawings to determine dimensions, but obtain information for accurate dimensions by referring to architectural and structural drawings, or by site measurements.

1.3.12. Become familiar with the condition of the existing power and control equipment. Allow for errors and omissions in the power and control schematics of the existing equipment and ensure that the tender price includes the provisions to make the necessary field reviews, field verifications, field changes, and drawing changes to suit the intent of the controls required.

1.3.13. Work which is indicated, but not completely detailed shall be installed by common practice or as directed by the Consultant.

1.3.14. Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions (runs around beams, columns, etc.).

1.3.15. Alter, at no additional cost, the location of materials and/ or equipment as directed, provided that the changes are made before installation and do not necessitate additional material.

1.3.16. Ceiling mounted components (lighting fixtures, detectors) shall be installed in accordance with reflected ceiling drawings, reviewed by the Consultant and Manufacturer's recommendation.

1.3.17. Leave space clear and install work to accommodate future materials and/or equipment as indicated and to accommodate equipment and/or material supplied by other trades. Verify spaces in which work is to be installed. Install conduit and cable runs to maintain headroom and clearances to conserve space.

1.3.18. Confirm on the site the exact location of outlets and fixtures. Confirm location of outlets for equipment supplied by other trades.

1.3.19. The drawings, specifications, and standards are complimentary to one another, meaning that, that which is called for on one is meant to be called for on all. Where conflict exists between the Sections, Standards and/or Drawings, it shall be referred to the Consultant for clarification and rectification before any material is purchased or electrical work commences. Code requirements shall be considered a minimum standard. When materials shown on drawings as indicated in the specifications exceed code requirements, the plans and specifications shall govern. If, having examined all documents pertaining to Division 16, concerning the nature and extent of the work being performed under other sections, clarification of the item and/or items in question will come from the Consultant.

1.4. Submittals

1.4.1. Conform to the requirements of the contract documents, except as varied by this Section.

1.4.2. Assume responsibility for accuracy of equipment dimensions related to available space and accessibility for maintenance and service, and compliance with codes and inspection authorities. Ensure that working drawings indicate the shipping and working weight of all equipment.

1.4.3. Obtain manufacturer's installation directions to aid in properly executing the work. Submit two copies of such directions to the Consultant prior to installation, for use in inspecting the work.

1.4.4. Bind one complete set of reviewed working drawings in each operating and maintenance instruction manual.

1.4.5. In addition to the requirements of the contract documents, provide working drawings with the following additional information:

1.4.5.1. Manufacturer's and Supplier's name.

1.4.5.2. Catalogue model number.

1.4.5.3. Number identifying item on the drawings and/or in the specifications such as equipment, item number, panel identification letters, etc.

1.4.5.4. Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

1.4.5.5. Where applicable, include wiring, single line and schematic diagrams.

1.4.5.6. Include wiring diagrams or diagrams showing interconnections with work of other sections.

1.4.6. Contractor is responsible for providing shop drawings showing the integration between supplied control panels and control panels supplied with equipment. These drawings are to be a single drawing for each specific device, showing interconnection between the device and all associated panels and terminal blocks. The Consultant reserves the right to request more detailed drawings if those provided are deemed insufficient.

1.4.7. Submit samples of material and equipment where specified or as may reasonably requested by the Consultant for review before ordering same in accordance with Division 1. The Consultant may retain the samples until the completion of the contract.

1.4.8. Complete all work in accordance with reviewed shop drawings.

1.4.9. Where conduits, cable trays and lay-in ducts are not detailed, submit conduit, cable tray and wiring layout drawings. Show conduit/tray and cable sizes including number of cables/conductors in each conduit/tray. Drawings shall be on the same size sheets as the contract drawings.

1.4.10. Update single line electrical diagrams to include any modifications to the electrical distribution system.

1.5. Control Schematic Diagrams

1.5.1. See Contract Drawings.

1.6. Record Drawings

1.6.1. Comply with requirements for record drawings stated in the contract documents.

1.6.2. Show on the record drawings as-built, all outlets and equipment such as runs of conduit, locations of pull boxes, outlets, motors, panels, etc., as well as all services entering the building and on the property. Dimension underground services and concealed main and sub-feeder conduits at key points of every run in relation to structure and building. Record all elevations for underground services in relation to the ground floor level of the building.

1.6.3. Indicate exact location of all services left for future work.

1.7. Operations and Maintenance Manuals

1.7.1. Comply with requirements for operating and maintenance manuals stated in the contract documents.

1.7.2. In addition to the requirements of the contract documents, include in the Operations and Maintenance Manuals:

1.7.2.1. Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

1.7.2.2. Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items and parts lists. Advertising or sales literature not acceptable.

1.7.2.3. Wiring and schematic diagrams and performance curves.

1.7.2.4. Names and addresses of local suppliers for items included in Maintenance Manuals.

1.7.2.5. Copy of test data.

1.7.2.6. Recommended spare parts list and unit cost.

1.8. Operation Instructions

1.8.1. Comply with requirements of the contract documents.

1.8.2. Upon completion of testing, provide on-site operating instructions by certified and experienced personnel to the operating/maintenance personnel at their convenience.

1.8.3. Provide these services as necessary to put equipment in operation. Ensure that plant staff, operating/ maintenance are conversant with its care and operation.

1.9. Delivery, Storage and Handling

1.9.1. See Division 1.

2. PRODUCTS

2.1. Warning Signs

2.1.1. Provide warning signs, as specified or to meet requirements of Inspection Authorities, Consultant, and the Owner.

2.2. Wiring Identification

2.2.1. Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic taped, on both ends of phase conductors of feeders and branch circuit wiring.

2.2.2. Maintain phase sequence and colour coding throughout.

2.2.3. Colour code: to applicable CSA standard:

2.2.3.1. Phase A - Red: Phase B - Black: Phase C - Blue

2.2.3.2. Neutral - White Only.

2.2.4. Use colour codes wires in communication cables, matched throughout system.

2.2.5. All instrumentation and control wiring is to be identified with markers as specified. The identification is to consist of the coding as detailed on the drawings and as specified herein.

2.2.6. Tag field wires with the field device tag and terminal information:

2.2.6.1. For devices connected to control panels or RPUs, show field source and destination information.

2.2.6.2. For devices connected to other panels (e.g. MCC) show field source information.

2.2.6.3. Label wires at both ends with the same information.

2.2.6.4. Wire number should not change unless there is a function change in the wire run i.e. a fuse, a relay, etc. Wires passing through a junction box without a change in function would retain the same wire number.

2.2.6.5. Generally, keep the wire tag to 18 characters or less. For longer tags, use smaller font.

2.2.7. Field source information consists of the following:

2.2.7.1. In most cases, the device type (up to 4 characters) and loop number (up to five characters) make up the device tag information needed on the labels.

2.2.7.2. Add a number or character (+,-) to each wire from the field device to make the field information unique for each wire.

2.2.7.3. In a few cases, the process code (three characters) may be needed to make the wire tag unique.

2.2.7.4. It is not necessary to include spaces, hyphens or leading zeroes in the field source information.

2.2.8. Cable numbers

2.2.8.1. Field cables should be tagged with the field device tag information at both ends.

2.2.8.2. Where cables carry wires from multiple field devices, the cable tag should use the device tag of the junction box.

2.2.8.3. For cables tags, use P or C or I added to the device tag for Power, Control and Instrument respectively as some devices such as valves have all three cables.

2.2.8.4. Cable numbering should show the Junction Box relevant numbers in that a cable runs to a JB, but the wiring itself would not have such designation.

2.2.8.5. For example, in the case of a Cable from a Junction Box to an RPU, assign a unique "loop/device number" to the Junction Box and treat it as a Device.

2.2.8.6. A Cable schedule will be provided showing Cable I.D., Cable Type, Origin, and Destination.

2.2.9. Wire Markers

2.2.9.1. Wire markers available from Brady amongst others allow more than one line of characters if required but one line should be used if possible.

2.2.9.2. Wire markers should be kept to a minimum for ease of installation and readability. A single line of text should be used, minimizing the characters as much as possible.

2.3. Equipment Identification

2.3.1. Identify all equipment listed below with lamacoid plastic plates, white background with black engraved letters 6 mm high, unless otherwise noted.

2.3.2. Lighting panel: Plates shall be mounted on inside of door, typical identification - "Lighting Panel `A' 120/240 V, 1 phase, 3 wire".

2.3.3. Disconnect switches and starters: Plates shall be mounted externally on switch box cover. Typical identification - "Pump No. 600 V, 3 phase".

2.3.4. Power Panel Board: Plates shall be mounted on face - Typical identification - "Pump No. ....."

2.3.5. Plates shall be installed after all painting has been completed and shall be secures with self-tapping screws except on the inside of panel door where gluing will be accepted.

2.3.6. Have the manufacturers' nameplates affixed to each equipment showing the size, name of equipment, serial number and all information usually provided, including voltage, cycle, phase, horsepower, etc. and the name of the manufacturer and his address. Ensure that all stamped, etched or engraved lettering on plates is perfectly legible. Do not paint over nameplates.

2.3.7. Identify all equipment with the corresponding remote controls.

2.3.8. Panels and other apparatus which have exposed faces in finished areas shall not have visible trademarks or other identifying symbols. Nameplates shall be mounted behind doors.

3. EXECUTION

3.1. Painting

3.1.1. Touch up all electrical equipment marred by shipment or during the period of construction, using the same paint, colour and finishes originally used.

3.2. Cutting, Fitting, and Patching

3.2.1. Locate and provide holes and sleeves required for electrical work relocate improperly located holes and sleeves at no cost.

3.2.2. Conform to the requirements of Division 1 in respect to cutting, patching, and fitting electrical equipment.

3.3. Concrete

3.3.1. Coordinate all related electrical work.

3.4. Mounting Heights

3.4.1. Mounting height of equipment is from above finished floor (AFF) to centreline of equipment unless specified or indicated otherwise.

3.4.2. If mounting height of equipment is not indicated, verify before proceeding with installation.

3.4.3. Install electrical equipment at the following heights unless indicated otherwise:

3.4.3.1. Local switches: 1,219 mm

3.4.3.2. Wall receptacles:

3.4.3.2.1. General: 300 mm dwelling units and offices, otherwise 1,219 mm Above Finished Floor (AFF).

3.4.3.2.2. Above top of counters of splash back: 177 mm

3.4.3.2.3. In mechanical rooms: 1,219 mm

3.4.3.3. Panelboards: 2,000 mm, or as required by Code

3.4.3.4. Telephone outlets: 300 mm, in offices and dwelling units, otherwise 1,219 mm AFF

3.4.3.5. Thermostats: 1,400 mm

3.4.3.6. Disconnects: 1,400 mm

Protection

3.4.4. Protect the work of others from damage resulting from the work of this project.

3.4.5. Protect the work of this project from that of others, make good any damage, remove all debris and rubbish and leave the project site in a clean and tidy condition to the approval of the Consultant.

3.4.6. Protect exposed line equipment during construction for personnel safety. Shield and mark live parts "Live 120 Volts", or with appropriate voltage.

3.5. Manufacturer's and CSA Labels

3.5.1. Manufacturer's nameplates and CSA labels to be visible and legible after equipment is installed.

3.6. Cleaning

3.6.1. Clean during construction and make final cleaning in accordance with Division 1.

3.6.2. Before energizing any systems, inspect and clean all the inside of power panel boards and cabinets to ensure that they are completely free from dust and debris.

3.6.3. Clean all polished, painted and plated work brightly. Clean all lighting fixtures and replace all burned out lamps.

3.6.4. Remove all debris, surplus material and all tools.

3.6.5. At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.

3.7. Coordination of Protective Devices

3.7.1. Ensure circuit protective devices such as over-current trips, relays and fuses, are installed to correct values and settings.

3.8. Testing

3.8.1. Comply with requirements of the contract documents requirements for start-up, testing and commissioning.

3.8.2. All equipment and electrical systems which are provided under this Division shall be performance tested for electrical and mechanical defects and all defects and adjustments made, prior to requesting inspection by the Consultant.

3.8.3. Submit original copies of letters from the manufacturers of auxiliary systems indicating that their technical representatives have inspected and tested the respective systems and are satisfied with the methods of installation, wiring and operation.

3.8.4. Perform tests using certified personnel only. Provide necessary instruments and equipment for testing.

3.8.5. Insulation and continuity tests shall be performed for all wiring and equipment installed under this Division. Insulation tests shall be performed with a "Megger" insulation tester and recorded in log book for reference. Lighting and power circuit feeders shall be meggered and if resistance to ground is less than 0.5 mega ohms on any lighting or power circuit, such circuit shall be considered defective and shall be replaced.

3.8.6. Conduits or ducts which are required to be installed but left empty shall be tested for clear bore using a ball mandrel of approximately 85% of the conduit or duct inside diameter. Any conduit or duct which rejects the ball mandrel shall be cleared at no additional cost to the Owner. These tests shall be witnessed by the Consultant. Three days notice shall be given prior to testing.

3.8.7. Single phase loads on three phase system shall be connected so that there is the least possible imbalance of the supply.

3.8.8. All testing shall be scheduled and coordinated through the Consultant. No testing of any kind shall be done without this clearance.

3.9. Trial Usage

3.9.1. The City has the privilege of the trial usage of electrical systems or parts thereof for the purpose of testing and learning the operational procedures.

3.9.2. Carry out the trial usage over a length of time as deemed reasonable by the Consultant, at no extra cost.

3.9.3. Carry out the operations only with the express knowledge and under supervision of the Subcontractor who shall not waive any responsibility because of trial usage.

3.9.4. Trial usage shall not be construed as acceptance by the Owner.

3.10. Final Inspection

3.10.1. Make request, in writing, to the Consultant to arrange for a final inspection of all electrical systems with a schedule of inspections.

3.10.2. Do not issue this written request until:

3.10.2.1. All deficiencies noted during the job inspection have been completed.

3.10.2.2. All systems have been balanced and tested and are ready for operation.

3.10.2.3. Operating and maintenance instructions have been submitted and approved.

3.10.2.4. Identification of equipment and raceways is complete.

3.10.2.5. Certificates have been submitted.

3.10.2.6. Spare parts and replacement parts specified have been provided and receipt of same acknowledged, in accordance with Section 01700 – Project Closeout.

3.10.2.7. Record drawings are completed and approved.

3.10.2.8. Owner's operating personnel have been instructed.

3.11. Demonstration of Complete Electrical Systems

3.11.1. Instruct the Owner's representatives in all aspects of the operation of systems and equipment.

3.11.2. Arrange for, and pay for services of service engineers and other manufacturers' representatives required for instruction on specialized portions of the installation.

3.11.3. Submit to the Consultant at the time of final inspection, a complete list of systems stating for each system:

3.11.3.1. Date instructions were given to the Owner's staff

3.11.3.2. Duration of instruction

3.11.3.3. Name of persons instructed

3.11.3.4. Other parties present (Manufacturer's representative, consultants, etc.)

3.11.3.5. Signature of Owner's staff stating that they properly understand the system installation, operation and maintenance requirements.

3.12. System Acceptance

3.12.1. Submit original copies of letters from the manufacturers of all systems indicating that their technical representatives have inspected and tested the respective systems and are satisfied with the methods of installation, connections and operation. Where existing systems are extended, such letters shall cover both new and existing equipment and connections.

3.12.2. These letters shall state the names of persons present at testing, and methods used, and a list of functions performed with location and room numbers where applicable.

END OF SECTION

1. GENERAL

1.1 General

1.1.1 Comply with the requirements of the contract documents.

1.2 Grounding

1.2.1 This section covers the supply and installation of a grounding system as applied to installation of new panels and insulation resistance tests of each circuit and extension to the existing system.

1.2.2 The ground resistance of the system shall not exceed 4 ohms for low potential systems and 1 ohm for high potential installations.

1.2.3 Existing system grounds to be checked for integrity and compliance with the latest Ontario Electrical Safety Code and Canadian Electrical Code.

1.2.4 Contractor is responsible for upgrading the existing grounding system in order to ensure code compliance.

1.3 Governing Conditions

1.3.1 Latest edition of Ontario Electrical Safety Code and Bulletins.

2. PRODUCTS

2.1 Materials

2.1.1 Grounding equipment to: CSA C22.2 No. 411950 (R 1967).

2.1.2 Copper grounding conductors to: ANSI G7.1-1964.

2.2 Equipment

2.2.1 Clamps for grounding of conductor, size as required to building ground or electrical grounding grid.

2.2.2 System and circuit, equipment, grounding conductors, bare stranded copper soft annealed, size as indicated.

2.2.3 Non-corroding accessories, necessary for grounding system, type, size, material as required, or as indicated, including but not necessarily limited to:

.1 Grounding and bonding brushings

.2 Protective type clamps

.3 Bolted type conductor connectors

.4 Bonding jumpers, straps

.5 Pressure wire connectors

3. EXECUTION

3.1 Execution

3.1.1 Test the grounding system within the scope of work for continuity of connections and for resistance to the flow of current through ground connections.

3.1.2 All equipment must be provided with a proper grounding and bondings as per Ontario Electrical Safety Code.

END OF SECTION

1. GENERAL

1.1 General

1.1.1 Comply with the requirements of the contract documents.

1.1.2 Comply with the requirements of the Ontario Electrical Safety Code.

1.2 Governing Conditions

1.2.1 The drawings are not intended to show in detail, the location and size of every conduit/conductor/wire.

1.2.2 Where cable is not shown or indicated as "Xc", this refers to the number of conductor cables of the size as required plus a suitable ground wire sized appropriately as per code requirements.

1.2.3 Colour code single conductors forming part of a multiple conductor cable for phase identification.

Line	Lighting & Power
Line 1	Red
Line 2	Black
Line 3	Blue
Neutral	White
Ground Wire	Green

1.2.4 Phase relationships and terminal arrangements:

Left	Middle	Right
Line 1 Phase: Red	Line 2 Phase: Black	Line 3 Phase: Blue

1.3 Requirements

1.3.1 Provide colour coding of insulated conductors conforming to the following:

1-conductor power	- Black (phase conductors), - White (neutral)
1-conductor control	- Red
2-conductor cable	- Black, white
3-conductor cable	- Red, Black, White (neutral)
4-conductor cable	- Red, Black, Blue, White
Multi-conductor cables	- Manufacturer's standard

2. PRODUCTS

2.1 Wires

2.1.1 Conductors: stranded copper for all wire sizes.

2.1.2 Copper conductors: sized as indicated or required, with 600 volt RW 90 insulation for conductors up to size #10 and 1000 volt RW 90 insulation for conductors size #8 and larger to CSA C22.2 No. 38 - latest edition. For direct buried installations or where indicated on drawings use TECK cable.

2.1.3 Minimum conductor size for power and lighting wiring: #12 AWG. Use GTF fixture wire, 600 V, 125 °C, flexible copper conductor for all connections between lighting fixtures and outlet boxes

2.1.4 Minimum conductor size for control monitoring, and indication circuit wiring: #14 AWG, coloured per unit function.

2.1.5 Flexible cable for pendant equipment - Type SEW 600 volt, 4 conductor.

2.1.6 Ground wires - bare copper with green RW 90 insulation when run in ducts, banks, tray or conduit.

2.2 Instrumentation Signal Cables

2.2.1 In conduit: fully shielded twisted pair, insulated stranded copper, aluminum-Mylar shield, bare copper drain wire with extended PVC jacket, conductor size #16 AWG.

2.3 Wiring Identification

2.3.1 Identify all wiring in accordance with Section 16010.

2.4 Wiring Signal Level Separation

2.4.1 Provide cables installed exposed, or underground with an aluminum or steel interlocking armour with an overall PVC jacket, i.e. TECK cables.

2.4.2 General purpose instrumentation cable to be approved equal to Belden #9318.

2.4.3 RS232 and RS485 cables to be 4 pair, 18 AWG stranded copper, each pair separately twisted. Provide overall 100% shield and tinned stranded drain wire. Cable to be approved equal to Belden #9305. Termination fittings to be of the type, configuration and gender required to connect cable directly to equipment without additional adapters or fittings.

2.5 Wiring Accessories

2.5.1 Provide plastic slip-on wire markers, black letters on white background, of one of the following manufacturers:

Electrovert	Z-Type
Thomas & Betts	Shur-Code

2.5.2 Provide cable markers for cables or conductors greater than 13 mm diameter, strap-on type, rigid PVC covered aluminum straps, as manufactured by:

Electrovert Cat. no. 510

2.5.3 Provide identified terminal blocks, minimum 600 V, 25 A rated, modular, 35 mm DIN rail mounted, individually removable, sized to accommodate conductor size and circuit current used, as manufactured by:

Entrelec
Phoenix
Schlegel
Weidmuller

2.5.4 Where screw-type terminals are provided on equipment, terminate field wiring with insulated fork tongue terminals, as manufactured by:

Thomas & Betts Sta-Kon
3M Scotchlok

3. EXECUTION

3.1 Installation of Wiring

3.1.1 Install all wiring as follows:

.1 In conduit system.

.2 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

3.1.2 All cables for systems other than power shall be of the type specified in the respective sections.

3.1.3 Run all feeders continuous length between power supply point and the load. No splices will be allowed in feeder cable.

3.1.4 Wire shall be placed in conduit without excessive strain or kink and fishpaper will be provided where required to prevent cables from resting against metal enclosures. Prior to using lubricants, check with the cable manufacturer as to what type of lubricant is approved for the specific cables in use.

3.1.5 Identify the circuits in the lighting panel and power panels with cable markers as indicated on the drawings. If the wiring is installed with different circuitry, review the "as-built drawings" in plan to determine the new circuit number which has been given to the outlet or receptacle. The legends in all panels shall be made up to agree with the wiring as installed.

3.1.6 All cables shall be identified in pullboxes, etc., with Electrovert Type Z markers , Electrovert strap-on markers or T & B SM markers.

3.1.7 All wiring for signal systems shall be identified as to circuit numbers with approved markers on the cables at all panels and terminal strips.

3.1.8 When the routing of the cables is not indicated on a drawing or described in the installation specification; the contractor should submit details of the proposed routing for approval prior to commencing the installation.

3.2 Installation

3.2.1 Install instrumentation signal cables as indicated. Use shielded instrumentation cables for all 4-20 mA DC or 1-5 VDC signals that are connected to the instrumentation and SCADA systems. No more than two wires connected to one terminal point.

3.2.2 Each instrument loop should have its own power supply disconnection switch to enable servicing without affecting other loops.

3.2.3 Ground the cable shields at the receiving end (RPU) only. Where cables are joined at terminal strips in terminal boxes or panels between the transmitter and receiver for series connections, join the shields but do not ground.

3.2.4 Only one ground must be maintained, multiple grounds result in ground loop (grounds at different potential).

3.3 Wiring Signal Level Separation

3.3.1 In order to control or eliminate electrical noise in plant wiring systems, group wires of compatible signal or power levels together but run separately or electromagnetically isolated from wires of incompatible signal or power level.

3.3.2 Provide neoprene or chrome vinyl jacket over complete assembly.

3.3.3 Identify each grouping (pair, triplet, quad) by consecutive number coding permanently marked at 25 mm intervals.

END OF SECTION

1. GENERAL

1.1 General

1.1.1 Comply with the requirements of contract documents.

1.2 Codes

1.2.1 All conduits to meet CSA Specification C22.2 No. 45.

1.2.2 Size conduits according to Table 6 or 9 of the Ontario Electrical Safety Code, unless otherwise indicated.

1.3 Conduit and Fittings

1.3.1 Supply and install all conduits and fittings required for the installation.

2. PRODUCTS

2.1 Conduits

2.1.1 Rigid aluminum or rigid steel conduit sized as indicated or required, minimum size 21 mm, approved for hazardous locations where required.

2.1.2 EMT may be used in non-hazardous locations.

2.2 Conduit Fittings

2.2.1 Fittings, as required, for use with conduit specified, with coating same as conduit.

2.2.2 Galvanized rigid steel for rigid galvanized steel conduit.

2.2.3 All locknuts and bushings shall be of T & B or Efcor in manufacture. All bushings shall be of the insulated type or a locknut and an insulating bushing may be used.

2.2.4 Approved for hazardous locations where required.

2.3 Expansion Fittings for Rigid Conduit

2.3.1 Expansion sleeves with bonding where conduit crosses a structural expansion joint, Crouse Hinds fitting complete with grounding strap and clamps.

2.3.2 For hazardous areas provide rigid galvanized steel conduit fittings, compound etc., to conform to the code requirements for the specific type of hazard present, Class 1, Division 1, Group D.

3. EXECUTION

3.1 Location of Conduits

3.1.1 Install conduit into the walls, ceilings or floors as required on the Contract Drawings. The actual route of the conduits to be selected to avoid beams,

columns and other obstructions, provided permission has been granted by the City Project Manager.

3.1.2 Conduit shall not interfere with other trades and shall be mounted over other piping where possible in parallel rows, parallel or perpendicular to walls and ceilings. Bends and offsets shall be uniform and symmetrical. The use of conduit bends shall be kept to a minimum.

3.1.3 Conduit and cables shall be installed to avoid proximity of water and heating pipes. In no case shall they run within 75 mm of such pipe except where crossings are unavoidable in which case they shall be kept at least 25 mm from the covering of pipe crossing.

3.1.4 Ensure that no conduit or pullboxes are closer than 200 mm to heating equipment.

3.2 Installation

3.2.1 Where conduit painting is noted on Contract Drawings, coordinate installation of conduit with painting contractor.

3.2.2 Conceal conduits, ducts, and wiring in floor, wall, and ceiling construction of finished areas except where indicated otherwise.

3.2.3 Install conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to a minimum

3.2.4 Install expansion sleeves with bonding wherever conduits cross a structural expansion joint. 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.

3.2.5 Cut all threads on conduit neatly with the ends square and the inner diameter reamed smooth to remove burrs.

3.2.6 Provide junction or pull boxes where the number of right angle bends in one run exceeds three.

3.2.7 Cap all open ends of conduit with proper threaded caps immediately after installation to prevent entrance of foreign materials. Do not use wooden plugs.

3.2.8 Form a continuous metallic path with all conduit and fittings in accordance with the latest requirements of the Ontario Electrical Safety Code, to the satisfaction of the local inspector.

3.2.9 For conduit connections to all equipment whose position is subject to adjustment or vibration, use flexible galvanized steel conduit with a PVC jacket equal to "Sealtite" for a length not exceeding 500 mm.

3.2.10 Where cables or conduits pass through floors and fire rated walls, pack space between wiring and sleeve with approved material and seal with caulking conforming to CGSB 19-GP-9 mA.

3.2.11 Use Liquid-Tight flexible steel conduit for connection to motors, except as indicated.

3.2.12 All conduits which are laid in reinforced concrete shall be installed after the reinforcing is in place. Conduits placed in the centre of the structural slab shall not be more than 25 mm I.P.S., except for those conduits shown.

3.2.13 Conduits passing through a membrane under a floor slab shall be sealed against moisture to the City's approval.

3.2.14 Conduit shall be installed with minimum number of joints.

3.2.15 All conduits shall be supported at intervals as required by the Code

3.2.16 Install nylon fish cord in empty conduits. Identify the empty conduits.

3.2.17 Minimum size of conduits shall be 21mm.

3.2.18 All conduits installed in hazardous areas are to be equipped with EYS seals as required by the Ontario Electrical Safety Code.

3.3 Cable Installation

3.3.1 Swab clean and dry the inside of all embedded conduits prior to cable pulling.

3.3.2 Do not exceed the number of wires in any conduit per the requirements of the current edition of the Ontario Electrical Safety Code.

3.3.3 Do not pull any group of wires sufficient to damage or distort them and use only, an approved silicone base (greaseless) lubricant to facilitate pulling.

END OF SECTION

1. GENERAL

1.1 General

1.1.1 Comply with the requirements of the contract documents.

1.1.2 Gang boxes where wiring devices are grouped, except for standard sectional type boxes which shall not be ganged

1.1.3 Use combination boxes with barriers where outlets for more than one system are grouped.

1.2 Codes

1.2.1 Size boxes in accordance with CSA C22.1-1978, Section 12-3042.

2. PRODUCTS

2.1 Conduit Boxes

2.1.1 Cast metal type FS or FD boxes with factory hubs and mounting feet for surface wiring of switches and receptacles.

2.1.2 Masonry electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.1.3 Concrete electro-galvanized steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.2 Pull and Junction Boxes

2.2.1 Provide pull or junction boxes where indicated or necessary to facilitate the pulling of conductors.

2.2.2 Provide identification on each box.

2.3 Outlet Boxes

2.3.1 Provide each light, switch, receptacle and/or outlet with a suitable outlet box, each approved for the particular area in which it is to be installed

2.3.2 Ceiling boxes shall be 100 mm octagon.

2.3.3 Switch receptacles, telephone and miscellaneous outlets on exposed conduit work shall be housed in FS boxes with PVC covers.

3. EXECUTION

3.1 Location of Outlet Boxes

3.1.1 The indicated outlet locations are approximate; exact locations shall be determined from details and architectural and process drawings or instructions

on the job. Allowance shall be made in locating outlets for overhead pipes, ducts and other obstructions. The city reserves the right to change location of outlets to within 3 m of points indicated on plans without extra charge providing the Contractor is advised prior to installation.

3.1.2 Where switches, receptacles, are in the same general location, outlets to be lined up vertically unless otherwise called for by the City Project Manager.

3.1.3 Locate light switches on latch side of doors. Locate disconnect devices on latch side of door.

3.2 Installation

3.2.1 Support boxes independently of connecting conduits.

3.2.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material.

3.2.3 Provide correct size of openings in boxes for conduit. Reducing washers are not allowed.

3.3 Outlet Boxes

3.3.1 All outlet boxes in furred area shall be rigidly secured by metal hangers bolted to furring strips. Outlet boxes intended for fixture supports shall be provided with fixture studs where required.

3.3.2 All outlet boxes installed in the formwork shall be filled with suitable filler material and shall be properly fastened to the formwork to prevent the outlet box filling with concrete during the pouring.

3.4 Pull and Junction Boxes

3.4.1 For concealed conduit make boxes flush with wall, complete with covers, accessible and easily removed.

END OF SECTION

1. GENERAL

1.1 General

1.1.1 Comply with the requirements of the contract documents.

2. PRODUCTS

2.1 Wall Switches

2.1.1 15 A, 20 A, 120 V, single pole switches as indicated or where required, manually operated, toggle, specification grade (colour to be advised).

2.1.2 Provide switches of one manufacturer through project where possible.

2.1.3 Acceptable manufacturers:

.1 Pass & Seymour

.2 Arrow Hart

.3 Bryant

.4 Hubbell

.5 Pass & Seymour

.6 Slater

.7 Smith & Stone

2.2 Receptacles

2.2.1 Duplex receptacles, CSA Type 5-15R, 125 Volt, 15 A, u-ground, colour to be advised, weather proof where indicated on drawings.

2.2.2 Receptacles of one manufacturer throughout projects, where possible.

2.2.3 Acceptable Manufacturers:

.1 Pass & Seymour

.2 Arrow Hart

.3 Bryant

.4 Hubbell

.5 Pass & Seymour

.6 Slater

.7 Smith & Stone

2.3 Coverplates

2.3.1 Coverplates for wiring devices in finished areas: stainless steel, type 302 alloy, 0.035 satin finish.

2.3.2 Coverplates from one manufacturer throughout project.

2.3.3 Coverplates for surface mount wiring devices and blank: Scepter PVC type.

2.3.4 Weatherproof duplex receptacle covers: Hubbell Cast Aluminum, Cat. No. 5205 UO.

2.3.5 All coverplates below grade to be NEMA 4 (watertight).

3. EXECUTION

3.1 Installation

3.1.1 Not used.

END OF SECTION

1. ENGINE-GENERATOR SET

1.1 Engine

1.1.1 The prime mover shall be a liquid cooled, natural gas fueled, naturally aspirated engine of 4-cycle design that includes low NOx combustion system. Gas engine output shaft to be mechanically coupled to alternator operating at nominal 1800RPM. The generator shall have a minimum standby nameplate power rating of 200 kW, 250 kVA, 120/208 Volt, 3 Phase, 4 Wire at 80% power factor at 40°C ambient and other local conditions as defined in latest CAN/CSA C282 Emergency Electrical Power Supply for Buildings.

1.1.2 The unit shall be oversized as required to accommodate motor starting, step loads, fault current duties and exhaust stack back pressure limitations all within the CSA specified tolerances.

1.1.3 The engine provided shall have additional BHP capacity for power requirements to drive engine driven components and accessories such as radiator fan, fuel pump, battery charging dynamo as well as additional BHP allowances for motor starting duties, step loading changes, stack back pressure levels and 10% overload capabilities at 40°C ambient, all within CSA specified tolerances for voltage, frequency and temperature.

1.1.4 For determining the engine model, size and rating; include for allowances for engine driven accessories, radiator fan with allowances for static pressure losses. BHP at Standby Rating of engine at generator RPM shall be substantiated by Engine manufacturer's regularly published BHP curves. Engine rating conditions shall be 40°C ambient, 150 m above sea level. Engine manufacturer shall either show horsepower curves at these conditions or at other conditions together with rerating factors including data on losses to engine driven components and accessories.

1.1.5 The engine manufacturer's catalogued BHP curves for Standby Rating shall be based on continuous duty conforming to or exceeding the following standards:

.1 SAE J816b (US)

.2 BS5514

.3 DIN 6271 (European)

.4 ISO 30461

1.1.6 The engine is to be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system providing visual diagnostic means to determine if the system is operating with a normal engine coolant level. The radiator shall be designed for operation in 122 degrees F, 50 degrees C ambient temperature.

1.1.7 The intake air filter(s) with replaceable element must be mounted on the unit. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s). Engine coolant and oil drain extensions, equipped with pipe plugs, must be provided to outside of the mounting base for cleaner and

more convenient engine servicing. A fan guard must be installed for personnel safety.

1.1.8 The engine shall have a battery charging DC alternator with a transistorized voltage regulator. Remote 2-wire starting shall be by a solenoid shift, electric starter.

1.1.9 The engine fuel system shall be designed for primary operation on natural gas having a nominal BTU content of 1000 BTU per cubic foot delivered to the unit in a vapor state. A carburetor, secondary regulator, fuel lock-off solenoid and all piping must be installed at the point of manufacturing, terminating at a single pipe opening external to the mounting base. The dedicated fuel supply line shall be connected directly to the site gas meter station in accordance with applicable codes and with the requirements of CSA C282. This division shall provide the wiring connection between all of the monitored valves (between the meter station and generator) to the generator set controller, wired for alarm on valve "closed" condition.

1.1.10 The engine shall have (a) unit mounted, thermostatically controlled water jacket heater(s) to aid in quick starting. The wattage shall be as recommended by the manufacturer. The contractor shall provide proper branch circuit from normal utility power source.

1.1.11 Sensing elements to be located on the engine for low oil pressure shutdown, high coolant temperature shutdown, low coolant level shutdown, overspeed shutdown and overcrank shutdown. These sensors are to be connected to the control panel using a wiring harness with the following features: wire number labeling on each end of the wire run for easy identification, each sensor connection shall be sealed to prevent corrosion and all wiring to be run in flexible conduit for protection from the environment and any moving objects.

1.1.12 Provide the following items installed at the factory:

.1 The manufacturer shall supply its recommended stainless steel, flexible connector to couple the engine exhaust manifold to the exhaust system. The connector must be approved for use in Canada.

1.1.13 The following equipment is to be provided by the engine-generator set manufacturer and shipped loose with the unit: N/A

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

1.1.15 One step load acceptance shall be 100% of engine-generator set nameplate rating and meet the requirements of CSA C282.

1.1.16 The generator system shall support generator start-up and load transfer within 15 seconds.

1.2 ALTERNATOR

1.2.1 The alternator shall be a 4 pole revolving field type, 6 or 12 lead, wired for 120/208VAC 3 phase 4 wire, 60 Hz, minimum rated at 200kW complete with a permanent magnet driven exciter. Photosensitive components will not be

permitted in the rotating exciter. The stator shall be direct connected to the engine to ensure permanent alignment. The generator shall meet temperature rise standards for Class "H" insulation, operate within Class "F" standards for extended life. All leads must be extended into a separate AC connection box. The alternator shall be protected by internal thermal overload protection and an automatic reset field circuit breaker.

1.2.2 One step load acceptance shall be 100% of engine-generator set nameplate rating and meet the requirements of CSA C282. The generator set and regulator must sustain 300% short circuit current for 10 seconds during 3 phase fault.

1.2.3 A NEMA 1 panel that is an integral part of the generator set must be provided to allow the installer a convenient location in which to make electrical output connections. A fully rated, isolated neutral must be included by the generator set manufacturer to insure proper sizing.

1.2.4 The electric plant (engine and alternator) shall be mounted with internal vibration isolation onto a welded steel base. External vibration isolation shall not be required for normal outdoor pad mounted applications.

1.2.5 Provide the following items installed at the factory:

.1 A main line circuit breaker carrying the UL/CSA mark shall be factory installed. The breaker shall be rated per the manufacturer's recommendations unless specified below and mounted in the AC connection box. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections. A system utilizing manual reset field circuit breakers and current transformers is unacceptable.

The circuit breaker shall incorporate a set of auxiliary contacts to annunciate a breaker “open” condition, as per CSA C282 Table 1. The contact configuration shall be form C (SPDT). The function of these contacts shall be for local and remote annunciation of breaker position. Wire to controller and program for auxiliary fault.

.2 A 2nd main line circuit breaker complete with shunt trip and auxiliary contact carrying the UL/CSA mark shall be factory installed. The breaker shall be rated per the manufacturer's recommendations unless specified below and mounted in the AC connection box. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections of a loadbank for testing purposes in accordance with CSA C282. A system utilizing manual reset field circuit breakers and current transformers is unacceptable.

The circuit breaker shall incorporate a set of auxiliary contacts to annunciate a breaker “open” condition. The contact configuration shall be form C (SPDT). The function of these contacts shall be for local and remote annunciation of breaker position.

.3 An alternator strip heater shall be installed to prevent moisture condensation from forming on the alternator windings.

1.3 CONTROLS

1.3.1 The generator control system shall be a fully integrated microprocessor-based control system for standby emergency engine generators meeting all requirements of CSA C282.

1.3.2 The generator control system shall be a fully integrated control system enabling remote diagnostics and easy building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions including: engine protection, alternator protection, speed governing, voltage regulation and all related generator operations. The generator controller must also provide seamless digital integration with the engine's electronic management system if so equipped. Generator controller's that utilize separate voltage regulators and speed governors or do not provide seamless integration with the engine management system are considered less desirable.

1.3.3 Communications shall be supported with building automation via the Modbus protocol without network cards or protocol exchangers. Optional internet and intranet connectivity shall be available.

1.3.4 The control system shall provide an environmentally sealed design including encapsulated circuit boards and sealed automotive style plugs for all sensors and circuit board connections. The use of non-encapsulated boards, edge cards, and pc ribbon cable connections are considered unacceptable.

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

1.3.6 A predictive maintenance algorithm that alarms when maintenance is required. The controller shall have the capability to call out to the local servicing dealer when maintenance is required.

1.3.7 Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture operational parameters during events, simultaneous monitoring of all input or output parameters, callout capabilities, support for multi-channel digital strip chart functionality and .1msec data logging capabilities.

1.3.8 The control system shall provide pre-wired customer use I/O: 4 contact inputs, 2 analog inputs, 4 relay outputs, and communications support via RS232, RS485, and an optional modem. Customer I/O shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality. In addition, custom ladder logic functionality shall be supported to provide application support flexibility. The ladder logic function shall have access to all the controller inputs and customer assignable outputs.

1.3.9 The control panel will display all user pertinent unit parameters according to Table 1 of CSA C282 including:

.1 Engine and alternator operating conditions

.2 Oil pressure and oil temperature

.3 Coolant temperature and level alarm

.4 Fuel level (where applicable)

.5 Engine speed

.6 DC battery voltage

.7 Run time hours

.8 Generator voltages, amps, frequency, kilowatts, and power factor

.9 Alarm Status

.10 Current alarm(s) condition per CSA C282

.11 Alarm Log of last twenty alarm events (date and time stamped)

1.3.10 For system reliability and security concerns, access to and manipulation of the internal operating parameters and alarm limits shall be conducted via password protected PC based software by trained personnel System configuration support shall be provided locally or remotely by the manufacturers servicing representatives.

1.3.11 The following equipment is to be installed at the engine-generator set manufacturer's facility:

.1 A DPDT relay (run relay) shall be socket mounted in the generator control panel and operate on engine start and run for customer connection.

1.3.12 The following equipment is to be provided by the engine-generator set manufacturer and shipped loose with the unit:

.1 Provide a CSA C282 compliant alarm annunciator panel for remote indication per local and national code requirements. The annunciator shall be controlled using RS485 communications from the generator controller. Annunciators requiring individual contacts and wires per indication point are not preferred. The panel shall have an ALARM switch that when moved to the OFF position silences the audible alarm. A TEST/RESET switch must be included to verify the lights are functional and reset any condition after it has cleared.

.2 A surface mount Remote Relay Panel must be provided. The panel will monitor 8 selectable channels via an RS485 data link with the generator control panel. A status change in a form A contact will occur when a monitored channel changes state.

2. ADDITIONAL UNIT REQUIREMENTS

2.1 Unit Accessories

2.1.1 The following equipment is to be installed at the engine-generator set manufacturer’s facility:

.1 Weather protective sound attenuating enclosure: the engine-generator set shall be enclosed in a 14 gauge steel enclosure constructed with corner posts, uprights

and headers. The roof shall include a drip edge. The enclosure shall be coated with electro-statically applied powder paint, baked and finished to manufacturer's specifications. The colour will be manufacturer's standard colour. The enclosure shall be completely lined with 2" Acoustiguard ML-200 thermal/acoustic insulation or equivalent, with a cover of matte black non-woven glass, and with a minimum density of 4 lbs./ ft^3, to meet the following specifications: ASTM C518 (thermal conductivity), UL94 HF-1 (flammability), and ASTM C423-90 (absorption). This material must be of a self extinguishing design. The enclosure is to have large, hinged doors to allow access to the engine, alternator and control panel. Hinges shall be galvanized or stainless steel. Each door will have cast aluminum powder-coated key-locking lever latches with identical keys. Padlocks do not meet this specification. Noise rating of the enclosed generator set will be less than 75 dbA @ 7m, in a free-field environment.

The exhaust silencer(s) shall be provided of the size as recommended by the manufacturer and shall be of minimum super critical grade unless otherwise specified on the tender drawings. The silencer(s) shall be mounted within the weather protective enclosure exhaust compartment for reduced exhaust noise and provide a clean, smooth exterior design. It shall be connected to the engine with a flexible, seamless, stainless steel exhaust connection. A rain cap will terminate the exhaust pipe and be installed so that the exhaust is oriented vertically and free from any impediments that would prevent the flow of the emissions. All components must be properly sized to assure operation without excessive back pressure when installed. The enclosure shall be equipped with motorized dampers to maintain a minimum internal temperature of 10ºC at all times when the generator set is not running. Supply and install a minimum 3kW fan forced unit heater c/w fan and internal thermostat. Dampers shall have R5 internal insulation, double blade edge seals, and be sealed at the ends for further thermal properties. Edge seals are stable in a -45ºC to +110ºC environment, and are physically locked to the blade edge extrusion. Dampers must operate in fail-safe mode, i.e. open when power fails, and stay open while generator set is running.

2.1.2 A heavy duty, lead acid 24Vdc battery set rated at 925 CCA, BCI group 31 as minimum shall be installed by the generator set manufacturer. Manufacturer shall be responsible for sizing the required battery set and providing a larger battery set as required. Provide all inter-cell and connecting battery cables as required for a complete operating system.

2.1.3 Provide an automatic dual rate battery charger. The automatic equalizer system shall monitor and limit the charge current to 10 amps. The output voltage is to be determined by the charge current rate. The charger must be protected against a reverse polarity connection. The battery charger is to be factory installed on the generator set. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.

2.1.4 The enclosure shall be equipped with a 100A 120/240VAC load centre complete with an appropriately sized main breaker to match site wiring and with sufficient circuits to power all of the accessories inside. It shall be powered with normal power from the main building. Supply a DC emergency light pack to the requirements of CSA C282 and a GFCI AC convenience receptacle wired from the load centre.

2.1.5 The motorized dampers shall be powered from the load centre through a N/C contact on the run relay. Damper motors shall be Belimo CSA approved, or approved equal.

3. ADDITIONAL PROJECT REQUIREMENTS

3.1 APPLIED STANDARDS

3.1.1 The unit shall be Canadian Standards Association certified.

3.2 FACTORY TESTING

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

.1 Verifying all safety shutdowns are functioning properly.

.2 Verify single step load pick-up per CSA C282

.3 Verify transient and voltage dip responses and steady state voltage and speed (frequency) checks.

3.3 OWNER'S MANUALS

3.3.1 Three (3) electronic copies on USB drives and three (3) hard copies of owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

3.4 INSTALLATION

3.4.1 Contractor shall install the complete electrical generating system including all fuel connections in accordance with local codes and the manufacturer's recommendations as reviewed by the Engineer.

3.5 SERVICE

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

3.5.2 Client has existing service contracts in place to provide routine maintenance service to all Toronto Fire generators and will not accept any additional service contracts at this time. The generator manufacturer must provide written confirmation that routine maintenance performed by the client's 3rd party maintenance provider in accordance with the manufacturers' maintenance schedule will not void equipment warranty.

3.6 WARRANTY

3.6.1 The standby electric generating system components, complete engine-generator and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of 24 months. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge. Travel and labor shall be included for the full 24 month period.

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

3.7 STARTUP AND CHECKOUT

3.7.1 The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to checkout the completed installation and to perform an initial startup inspection and commissioning to include:

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

.2 Verification of all engine parameters within specification.

.3 Verify no load frequency and voltage, adjusting if required.

.4 Test all automatic shutdowns of the engine-generator.

.5 Perform a 4 hour full load test of the electric plant, ensuring full load frequency and voltage are within specification, by using portable load banks. Note any deficiencies. Complete all testing as per CSA C282 requirements, and submit a report and letter of acceptance when complete, to the engineer for review.

3.8 SUBMITTALS

3.8.1 Provide three complete sets of Engineering Submittal for approval, prior to production release, showing all components, in addition to the engine and generator. Submittals shall include compliance with these specifications.

3.8.2 Prior to final purchase and production release of Gas-generator set, submit complete sets of Engineering Submittals showing all that components in addition to the engine and generator are compliant with these specifications. The submission must include the following information for approval as a minimum:

.1 Preliminary dimensioned outline and enclosure of unit

.2 Brake horsepower versus rated speed curves

.3 Gas fuel consumption

.4 Performance curves for local conditions and multipliers for ambient temperatures

.5 Generator damage curves

.6 Generator decrement curves showing current delivered for specified faults

.7 Generator decrement curves against generator main breaker curve

.8 Efficiency of generator

.9 List of components

.10 Expected performance for NOx, CO and UHC at 25%, 50%, 75% & 100% load.

.11 Submit three phase and single phase decrement and generator damage curves to show fault current sustaining ability of generator as outlined.

3.8.3 No equipment substitutions or deviations from the above performance specification will be entertained during the tender process. After contract award the contractor may choose to submit equipment shop drawings for consultant/owner review which may include minor equipment substitutions or deviations which must be clearly identified on the submission. If the consultant approves any substitutions or deviations from the performance specification the contractor must pass on any cost savings to the owner. The contractor will be responsible for any additional project costs and/or design adjustments associated with the deviations from the performance specification.

3.9 TRAINING PROGRAM

3.9.1 Include in the equipment supply tender price the services of a qualified technical representative at the site to conduct "hands-on" training programs for the Owner's staff.

3.9.2 The amount of time to be included in the tender is one (1) day at the site for a total of 4 hours.

3.9.3 The training shall include identification of components and diagnostic alarms as well as basic inspection, housekeeping and logging procedures.

3.9.4 Submit an outline of the training program for review, adjustment and approval by the engineer.

3.9.5 Training will occur in a single one-day session, at a time convenient to the Owner, over the construction and warranty period.

3.9.6 Sessions may be videotaped by the Owner as an aid to ongoing training of Owners staff.

END OF SECTION

1. GENERAL

1.1 General

1.1.1 Comply with the requirements of the contract documents.

1.1.2 Provide the specified products where shown on schedules, device data sheets or as shown on the Contract Drawings.

1.1.3 For each connected motor one horsepower or above, provide a disconnect switch whether or not shown on the drawings. For fractional horsepower motor disconnects use manual motor starters without overloads.

1.1.4 Provide all fuses required to complete the installation under this section complete with renewable links of Economy manufacture or approved equal.

2. PRODUCTS

2.1 Equipment Enclosure

2.1.1 Compatible with room or area environment and unless otherwise indicated, in accordance with classification specified in Section 16010.

2.1.2 Unless otherwise indicated, factory finish all equipment inside and outside with ANSI/ASA #61 grey paint.

2.2 Disconnect Switch

2.2.1 Switch

.1 Type: Fusible and Non-fusible as indicated

.2 Operation: Front-operated, heavy duty, industrial grade, quick-make, quick-break, with provision for padlocking in OFF position.

.3 Rating: As required

.4 Fuse holders (for fusible switches): For HRC1-J fuses without adapters.

2.2.2 Manufacturers:

.1 Cutler-Hammer Industrial Controls

.2 Square 'D' Canada

.3 Siemens Canada

.4 Allen-Bradley Canada Ltd.

2.3 Manual Motor Starter

2.3.1 Manual motor starters:

.1 Type: Single or multi-pole (as indicated), quick-make, quick-break, manual reset, trip indicating handle, with one overload device in each ungrounded phase conductor, toggle operated.

.2 Integral horsepower manual motor starter: EEMAC size M-1 minimum and to be same type and manufacturer as the MCC.

.3 Mounting: Flush-mount in concealed conduit areas.

2.3.2 Manufacturers:

.1 Cutler-Hammer Industrial Controls

.2 Square 'D' Canada

.3 Siemens Canada

.4 Allen-Bradley Canada Ltd.

2.4 Breakers in MCC

2.4.1 Automatic Breakers: With adjustable, interchangeable thermal magnetic trip units.

2.4.2 Thermal magnetic trips for feeder breaker: Interchangeable except on 100 A and 150 A frame units.

2.5 Local Control Panels, Control Panels

2.5.1 Provide local control panels with control and indicating devices as indicated, enclosure to be suitable for the area where the local control panel is located and as indicated on contract documents.

2.6 Magnetic Motor Starters and Contactors

2.6.1 Magnetic motor starters: Combination type, full voltage, reduced voltage or multi-speed type, reversing or non-reversing, EEMAC Size 1 minimum, rated for system fault capacity. Intermediate EEMAC sizes not acceptable.

2.6.2 Overload relays: Adjustable, ambient compensated, manually resettable from enclosure door, one element for each ungrounded phase.

2.6.3 Overload relay heaters: Field installed, selected to match installed motor nameplate data.

2.6.4 Contactor: Electrically drawn in and held.

2.6.5 Reversing starters: Contactors mechanically and electrically interlocked.

2.6.6 Circuit disconnecting means: Circuit breaker as indicated.

2.6.7 Fusible switch fuse holders: Suitable for HRC1-J fuses.

2.6.8 Motor starter circuit breaker: Moulded case, with adjustable magnetic only trips. Co-ordinate with thermal overload device.

2.6.9 Mechanical interlock: Prevent opening of door when disconnecting device in ON position.

2.6.10 Control transformer: Fused 120 V secondary winding, unfused leg grounded.

2.6.11 Manufacturers:

.1 Cutler-Hammer Industrial Controls

.2 Square 'D' Canada

.3 Siemens Canada

.4 Allen-Bradley Canada Ltd.

2.7 Ancillary Devices

2.7.1 Auxiliary contacts: In addition to contacts indicated, minimum one normally open and one normally closed spare contact, separate poles.

2.7.2 Operator devices: Heavy duty, industrial, oil tight, functions as indicated (pushbuttons, selector switches), rated 120 V AC, wired to terminal blocks, Type K by Square D Canada, Type CR104P by GE Canada, Type PB1 by Cutler Hammer, Type 10250T by Cutler Hammer, Type 800T by Allen-Bradley Canada Ltd.

2.7.3 Indicating lights: Integral transformer type, 12 V secondary, with clustered LED lamps replaceable from front without disconnecting power supply, push to test type.

2.7.4 COMPUTER/LOCAL type selector switches shall be of early-make, late-break type contacts in control circuits for bumpless transfer of device control mode. Switch operation shall be maintained position. One spare set of contacts for each panel.

2.7.5 Emergency Stop Button – Red, mushroom handle, heavy duty mechanically held, three contacts minimum, pull to reset protective cover around handle to reduce accidental operation.

2.7.6 Heater and lighting contactors: Similar to magnetic motor starters, but without thermal overload devices.

2.7.7 Heater and lighting circuit breakers: Moulded case, with integral thermal magnetic trips, interrupting rating 18,000 A RMS symmetrical minimum at 600 V.

2.7.8 Internal power wiring: Stranded copper, minimum #12 AWG, rated 600 V, sized to accommodate largest load starter is capable of switching.

2.7.9 Control wiring: Stranded copper, minimum #14 AWG, 600 V rated. Utilize extra flexible conductors for wiring to panel doors.

2.7.10 Wire identification: Oil-resistant, Type Z markers by Wieland Electric Inc. at conductor ends. Adhesive cloth or Mylar types will not be accepted.

2.7.11 Terminal blocks: Compression type, modular, 25 A, 600 V minimum, identified with numbers identical to wire numbers. Supply six spare terminal blocks minimum.

2.7.12 Maximum number of wires under each terminal screw: Two.

2.7.13 Wiring and schematic diagram: Permanently mounted inside enclosure.

2.7.14 Hazardous area application: Panel and associated devices suitable for application in specific hazardous area. Type EMP by Crouse-Hinds, G Series by Killark Electric Manufacturing Co.

2.8 Control Relays

2.8.1 General purpose relays: Heavy duty, industrial, EEMAC rated, electrically held, 120 V AC coil, minimum 10 A, 120 V AC convertible contacts. Manufacturers

.1 Allen-Bradley Canada Ltd., Type P

.2 Square D Canada, Type X

.3 Cutler-Hammer Canada. Type AR

2.8.2 Magnetic latching relays: Heavy duty, industrial, EEMAC rated, magnetically or mechanically held, electrically released, 120 V AC coil, minimum 10 A, 120 V AC convertible contacts. Manufacturers:

.1 Allen-Bradley Canada Ltd., Type NM

.2 Square D Canada, Type XL

.3 Cutler-Hammer Canada. Type ARML

2.8.3 Timing relays: ON delay, OFF delay or Interval type as indicated, 120 V AC coil, minimum 10A, 120 V AC convertible contacts, knob adjustable timing, timing range as indicated. Manufacturers:

.1 Allen-Bradley Canada Ltd., Type PT or NT

.2 Square D Canada, Type X

.3 Cutler-Hammer Canada. Type ARPT

2.8.4 Double voltage relays: Convertible contacts, number and type as indicated, metal barrier between coil and contact terminations, where indicated or required by the Inspection Authorities.

2.8.5 Thermistor relays: Type 3UN2100 by Siemens Electric Ltd. compatible with respective motor winding temperature sensors (thermistors).

2.9 Panelboards

2.9.1 Supply 208/120V and 600V panelboards from same manufacturer as the Motor Control Centre.

2.9.2 Circuit breaker type panelboards: Deadfront design, equipped with double or single row, bolt-on, thermal magnetic, non-interchangeable, moulded case branch circuit breakers of sizes and types indicated.

2.9.3 Ratings: unless otherwise indicated, circuit breaker panelboards and components with the following minimum (symmetrical) short circuit ratings:

.1 600 V Power Panelboards 25,000A

.2 208/120 V Panelboards 10,000A

2.9.4 Busbars: Tin plated copper equipped with solderless lugs for incoming cables where main circuit disconnecting device is not indicated.

2.9.5 Doors: With spring latches and cylinder locks keyed alike, two keys per panelboard.

2.9.6 Circuit directory: Framed plexiglass enclosed legend, located on inside of door.

2.9.7 Lock-on/lock-out devices: For all main and feeder breakers.

2.9.8 Isolated ground bus: In designated panels as indicated.

2.9.9 Ground fault protection circuit breakers: Class A type, 120 V, automatic shunt trip, facilities for testing and reset.

2.9.10 Manufacturers for 208/120V and 600V Panelboards:

.1 Square D Canada: NQOB

.2 Cutler-Hammer: Pow-R-Line series

.3 Siemens Canada

2.10 Distribution Transformers

2.10.1 Design: General purpose, high efficiency, dry type, ANN, 60 Hz, low sound level with vibration isolators, rating and voltages as indicated. Four 2½% primary taps (2-FCAN, 2-FCBN).

2.10.2 Insulation: Class 185 °C minimum with maximum 80 °C temperature rise in 40 °C ambient, epoxy encapsulated in damp, hazardous or outdoor areas.

2.10.3 Windings: Copper, delta connected primary, wye connected secondary with neutral grounding provision.

2.10.4 Manufacturers Supply distribution transformers of one manufacture throughout project:

.1 Hammond Manufacturing Co. Ltd.

.2 ABB Canada

.3 MagneTek Polygon Transformer Co.

.4 Square `D' Canada

.5 Marcus Transformer of Canada Ltd.

.6 Rex Manufacturing

.7 Delta Transformer of Canada Ltd.

2.11 Flashing Lights

2.11.1 Non-hazardous areas: 120 V AC, heavy duty, weatherproof, red lens. AdaptaBeacon 97C Series by Edwards, VDAS by Crouse-Hinds, Industrial Strobe by Applied Strobe Technology Co. Ltd., 371DST by Federal Signal Corp.

2.11.2 Hazardous areas: 120 V AC, approved for use in specific area, red lens. AdaptaBeacon, 50REX-5 by Edwards, EV Series by Crouse-Hinds, Factory Sealed Strobe by Applied Strobe Technology Co. Ltd., Model 27XST Series B by Federal Signal Corp.

2.12 Horn

2.12.1 Non-hazardous areas: 120 V AC, low current, high decibel, vibrating, heavy duty, weatherproof, field adjustable output range, 78-103 dB at 3040 mm, Adaptahorn 876-N5 by Edwards, Vibratone Model 350 by Federal Signal Corp., WH Series by Crouse-Hinds.

2.12.2 Hazardous areas: 120 V AC, low current, high decibel, vibrating, 100 dB at 3040 mm. Adaptahorn 878-120 by Edwards, Model 31X by Federal Signal Corp., ETH High Power Horn by Crouse-Hinds.

2.13 Wiring Terminations

2.13.1 Lugs, terminals and screws used for termination of wiring to be made of tin-plated copper, except as specified in the detailed specifications, e.g. instrument/control panels.

3. EXECUTION

3.1 Disconnect Switch Installation

3.1.1 Provide fusible disconnect switches complete with fuses and store spare fuses kept in original containers in the appropriate storage cabinet.

3.1.2 Provide mounting pedestal for units located adjacent to equipment in open areas.

3.2 Manual Motor Starter Installation

3.2.1 Flush-mount manual starters in concealed conduit areas.

3.3 Breakers in MCC

3.3.1 Mount breakers in MCC’s as indicated, provide hardware to suit.

3.4 Local Control Panel Installation

3.4.1 Mount as indicated on Contract Drawings or Data Sheets.

3.5 Magnetic Motor Starter and Contactor Installation

3.5.1 Connect auxiliary control devices.

3.6 Panelboard Installation

3.6.1 Provide panelboards of type and size indicated.

3.6.2 Terminate and connect field wiring.

3.6.3 For ground fault protected circuits, wire in accordance with manufacturer's recommendation.

3.7 Fuses

3.7.1 Install fuses in mounting assembly before energizing circuit.

3.7.2 Verify fuses physically match mounting devices. Where fuses and holders do not match, replace holder.

3.7.3 Provide size and type of fuses in accordance with Inspection Authority requirements.

3.8 Distribution Transformer Installation

3.8.1 Provide distribution transformers, mounted in upright position, as indicated. Verify wall or ceiling is adequate to support transformer. Provide additional bracing as required.

3.8.2 Install transformer to permit full accessibility to wiring and tap connections. For floor mounted units, allow 150 mm clearance from walls or other equipment to permit adequate ventilation through and around the housing.

3.8.3 Adjust vibration isolators for optimum noise suppression.

3.9 Load Balance

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

3.9.2 Measure phase voltages at loads and adjust transformer taps to within 3% of rated voltage of equipment.

3.10 Flashing Light and Horn Installation

3.10.1 Adjust as per manufacturer's recommendations.

END OF SECTION

1. GENERAL

1.1 Product Data

1.1.1 Submit product data in accordance with Section 16010.

1.1.2 Include time-current characteristic curves for breakers with ampacity of 100A and over.

2. PRODUCTS

2.1 Breakers

2.1.1 Bolt-on molded case circuit breaker: quick-make, quick-break type, for manual and automatic operation.

2.1.2 Common-trip breakers: with single handle for multi-pole applications.

2.1.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches 10X setting. Trip settings on breakers with adjustable trips to range from 3-8 time's current rating.

2.1.4 Circuit breakers with interchangeable trips as indicated.

2.1.5 Approved Manufacturers:

.1 Cutler-Hammer

.2 Siemens

.3 Square D

2.2 Thermal Magnetic Breakers

2.2.1 Molded 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.

2.2.2 Optional Features

2.2.3 Include ON-OFF locking devices as indicated.

3. EXECUTION

3.1 Installation

3.1.1 Install circuit breakers as indicated.

3.1.2 Ensure that all circuit breakers are properly rated and coordinated.

END OF SECTION