CFIA
REPLACEMENT OF MAIN FIRE PUMP
C0091

SPECIFICATION
Issued for Tender

Prepared by:

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END OF SECTION

PART 1 - GENERAL

1.1 MINIMUM STANDARDS

.1 Materials shall be new and work shall conform to the minimum applicable standards of the Canadian General Standards Board, the Canadian Standards Association, the National Building Code of Canada 2015 (NBCC) and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirement shall apply.

1.2 COVID SAFETY PROTOCOLS

.1 The Contractor shall comply with all COVID related measures recommended by Public Health Authorities and implement COVID protocols on the worksite as specified in Construction Association Best Practices and Construction Site Safety Occupational Health and Safety regulations and procedures. It is expected that the Contractor's worksite will be segregated from the rest of the CFIA building and operations. If access to the building is required, outside of the Contractor's worksite, the Contractor is expected to comply with CFIA COVID related procedures and protocols.

1.3 TAXES

.1 Pay all taxes properly levied by law (including Federal, Provincial and Municipal).

1.4 FEES, PERMITS, AND CERTIFICATES

.1 Pay all fees and obtain all permits. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.

1.5 FIRE SAFETY REQUIREMENTS

.1 Comply with the National Building Code of Canada 2015 (NBCC) for fire safety in construction and the National Fire Code of Canada 2015 (NFCC) for fire prevention, fire fighting and life safety in building in use.

.2 Comply with PSPC Standard on Construction Occupational Health and Safety, Fire Commissioner of Canada (FCC) standards:

- .1 No. 301: Standard for Construction Operations
- .2 No. 302: Standard for Welding and Cutting
- .3 No. 374: Fire Protection Standard for General Storage (Indoor and Outdoor)
- .4 available from Fire Protection Engineering Services, Labour Program, HRSDC or following internet site: es, Labour Program, HRSDC or following internet
- .5 Retain all fire safety documents and standards on site.

1.6 FIELD QUALITY CONTROL

.1 Carry out Work using qualified licenced workers or apprentices in accordance with Provincial Act respecting manpower vocational training and qualification.

.2 Permit employees registered in Provincial apprenticeship program to perform specific tasks only if under direct supervision of qualified licenced workers.

.3 Determine permitted activities and tasks by apprentices, based on level of training attended and demonstration of ability to perform specific duties.

1.7 HAZARDOUS MATERIALS

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

1.8 REMOVED MATERIALS

.1 Confirm with Departmental Representative before removal of items from site. Unless given direction otherwise, materials for removal become the Contractor's property and shall be taken from site.

1.9 PROTECTION

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

.2 Protect adjacent work against the spread of dust and dirt

.3 Protect operatives and other users of site from all hazards.

1.10 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to the normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

.3 Where security is reduced by work provide temporary means to maintain security.

.4 Where elevators, dumbwaiters, conveyors or escalators exist Contractor may use these at Departmental Representative's discretion. Protect from damage, safety hazards and overloading of existing equipment.

.5 Sanitary facilities will be assigned for Contractor's personnel. Others shall not be used. Keep facilities clean.

.6 Closures: Protect work temporarily until permanent enclosures completed.

1.11 SITE STORAGE

.1 Do not unreasonably encumber site with materials or equipment.

.2 Move stored products or equipment which interfere with operations of Departmental Representative or other contractors.

.3 Obtain and pay for use of additional storage as space for equipment storage on site is minimal.

1.12 CUT, PATCH AND MAKE GOOD

.1 Cut existing surfaces as required to accommodate new work.

.2 Remove all items so shown or specified.

.3 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture.

.4 Install firestops and smoke seals in accordance with ULC-S115-11, around pipe, ductwork, cables, and other objects penetrating fire separations to provide fire resistance not less than the fire resistance rating of surrounding floor, ceiling, and wall assembly.

1.13 SLEEVES, HANGERS AND INSERTS

.1 Co-ordinate setting and packing of sleeves and supply and installation of hangers and inserts. Obtain Departmental Representative's approval before cutting into structure.

1.14 EXAMINATION

.1 Examine site and conditions likely to affect work and be familiar and conversant with existing conditions

1.15 SIGNS

.1 Provide common-use signs related to traffic control, information, instruction, use of equipment, public safety devices, etc., in both official languages or by the use of commonly-understood graphic symbols to the Departmental Representative's approval.

.2 No advertising will be permitted on this project.

1.16 WASTE MANAGEMENT

.1 Comply with the Environmental Protection Act, Ontario Regulations O.Reg. 102/94 and O. Reg. 103/94 for waste management program on construction and demolition projects.

.2 Conduct "waste audit" to determine waste generated during demolition or construction operations, prepare written "waste reduction work plan" and implement procedures to reduce, reuse and recycle materials to the extent possible.

.3 Provide a "source separation program" to disassemble and collect in an orderly fashion the following "materials designated for alternative disposal" from the "general waste" stream.

.1 Cardboard (corrugated).
.2 Steel.
.3 Wood (not including treated or laminated wood).

.4 Submit complete records of all removals from site for both "materials designated for alternative disposal" and "general waste" including:
- .1 Time and date of removal.
- .2 Description of material and quantities.
- .3 Proof that materials have been received at an Approved Waste Processing .
- .4 Site or certified Waste Disposal Site as required.

1.17 GUARANTEES AND WARRANTIES

.1 Before completion of work collect all manufacturer's guarantees and warranties and deposit with Departmental Representative.

1.18 SECURITY ESCORT

.1 Personnel will be checked daily at start of work shift and given a pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.

.2 All personnel must attend a mandatory 2 hour site specific safety training session. Provide minimum 72 hours notice to Departmental Representative requesting site training.

1.19 BUILDING SMOKING ENVIRONMENT

.1 Smoking is not permitted in the Building. Obey smoking restrictions on building property.

1.20 DUST CONTROL

.1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of work and public.

.2 Maintain and relocate protection until such work is complete.

1.21 TESTING LABORATORY SERVICES

.1 Departmental Representative will appoint and pay for costs of inspection and testing services, unless indicated otherwise.

.2 Provide safe working areas and assist with testing procedures, including provisions for materials or services and co-ordination, as required by testing agency and as authorized by Departmental Representative.

.3 Where tests indicate non-compliance with specifications, contractor to pay for initial test and all subsequent testing of work to verify acceptability of corrected work.

1.22 SCHEDULING

.1 On award of contract submit bar chart construction schedule for work, indicating anticipated progress stages within time of completion. When schedule has been reviewed by the Departmental Representative, take necessary measures to complete work within scheduled time. Do not change schedule without notifying Departmental Representative.

.2 Carry out door work during "normal working hours" Monday to Friday 06:00 to 18:00 and on Saturdays, Sundays and statutory holidays.

.3 Carry indoor work during after working hours.

.4 Give the Departmental Representative 48 hours notice for work to be carried out during "off hours".

1.23 COST BREAKDOWN

.1 Before submitting first progress claim submit breakdown of Contract Amount in detail as directed by Departmental Representative and aggregating the Contract Amount. After approval by Departmental Representative cost breakdown will be used as the basis of progress payments.

1.24 PRECEDENCE

.1 Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual.

1.25 WORK PERMIT

.1 Obtain applicable work and hot work permit forms from building operator.

1.26 STAGING PLAN

.1 Submit to Departmental Representative for review and approval, a Staging Plan that outlines work stages in compliance with specified implementation restrictions and in accordance with submitted schedule. Once approved by the Departmental Representative, do not make changes to specified stages without prior written approval of Departmental Representative. Any changes to the Phasing Plan will require a minimum of 7 days advanced notice. Do not work in staging areas outside of indicated times.

1.27 REGULATORY REFERENCES

.1 PSPC Asbestos Management Directive and Standard, 2017.

.2 O.Reg 278/05 Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations.

.3 MOL - Lead on Construction Projects.

.4 MOL - Silica on Construction Projects.

.5 Canada Labour Code.

.6 MD15161-2013 - Control of Legionella in Mechanical Systems.

1.28 CMMS FORMS

.1 Contractor to complete CMMS Forms for all new equipment. Forms will be provided by Departmental Representative.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 ADMINISTRATIVE

.1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

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

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

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

.2 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 co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.3 Allow 10 days for Departmental Representative's review of each submission.

.4 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.5 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.6 Accompany submissions with transmittal letter, containing:
- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.7 Submissions include:
- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Capacities.
  - .4 Performance characteristics.
  - .5 Operating weight.

.8 After Departmental Representative's review, distribute copies.

.9 Submit an electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.10 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.11 Delete information not applicable to project.

.12 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.3 CERTIFICATES AND TRANSCRIPTS

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

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.2 Province of Ontario
- .1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990, c.0.1, as amended and O. Reg. 213/91 as amended - Updated 2005.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
- .1 Results of site specific safety hazard assessment.
- .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.

.4 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

1.3 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.

1.4 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.5 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.6 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.7 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990, c. 0.1 and Ontario Regulations for Construction Projects, O. Reg. 213/91.

.2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.8 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Ontario having jurisdiction and advise Departmental Representative verbally and in writing.

1.9 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Ontario having jurisdiction, and in consultation with Departmental Representative.

1.10 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

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

.2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

.3 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

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

1.3 STORAGE, HANDLING AND PROTECTION

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

.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.

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

.4 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.4 TRANSPORTATION

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

1.5 MANUFACTURER'S INSTRUCTIONS

.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.

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.

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

1.6 QUALITY OF WORK

.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 Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.7 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

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

1.8 LOCATION OF FIXTURES

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

.2 Inform Departmental Representative of conflicting installation. Install as directed.

1.9 FASTENINGS - EQUIPMENT

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

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

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

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

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.

.3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.4 Dispose of waste materials and debris off site.

.5 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.

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

1.2 FINAL CLEANING

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Prior to final review remove surplus products, tools, construction machinery and equipment.

.3 Remove waste products and debris.

.4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative.

.5 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.6 Remove stains, spots, marks and dirt from decorative work and mechanical fixtures.

.7 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Canadian Construction Documents Committee (CCDC)
- .1 CCDC 2-2008, Stipulated Price Contract.
- .2 DOC 14-2013, Design-Build Stipulated Price Contract.
- .3 DOC 15-2013, Design-Builder/ Consultant Contract.

.2 Canadian Environmental Protection Act (CEPA)
- .1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:
- .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
  - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
  - .2 Request Departmental Representative inspection.
- .2 Departmental Representative Inspection:
  - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
  - .2 Contractor to correct Work as directed.
- .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
  - .1 Work: completed and inspected for compliance with Contract Documents.
  - .2 Defects: corrected and deficiencies completed.
  - .3 Equipment and systems: tested, adjusted and balanced and fully operational.
  - .4 Operation of systems: demonstrated to Owner's personnel.
  - .5 Commissioning of mechanical systems: completed in accordance with 01 91 13 -General Commissioning Requirements and copies of final Commissioning Report submitted to Departmental Representative.
  - .6 Work: complete and ready for final inspection.
- .4 Final Inspection:
  - .1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.
  - .2 When Work incomplete according to Owner and Departmental Representative, complete outstanding items and request re-inspection.

1.3 FINAL CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.
- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

1.2 FORMAT

.1 O&M soft copies are reviewed and approved by BGIS Cx Oversight prior to hard copies being printed out.

.2 O&M soft copies to be available 2 weeks prior to substantial completion (as per spec document).

.3 O&M are to be indexed/sectioned as follows:

- .1 If a section is N/A, still leave the specific Tab and title in the folder (soft copy) or binder (hard copy) and insert a blank sheet stating N/A and short statement justifying the reason .
- .2 For soft copies of the O&M each section needs to have its own folder named as per below.
  - .1 Assembled in 1" or greater, 3 ring binders and one electronic copy provided on USB Memory Stick (or appropriate electronic media).
  - .2 Binder Cover and Binder Edge and Title Page:
    - .1 Project Name, Building Name, address, project number (GOC#), Project Completion Date.
  - .3 Table of Contents:
    - .1 Project Name, Building Name, address, project number (GOC#), Project Completion Date and table of contents.
  - .4 Tab A - Contact information:
    - .1 Include contact information for Consultant, General Contractor and all Sub-Contractors. Contractor Information: name, address, telephone number of manufacturer, installing contractor, 24-hour number for emergency service for all equipment in this section identified by equipment.
  - .5 Tab B - Signed letter of Warranty:
    - .1 Signed and dated letter of Warranty to include: project name, project number (GOC#), location, warranty start date (to be the date of Substantial Completion as declared by Consultant), and all manufacturer and extended warranties.
  - .6 Tab C - Shop Drawings:
    - .1 Shop drawings log.
    - .2 A copy of all Shop Drawings reviewed by the Consultant.
  - .7 Tab D - All Reports:
    - .1 Copies of all TAB reports, pre-functional tests, start up reports, completed performance verification forms and permits or certifications from Authorities Having Jurisdictions.
  - .8 Tab E - Sequences of Operation: (as required)
    - .1 Provide Designers and/or the Manufactures operating instructions and sequence of operations.
  - .9 Tab F - Maintenance and Service Procedures: (as required)
    - .1 Specific service and maintenance manuals, preventative and corrective maintenance, with service procedures and schedules.
  - .10 Tab G - As Build Drawings:
    - .1 Marked in red ink, by the Contractor and reviewed by the Consultant.
  - .11 Tab H - CMMS Data Sheets:
    - .1 A copy of all completed CMMS Data Sheets for all equipment which was deleted, removed, added or replaced.

.12 Tab I - Letter, signed by the Consultant or Commissioning Provider:
.1 Indicating whether the Project included a system or modification to system susceptible to Legionella and whether the Facility Legionella Binder as per MD-15161 was updated in particular the Facility Checklist LBCMP-1, Contact List LBCMP-2 and Schematic Drawings, and whether the update was completed.

.13 Tab J - Final Cx Report (by Consultant as per template provided by BGIS Cx Oversight:
.1 Letter from the Consultant stating that they have reviewed the installation of new filter banks and find it satisfactory to the Basis of Design.

1.3 AS -BUILT DOCUMENTS AND SAMPLES

.1 Maintain one record copy of:
.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Change Orders and other modifications to Contract.
.5 Reviewed shop drawings, product data, and samples.

.2 Maintain record documents in clean, dry and legible condition.
.1 Do not use record documents for construction purposes.

1.4 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of black line opaque drawing.

.2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress.
.1 Do not conceal Work until required information is recorded.

.4 Contract Drawings: mark each item to record actual construction, including:
.1 Measured depths of elements of foundation in relation to finish first floor datum.
.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
.4 Field changes of dimension and detail.
.5 Changes made by change orders.
.6 Details not on original Contract Drawings.
.7 Referenced Standards to related shop drawings and modifications.

.5 Other Documents: maintain field test records, required by individual specifications sections.

.6 Provide digital photos, if requested, for site records.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 This Section specifies roles and responsibilities of Commissioning Training.

1.2 TRAINEES

.1 Trainees: personnel selected for operating and maintaining this facility. Includes Property Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
- .1 Start-Up, operation, shut-down of equipment, components and systems.
- .2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
- .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.2 Contractor and equipment manufacturer to provide instruction on:
- .1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:
- .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
- .2 Effective on-going inspection, measurements of system performance.
- .3 Proper preventive maintenance, diagnosis and trouble-shooting.
- .4 Ability to update documentation.
- .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:
- .1 "As-Built" Contract Documents.
- .2 Operating Manual.
- .3 Maintenance Manual.
- .4 Management Manual.
- .5 TAB and PV Reports.

.3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.

.4 Training materials to be in a format that permits future training procedures to same degree of detail.

.5 Supplement training materials:
- .1 Transparencies for overhead projectors.
- .2 Multimedia presentations.
- .3 Manufacturer's training videos.
- .4 Equipment models.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be 3 hours in length.

.3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

.1 Be responsible for:
- .1 Implementation of training activities,
- .2 Coordination among instructors,
- .3 Quality of training, training materials,

.2 Departmental Representative will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors.

1.8 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:
- .1 Review of facility and occupancy profile.
- .2 Functional requirements.
- .3 System philosophy, limitations of systems and emergency procedures.
- .4 Review of system layout, equipment, components and controls.
- .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
- .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
- .7 Maintenance and servicing.
- .8 Trouble-shooting diagnosis.
- .9 Inter-Action among systems during integrated operation.
- .10 Review of O&M documentation.

.3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
- .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

.2 Acronyms:
- .1 AFD - Alternate Forms of Delivery, service provider.
- .2 BMM - Building Management Manual.
- .3 Cx - Commissioning.
- .4 EMCS - Energy Monitoring and Control Systems.
- .5 O&M - Operation and Maintenance.
- .6 PI - Product Information.
- .7 PV - Performance Verification.
- .8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
- .1 Verify installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.
- .2 Ensure appropriate documentation is compiled into the BMM.
- .3 Effectively train O&M staff.

.2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
- .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
- .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

.1 Cx to be a line item of Contractor's cost breakdown.

.2 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.3 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.

.4 Departmental Representative will issue Interim Acceptance Certificate when:
- .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
- .2 Equipment, components and systems have been commissioned.
- .3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

.1 Before Construction:
- .1 Review Contract Documents, confirm by writing to Departmental Representative.
  - .1 Adequacy of provisions for Cx.
  - .2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:
- .1 Co-ordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:
- .1 Fully understand Cx requirements and procedures.
- .2 Have Cx documentation shelf-ready.
- .3 Understand completely design criteria and intent and special features.
- .4 Have Cx schedules up-to-date.
- .5 Ensure systems have been cleaned thoroughly.
- .6 Ensure "As-Built" system schematics are available.

.4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI) /Performance Verification (PV) Forms for requirements and instructions for use.

.2 Departmental Representative to review and approve Cx documentation.

.3 Provide completed and approved Cx documentation to Departmental Representative.

1.8 COMMISSIONING MEETINGS

.1 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.

.2 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.3 Meeting will be chaired by Departmental Representative, who will record and distribute minutes.

1.9 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.10 WITNESSING OF STARTING AND TESTING

.1 Provide 14 days notice prior to commencement.

.2 Departmental Representative to witness of start-up and testing.

1.11 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:
- .1 Included in delivery and installation:
  - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
  - .2 Visual inspection of quality of installation.
- .2 Operational testing: document equipment performance.
- .3 System PV: include repetition of tests after correcting deficiencies.

.3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.

.4 Document require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
  .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
  .2 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
    .1 Rejected equipment to be remove from site and replace with new.
    .2 Subject new equipment/systems to specified start-up procedures.

1.12 START OF COMMISSIONING

.1 Notify Departmental Representative at least 14 days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.13 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:
  .1 Under actual operating conditions, over entire operating range, in all modes.
  .2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

1.14 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

1.15 AUTHORITIES HAVING JURISDICTION

.1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

.3 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.16 REPEAT VERIFICATIONS

.1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
  .1 Verification of reported results fail to receive Departmental Representative's approval.
  .2 Repetition of second verification again fails to receive approval.
  .3 Departmental Representative deems Contractor's request for second verification was premature.

1.17 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.18 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.19 ACTIVITIES UPON COMPLETION OF COMMISSIONING

.1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.20 OWNER'S PERFORMANCE TESTING

.1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

.1 Provide a fully functional facility:
- .1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
- .2 Facility user and O&M personnel have been fully trained in aspects of installed systems.
- .3 Optimized life cycle costs.
- .4 Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 Use this Cx Plan as master planning document for Cx:
- .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
- .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
- .3 Sets out deliverables relating to O&M, process and administration of Cx.
- .4 Describes process of verification of how built works meet design requirements.
- .5 Produces a complete functional system prior to issuance of Certificate of Occupancy.
- .6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
  - .1 Overview of Cx.
  - .2 General description of elements that make up Cx Plan.
  - .3 Process and methodology for successful Cx.

.4 Acronyms:
- .1 Cx - Commissioning.
- .2 BMM - Building Management Manual.
- .3 EMCS - Energy Monitoring and Control Systems.
- .4 WHMIS Safety Data Sheets (SDS).
- .5 PI - Product Information.
- .6 PV - Performance Verification.
- .7 TAB - Testing, Adjusting and Balancing.
- .8 WHMIS - Workplace Hazardous Materials Information System.

.5 Commissioning terms used in this Section:
- .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
- .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.2 DEVELOPMENT OF 100% CX PLAN

.1 Cx Plan to be 95% completed before added into Project Specifications.

.2 Cx Plan to be 100% completed within 8 weeks of award of contract to take into account:
- .1 Approved shop drawings and product data.
- .2 Approved changes to contract.
- .3 Contractor's project schedule.
- .4 Cx schedule.

.5 Contractor's, sub-contractor's, suppliers' requirements.
.6 Project construction team's and Cx team's requirements.

.3 Submit completed Cx Plan to Departmental Representative and obtain written approval.

1.3 REFINEMENT OF CX PLAN

.1 During construction phase, revise, refine and update Cx Plan to include:
.1 Changes resulting from Client program modifications.
.2 Approved design and construction changes.

.2 Revise, refine and update every 2 weeks during construction phase. At each revision, indicate revision number and date.

.3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.

.4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.4 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

.1 Departmental Representative (Design Consultant) to maintain overall responsibility for project and is sole point of contact between members of commissioning team.

.2 Project Manager will select Cx Team consisting of following members:
.1 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
.2 PWGSC Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
.1 Review of Cx documentation from operational perspective.
.2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
.3 Protection of health, safety and comfort of occupants and O&M personnel.
.4 Monitoring of Cx activities, training, development of Cx documentation.
.5 Work closely with members of Cx Team.
.3 Departmental Representative is responsible for:
.1 Organizing Cx.
.2 Monitoring operations Cx activities.
.3 Witnessing, certifying accuracy of reported results.
.4 Witnessing and certifying TAB and other tests.
.5 Developing BMM.
.6 Ensuring implementation of final Cx Plan.
.7 Performing verification of performance of installed systems and equipment.
.8 Implementation of Training Plan.
.4 Construction Team: contractor, subcontractors, suppliers and support disciplines, is responsible for construction/installation in accordance with Contract Documents, including:
.1 Testing.
.2 TAB.
.3 Performance of Cx activities.
.4 Delivery of training and Cx documentation.

.5 Assigning one person as point of contact with Consultant and PWGSC Cx Manager for administrative and coordination purposes.

.5 Departmental Representative implements specified Cx activities including:
- .1 Demonstrations.
- .2 Training.
- .3 Testing.
- .4 Preparation, submission of test reports.

.6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
- .1 Receiving facility.
- .2 Day-To-Day operation and maintenance of facility.

1.5 CX PARTICIPANTS

.1 Employ the following Cx participants to verify performance of equipment and systems:
- .1 Installation contractor/subcontractor:
  - .1 Equipment and systems except as noted.

.2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
- .1 To include performance verification.

.3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.

.4 Specialist Cx agency:
- .1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.

.5 Client: responsible for intrusion and access security systems.

.6 Ensure that Cx participant:
- .1 Could complete work within scheduled time frame.
- .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O&M personnel, including:
  - .1 Modify ventilation rates to meet changes in off-gassing.
  - .2 Changes to heating or cooling loads beyond scope of EMCS.
  - .3 Changes to EMCS control strategies beyond level of training provided to O&M personnel.
  - .4 Redistribution of electrical services.
  - .5 Modifications of fire alarm systems.
  - .6 Modifications to voice communications systems.

.7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.6 EXTENT OF CX

.1 Commission mechanical systems and associated equipment:
- .1 Plumbing systems:
  - .1 Domestic CWS and HWS.
  - .2 Regular sanitary waste systems.
- .2 HVAC and exhaust systems:
  - .1 HVAC systems.
  - .2 General exhaust systems.

.3 Laboratory fume hoods and related systems.

.2 Commission electrical systems and equipment:
.1 Low voltage below 750 V:
.1 Low voltage equipment.
.2 Low voltage distribution systems.
.3 Central clock systems.
.4 Electronic data and communications information systems.

1.7 DELIVERABLES RELATING TO O&M PERSPECTIVES

.1 General requirements:
.1 Compile English documentation.
.2 Documentation to be computer-compatible format ready for inputting for data management.

.2 Provide deliverables:
.1 Warranties.
.2 Project record documentation.
.3 Inventory of spare parts, special tools and maintenance materials.
.4 Maintenance Management System (MMS) identification system used.
.5 WHMIS information.
.6 WHMIS Safety Data Sheets (SDS).
.7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.8 DELIVERABLES RELATING TO THE CX PROCESS

.1 General:
.1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.

.2 Definitions:
.1 Cx as used in this section includes:
.1 Cx of components, equipment, systems, subsystems, and integrated systems.
.2 Factory inspections and performance verification tests.

.3 Deliverables: provide:
.1 Cx Specifications.
.2 Startup, pre-Cx activities and documentation for systems, and equipment.
.3 Completed installation checklists (ICL).
.4 Completed product information (PI) report forms.
.5 Completed performance verification (PV) report forms.
.6 Results of Performance Verification Tests and Inspections.
.7 Description of Cx activities and documentation.
.8 Description of Cx of integrated systems and documentation.
.9 Training Plans.
.10 Cx Reports.
.11 Prescribed activities during warranty period.

.4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.

.5 Departmental Representative to participate.

1.9 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Items listed in this Cx Plan include the following:
- .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
- .2 Departmental Representative to use approved check lists.

.2 Pre-Cx activities - MECHANICAL:
- .1 HVAC equipment and systems:
  - .1 At this time, complete pre-start-up checks and complete relevant documentation.
  - .2 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
  - .3 Perform TAB on systems. TAB reports to be approved by Departmental Representative.
- .2 EMCS:
  - .1 EMCS trending to be available as supporting documentation for performance verification.
  - .2 Perform point-by-point testing in parallel with start-up.
  - .3 Carry out point-by-point verification.
  - .4 Demonstrate performance of systems, to be witnessed by Departmental Representative prior to start of 30 day Final Acceptance Test period.
  - .5 Perform final Cx and operational tests during demonstration period and 30 day test period.
  - .6 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".

1.10 START-UP

.1 Start up components, equipment and systems.

.2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, following equipment, systems:
- .1 Make-up air handling unit.
- .2 Air valves.
- .3 Exhaust fan.
- .4 Fume hood.

.3 Departmental Representative to monitor some of these start-up activities.
- .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.

.4 Performance Verification (PV):
- .1 Departmental Representative to perform.
  - .1 Repeat when necessary until results are acceptable to Departmental Representative.
- .2 Use procedures modified generic procedures to suit project requirements.
- .3 Departmental Representative to witness and certify reported results using approved PI and PV forms.
- .4 Departmental Representative to approve completed PV reports and provide to Departmental Representative.
- .5 Departmental Representative reserves right to verify up to 30% of reported results at random.
- .6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.11 CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Perform Cx by specified Cx agency using procedures developed by Departmental Representative and approved by Departmental Representative.

.2 Departmental Representative to monitor Cx activities.

.3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.

.4 Departmental Representative to witness, certify reported results of, Cx activities and forward to Departmental Representative.

.5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

1.12 INSTALLATION CHECK LISTS (ICL)

.1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI) /Performance Verification (PV) Forms.

1.13 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI) /Performance Verification (PV) Forms.

1.14 PERFORMANCE VERIFICATION (PV) REPORT

.1 Refer to Section 01 91 13.16 - Commissioning Forms: Installation Check Lists and Product Information (PI) /Performance Verification (PV) Forms.

1.15 DELIVERABLES RELATING TO ADMINISTRATION OF CX

.1 General:
  .1 Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

1.16 CX SCHEDULES

.1 Prepare detailed Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:
  .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
    .1 Design criteria, design intents.
    .2 Pre-TAB review: 28 days after contract award, and before construction starts.
    .3 Cx credentials: 60 days before start of Cx.
    .4 Cx procedures: 3 months after award of contract.
    .5 Cx Report format: 3 months after contract award.
    .6 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.
    .7 Notification of intention to start TAB: 21 days before start of TAB.

.8 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.
.9 Notification of intention to start Cx: 14 days before start of Cx.
.10 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
.11 Identification of deferred Cx.
.12 Implementation of training plans.
.13 Cx reports: immediately upon successful completion of Cx.

.2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Property Manager.

.3 6 months in Cx schedule for verification of performance in all seasons and wear conditions.

.2 After approval, incorporate Cx Schedule into Construction Schedule.

.3 Contractor and Departmental Representative will monitor progress of Cx against this schedule.

1.17 CX REPORTS

.1 Submit reports of tests, witnessed and certified by Departmental Representative to Departmental Representative who will verify reported results.

.2 Include completed and certified PV reports in properly formatted Cx Reports.

.3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

1.18 ACTIVITIES DURING WARRANTY PERIOD

.1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:
.1 Fine tuning of HVAC systems.

1.19 TRAINING PLANS

.1 Refer to Section 01 79 00.13 - Demonstration and Training for Building Commissioning.

1.20 FINAL SETTINGS

.1 Upon completion of Cx to satisfaction of Departmental Representative lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:
- .1 Product manufacturer's installation instructions and recommended checks.
- .2 Special procedures as specified in relevant technical sections.
- .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.2 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.3 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.4 SAMPLES OF COMMISSIONING FORMS

.1 Departmental Representative will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.

.2 Revise items on Commissioning forms to suit project requirements.

1.5 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

.1 When additional forms are required, but are not available from Departmental Representative develop appropriate verification forms and submit to Departmental Representative for approval prior to use.
  .1 Additional commissioning forms to be in same format as provided by Departmental Representative

1.6 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:
  .1 Departmental Representative provides Contractor project-specific Commissioning forms with Specification data included.
  .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
  .3 Confirm operation as per design criteria and intent.
  .4 Identify variances between design and operation and reasons for variances.
  .5 Verify operation in specified normal and emergency modes and under specified load conditions.
  .6 Record analytical and substantiating data.
  .7 Verify reported results.
  .8 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.
  .9 Submit immediately after tests are performed.
  .10 Reported results in true measured SI unit values.
  .11 Provide Departmental Representative with originals of completed forms.
  .12 Maintain copy on site during start-up, testing and commissioning period.
  .13 Forms to be both hard copy and electronic format with typed written results in Building Management Manual.

1.7 LANGUAGE

.1 To suit the language profile of the awarded contract.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

Goodkey Weedmark
Consulting Engineers

Pump Installation Check Sheet

Project: CFIA – Replacement of Main Fire Pump

Spec. Section # 01 91 13.16

Pump Ref. #

Rev. #:

Intent: ***To verify pump model, data and system static completion.***

Model Verification:

Item	Specified	Installed
Manufacturer		
Model #		
Serial #:		
Flowrate: ℓ/s (GPM)		
Head: kPa (psi)		
Variable speed drive y/n		

Description	Initials	Comments
Pump installed to manufacturers recommendations.		
All maintenance access requirements met.		
Approved isolation installed.		
All pipework connections complete.		
Pressure gauge installed across pump.		
System pipework installation complete.		
Pump suction pipe is flushed in accordance with NFPA 20		
Hydrostatic test is performed on suction and discharge piping		
Name plates are installed.		
Controls wiring complete.		
Fire pump controller is tested to manufacturers requirements.		
Electrical wiring complete and tested.		
Seismic bracing installed and approved by seismic Engineer.		

Outstanding Items:

Contractor: Sign: Print: Date:

Cx Agent: Sign: Print: Date:

Goodkey Weedmark
Consulting Engineers

Pump Installation
Performance Verification Form

Project: CFIA – Replacement of Main Fire Pump

Spec. Section # 01 91 13.16

Intent: ***To verify the operation of the system in accordance with the sequence of operation.***

Visual Inspection

- ☐ Piping installed as per drawing.
- ☐ Valve tags in place.
- ☐ Strainers clean.
- ☐ Pump supported as per manufacturer's instructions.

Submissions

- ☐ Installation check sheet.
- ☐ Start-up report.
- ☐ Pressure test report.
- ☐ Seismic review letter.

Operational Inspection

- ☐ Pump start/stops automatically.
- ☐ Manual start/stops and fire alarm.
- ☐ Pressure gauge operational.

PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for fire pump package and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
- .2 Indicate on drawings:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
  - .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Acoustical sound power data, where applicable.
  - .3 Points of operation on performance curves.
  - .4 Manufacturer to certify current model production.
  - .5 Certification of compliance to applicable codes.
- .4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.2 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for fire pump package for incorporation into manual.
- .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
- .2 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
- .3 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.
- .4 Performance data to include:
  - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified.

.5 Approvals:
  .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  .2 Make changes as required and re-submit as directed by Departmental Representative.
.6 Additional data:
  .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
.7 Site records:
  .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
  .3 Use different colour waterproof ink for each service.
  .4 Make available for reference purposes and inspection.
.8 As-Built drawings:
  .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  .3 Submit to Departmental Representative for approval and make corrections as directed.
  .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish spare parts as follows:
  .1 One set of packing for each pump.
  .2 One casing joint gasket for each size pump.
  .3 One glass for each gauge glass.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for fire pump package installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 DEMONSTRATION

.1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
  .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.7 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

.2 Section 28 31 00 - Fire Detection and Alarm.

1.2 REFERENCE STANDARDS

.1 American Society of Sanitary Engineering (ASSE)
- .1 ASSE (Plumbing) 1015-2011, Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies.

.2 Canada Standards Association (CSA)
- .1 CAN/CSA B64 Series-11 (R2016), Backflow Preventers and Vacuum Breakers.
- .2 CSA B64.10-17/B64.10.1-17, Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers.

.3 National Fire Prevention Association (NFPA)
- .1 NFPA (Fire) 13, Standard for the Installation of Sprinkler Systems, 2019 Edition.
- .2 NFPA (Fire) 20, Standard for the Installation of Stationary Pumps for Fire Protection, 2019 Edition.
- .3 NFPA (Fire) 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2020 Edition.

.4 NSF International
- .1 NSF/ANSI/CAN 61-2020, Drinking Water System Components - Health Effects.

.5 Ontario Regulation
- .1 ONTARIO OBC-2017, 2017 Ontario Building Code.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:
- .1 Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
- .2 Indicate:
  - .1 Materials.
  - .2 Finishes.
  - .3 Method of anchorage
  - .4 Number of anchors.
  - .5 Supports.
  - .6 Reinforcement.
  - .7 Assembly details.

.8 Accessories.

.4 Samples:
.1 Submit samples of following:
.1 Each type of sprinkler head.
.2 Signs.

.5 Test reports:
.1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.6 Certificates:
.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.7 Manufacturers' Instructions:
.1 Provide manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation, maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance wih NFPA (Fire) 20.

.2 Manufacturer's catalogue Data, including specific model, type, and size for:
.1 Pipe and fittings.
.2 Alarm valves.
.3 Valves, including gate, check, and globe.
.4 Water motor alarms.
.5 Sprinkler heads.
.6 Pipe hangers and supports.
.7 Pressure or flow switch.
.8 Fire department connections.
.9 Excess pressure pump.
.10 Mechanical couplings.

.3 Drawings:
.1 Sprinkler heads and piping system layout.
.1 Prepare 760 mm by 1050 mm detail working drawings of system layout in accordance with NFPA (Fire) 13, "Working Drawings (Plans)".
.2 Show data essential for proper installation of each system.
.3 Show details, plan view, elevations, and sections of systems supply and piping.
.4 Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.
.2 Electrical wiring diagrams.

.4 Design Data:
.1 Calculations of sprinkler system design.
.2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.

.5 Field Test Reports:
.1 Preliminary tests on piping system.

.6 Records:
.1 As-built drawings of each system.
.1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
.2 Submit 760 mm by 1050 mm drawings on reproducible Mylar film with title block similar to full size contract drawings.

1.5 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: company or person specializing in wet sprinkler systems with documented experience or approved by manufacturer.

.2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:
.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
.2 Provide spare sprinklers and tools in accordance with NFPA (Fire) 13.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:
.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Storage and Protection:
.1 Store materials indoors.
.2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTOR

.1 Double Check Valve Assembly (DCVA):
.1 Lead free construction, 304 stainless steel body, stainless steel fasteners and springs. Checksremovable for maintenance. Rated for 60°C (140°F) and 1207 kPa (175 psi). Complete with flanged end OS&Y gate valves. Certified to CSA B64.5. ULC & FM listed. ASSE 1015 and NSF/ANSI/CAN 61 compliant.
.2 Provide suitable supervisory switches, where not integral to backflow preventer shut off valves.

.2 All backflow preventers shall be selected and installed in accordance with OBC & CSA B64.10.

2.2 PIPE, FITTINGS AND VALVES

.1 Pipe:
- .1 Ferrous: to NFPA (Fire) 13.
- .2 Copper tube: to NFPA (Fire) 13.

.2 Fittings and joints to NFPA (Fire) 13:
- .1 Ferrous: screwed, welded, flanged or roll grooved.
  - .1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
- .2 Copper tube: screwed, soldered, brazed, grooved.
- .3 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
- .4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
- .5 Rubber gasketted grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
- .6 Fittings: ULC approved for use in wet pipe sprinkler systems.
- .7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
- .8 Side outlet tees using rubber gasketted fittings are not permitted.
- .9 Sprinkler pipe and fittings: metal.

.3 Valves:
- .1 ULC listed for fire protection service.
- .2 Gate valves: open by counterclockwise rotation.
- .3 Provide rising stem OS & Y valve beneath each alarm valve in each riser when more than one alarm valve is supplied from same water supply pipe.
- .4 Check valves: flanged clear opening swing or spring actuated check type with flanged inspection and access cover plate for sizes 10 cm and larger.

.4 Pipe hangers:
- .1 ULC listed for fire protection services in accordance with NFPA.

2.3 SPRINKLER HEADS

.1 General: to NFPA (Fire) 13 and ULC listed for fire services.

.2 Upright Sprinkler:
- .1 Upright bronze, quick response for hazard coverage as indicated, 5.6 K factor, FM approved, chrome finish, glass bulb type c/w wire guard; 68°C (155°F) rated, 13 mm (½") orifice.

2.4 SUPERVISORY SWITCHES

.1 General: to NFPA (Fire) 13 and ULC listed for fire service.

.2 Valves:
.1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

.3 Pressure or flow switch type:
.1 With normally open and normally closed contacts and supervisory capability.
.2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.
.3 Connect into building fire alarm system.
.4 Connection of switch: Section 28 31 00 - Fire Detection and Alarm.
.5 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and instantly recycle.

.4 Pressure alarm switch:
.1 With normally open and normally closed contacts and supervisory capability.

2.5 PRESSURE GAUGES

.1 Maximum limit of not less than twice normal working pressure at point where installed.

2.6 PIPE SLEEVES

.1 Provide pipe sleeves where piping passes through walls.

.2 Secure sleeves in position and location during construction.

.3 Provide sleeves of sufficient length to pass through entire thickness of walls.

.4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.
.1 Firmly pack space with mineral wool insulation.
.2 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass.
.3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.

.5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
.1 Provide hot-dip galvanized steel sleeves.
.2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.

.6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:
.1 Provide 0.61 mm thick galvanized steel sheet.

2.7 ESCUTCHEON PLATES

.1 Provide one piece or split hinge type metal plates for piping passing through walls in exposed spaces.

.2 Provide polished stainless steel plates in finished spaces.

.3 Provide paint finish on metal plates in unfinished spaces.

2.8 SIGNS

.1 Attach properly lettered Bilingual and approved metal signs to each valve and alarm device to NFPA (Fire) 13.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install, inspect and test to acceptance in accordance with NFPA (Fie) 13 and NFPA (Fire) 25.

3.3 PIPE INSTALLATION

.1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.

.2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.

.3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.

.4 Inspect piping before placing into position.

3.4 ELECTRICAL CONNECTIONS

.1 Provide electrical work associated with this section under Section 26 05 00 - Common Work Results for Electrical.

.2 Provide fire alarm system under Section 28 31 00 - Fire Detection and Alarm.

.3 Provide control and fire alarm wiring, including connections to fire alarm systems, in accordance with National Electrical Code.

.4 Provide wiring in rigid metal conduit or intermediate metal conduit.

3.5 CONNECTIONS TO EXISTING WATER SUPPLY SYSTEMS

.1 Notify Contracting Officer in writing at least 15 days prior to connection date.

.2 Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure.

.3 Bolt sleeves around main piping.

.4 Bolt valve to branch connection. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, without interruption of service.

.5 Furnish materials required to make connections into existing water supply systems, and perform excavating, backfilling, and other incidental labour as required.

3.6 FIELD PAINTING

.1 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.

.2 Apply coatings to clean, dry surfaces, using clean brushes.

.3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.

.4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 ml, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 ml.

.5 Shield sprinkler heads with protective covering while painting is in progress.

.6 Upon completion of painting, remove protective covering from sprinkler heads.

.7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.

.8 Provide primed surfaces with following:
- .1 Piping in Unfinished Areas:
  - .1 Provide primed surfaces with one coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil in spaces where walls or ceiling are not painted or not constructed of a prefinished material.
  - .2 Provide piping with 50 mm wide red enamel bands spaced at maximum of 6 m intervals.

3.7 FIELD QUALITY CONTROL

.1 Site Test, Inspection:
- .1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.
- .2 Test, inspect, and approve piping before covering or concealing.
- .3 Preliminary Tests:
  - .1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.
  - .2 Flush piping with potable water in accordance with NFPA (Fire) 13.
  - .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
  - .4 Test alarms and other devices.
  - .5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA (Fire) 13.
- .4 Formal Tests and Inspections:
  - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.

.2 Submit written request for formal inspection at least 15 days prior to inspection date.
.3 Repeat required tests as directed.
.4 Correct defects and make additional tests until systems comply with contract requirements.
.5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.
.6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.

.2 Site Tests:
.1 Field test each fire pump, driver and controllers in accordance with NFPA (Fire) 20. Testing shall include:
.1 Verification of proper installation, system initiation, adjustment and fine tuning.
.2 Verification of the sequence of operations and alarm systems.
.2 Testing to be witnessed by Fire Commissioner of Canada or Canadian Forces Fire Marshal or authority having jurisdiction.
.3 Develop, with Departmental Representative assistance, detailed instructions for O & M of this installation.

3.8 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 National Fire Protection Association (NFPA)
  .1 NFPA (Fire) 20, Standard for the Installation of Stationary Fire Protection. 2019 Edition.

.2 Underwriters' Laboratories of Canada (ULC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet for fire pump control and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
  .1 Submit drawings for fire pump controller packaged fire pump stamped and signed by professional engineer registered or licensed in Ontario, Canada.
  .2 Indicate:
    .1 Method of anchorage
    .2 Number of anchors.
    .3 Supports.
    .4 Reinforcement.
    .5 Assembly details.
    .6 Accessories.
    .7 Indicate hydraulic and electrical characteristics including Net Positive Suction Head (NPSH) required, make and model number.
  .3 Provide power and control diagrams.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals in accordance with NFPA (Fire) 20.

1.4 EXTRA MATERIALS

.1 Extra Materials:
  .1 Furnish spare parts for each pump in accordance with Section 01 78 00 - Closeout Submittals and as follows:
    .1 One set of packing.
    .2 One casing joint gasket.

1.5 QUALITY ASSURANCE

.1 Quality Assurance:
  .1 Test reports:
    .1 Submit certified test reports for packaged fire pumps from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
    .2 Test each pump/driver package at factory to provide detailed performance data and to demonstrate compliance with NFPA and specification. Submit certified test curves for approval of Departmental Representative.
    .3 Test hydrostatically to meet requirements of fire protection system to which it will be connected.
  .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  .3 Instructions: submit manufacturer's installation instructions.

.2 Qualifications:
  .1 Installer: company or person specializing in packaged fire pump installations with documented experience or approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:
  .1 Select fire pump to satisfy fire protection system requirements and NFPA (Fire) 20.
  .2 Water supply:
    .1 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for basis of design including NPSH available, and in accordance with NFPA (Fire) 20.

2.2 FIRE PUMP

.1 Packaged, ULC, CSA listed and labelled vertical shaft turbine fire pump and controller.

.2 Driver: electric totally enclosed motor.

.3 Mounting: install pump and driver on common base.

.4 Materials and construction: to NFPA (Fire) 20.

.5 Capacity: as indicated:
  .1 Flow rate: 31.5 L/s.
  .2 Pressure: 517 kPa.
  .3 Speed: 3600 r/min.

.6 Accessories to NFPA (Fire) 20 requirements and in addition:
- .1 Fire pump bypass fitted with shut off valves and check valves.
- .2 Audible and visual suction side alarm.
- .3 OS&Y valves on suction and shut off valves on discharge, electrically supervised.

.7 Anchor bolts and templates:
- .1 Supply for installation by others.

2.3 PRESSURE MAINTENANCE (JOCKEY) PUMP

.1 General: close-coupled, electrically driven centrifugal pump and controller.

.2 Capacity: as indicated:
- .1 Flow rate: 0.315 L/s.
- .2 Pressure: to NFPA (Fire) 20.
- .3 Speed: r/min.

.3 Accessories: to NFPA (Fire) 20.

2.4 FIRE PUMP CONTROLLER

.1 Provide full service reduced voltage autotransformer (65%) fire pump controller and automatic transfer switches, full service type, ULC listed to meet the requirements of NFPA (Fire) 20.

.2 Controller to incorporate fire pump controller and one jockey pump controller. Controller to be mounted in separate enclosure from transfer switch. All bus on line side of isolating switches to be protected and labelled "live incoming feed".

.3 Controller to be wired and tested by manufacturer, mounted in a CSA/NEMA 3 enclosure suitable for pump room environment. All relays and contactor coils suitable for operation ±15% nominal voltage.

.4 Controller to each incorporate the following:
- .1 Externally operated main isolating switch, complete with normal/emergency power, as well as interlock and manual release spring latch.
- .2 Externally operated circuit breaker providing short circuit magnetic trip and time delayed locked rotor trip.
- .3 Voltage surge arrester.
- .4 Motor starting contactor rated to suit pump motor, capable of being energized automatically by the pressure switch or manually by the start pushbutton. Lead or lag pump contacts of motor starting contractor to also be capable of being closed manually by an externally operable emergency start handle.
- .5 Individual dry alarm contacts in each controller SPDT 240 V.A.C. for:
  - .1 power failure or circuit breaker in off position and/or loss of one phase (10 A contact rating)
  - .2 wrong phase rotation (5 A contact rating)
  - .3 pump motor running (10 A contact rating)
  - .4 control panel general trouble.
- .6 Power available and circuit breaker or switch in ON position pilot light.
- .7 Common trouble pilot light.
- .8 Wrong phase rotation pilot light.
- .9 Start and stop pushbuttons.
- .10 Provision for remote pushbutton start.

.11 Water pressure switch.
.12 Electric interlock to assure operation of one pump only and to provide automatic switchover to standby pump controller in case first pump controller activated cannot maintain set water pressure.
.13 Minimum run time.
.14 Sequence start timer of electronic solid stat design adjustable 0 to 60 seconds.
.15 Automatic weekly exercising cycle complete with seven day electronic time clock with minimum 250 hours time reserve and minimum 10 minutes ON cycle.
.16 Low suction pressure switch and pilot light.
.17 Time totalizer.
.18 Ampere meter one phase.
.19 Volt meter L1-L2-L3.
.20 Weekly exercising pilot light and alarm relay for local and remote annunciation of exercise cycle.
.21 Low suction pressure alarm relay for remote annunciation of low suction pressure.
.22 Pump running pilot light.
.23 Provision for automatic start if water flow switch is activated.
.24 Bilingual name plates (English and French). [PWGSC's projects only.]
.25 Floor mounting feet.
.26 DPST load shedding signal contact - closed continuously when pump motor is running.

.5 Fire pump controller to pump to be supplied with automatic transfer switches. Automatic transfer switches and pump controller to each be mounted in barriered enclosures mechanically attached to form one unit and provide for protected interlock wiring.

.6 The automatic transfer switch to be mechanically held and electrically operated and to provide automatic power transfer from normal to alternate (generator) power source in case of voltage drop to 90% of normal, phase failure or phase reversal and automatic retransfer after restoration of normal power conditions. Switch to be equipped with:
.1 Operating handle to allow for manual operation of transfer switch.
.2 Test switch to momentarily simulate normal source failure.
.3 Signal light (green) to indicate automatic transfer switch is in normal source position.
.4 Signal light (red) to indicate automatic transfer switch is in generator source position.
.5 Signal light (red) and audible alarm to indicate alternate power isolating switch in OFF position.
.6 Signal light (green) to indicate normal source is available.
.7 Signal light (red) to indicate alternate source is available.
.8 Signal light (red) to indicate phase reversal.
.9 Auxiliary contact SPDT closed to indicate automatic transfer switch is in normal source position.
.10 Auxiliary contact SPDT closed to indicate automatic transfer switch is in alternate source position.
.11 Auxiliary contact SPDT closed to indicate alternate power isolating switch in OFF position.
.12 Auxiliary contact closed to start alternate source generator in case of normal power failure. Start signal to interrupt if alternate power isolation switch is in the OFF position.
.13 Time delay to override momentary normal source outages and delay all transfer switch and engine starting signals, factory set at 3 seconds.
.14 Unloaded running time delay for emergency engine generator cool-down, factory set at 5 minutes.
.15 Retransfer to normal power time delay. Time delay to be automatically bypassed if emergency source fails and normal source is available, factory set at 5 minutes.
.16 Start delay of electric motor after transfer to prevent current surges due to power source switchover, factory set at 1 second.
.17 All relays and contractor coils suitable for operational ±15% nominal voltage.

2.5 PRESSURE MAINTENANCE CONTROLLER (JOCKEY)

.1 Pump controller, across the line, combination magnetic starter, thermal overload relay, CSA Enclosure 3, hand-off-auto switch, control transformer with fused secondary, running period timer adjustable to 1-10 min., main circuit breaker or fused switch and indicating lights.

.2 Rating: 0.56 kW (¾ Hp) 575V/3Ø/60 Hz.

.3 Pump controlled by a combined manual automatic start interconnected with a high-low pressure switch installed on fire pump discharge line.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with ULC listing, NFPA (Fire) 20, manufacturer's instructions and approved shop drawings.

.2 Install wiring in accordance with manufacturer's instructions and applicable codes.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
  .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
  .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
  .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

.2 Site Tests:
  .1 Field test each fire pump, driver and controllers in accordance with NFPA (Fire) 20. Testing to include:
    .1 Verification of proper installation.
    .2 Verification of the sequence of operations and alarm systems.
  .2 Testing to be witnessed by authority having jurisdiction.
  .3 Develop, with Departmental Representative assistance, detailed instructions for O & M installation.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

.2 Clean installed products in accordance to manufacturer's recommendation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, , Canada.
- .2 Indicate on drawings:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
  - .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Acoustical sound power data, where applicable.
  - .3 Points of operation on performance curves.
  - .4 Manufacturer to certify current model production.
  - .5 Certification of compliance to applicable codes.
- .4 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
- .1 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
- .2 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
- .3 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
  - .2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:
  .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
  .2 Equipment performance verification test results.
  .3 Special performance data as specified.
.5 Approvals:
  .1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  .2 Make changes as required and re-submit as directed by Departmental Representative.
.6 Additional data:
  .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
.7 Site records:
  .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
  .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
  .3 Use different colour waterproof ink for each service.
  .4 Make available for reference purposes and inspection.
.8 As-built drawings:
  .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
  .3 Submit to Departmental Representative for approval and make corrections as directed.
  .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
.9 Submit copies of as-built drawings for inclusion in final TAB report.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Furnish spare parts as follows:
  .1 One set of packing for each pump.
  .2 One casing joint gasket for each size pump.
  .3 One glass for each gauge glass.

.3 Provide one set of special tools required to service equipment as recommended by manufacturers.

.4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for plumbing installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PAINTING REPAIRS AND RESTORATION

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged.

3.3 SYSTEM CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.
  .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.6 PROTECTION

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)
- .1 CSA B79-08 (R2018), Commercial and Residential Drains and Cleanouts.

.2 National Research Council Canada (NRC)
- .1 National Plumbing Code of Canada 2015 (NPC).

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-installation Meetings:
- .1 Convene pre-installation meeting 1 week prior to beginning work of this Section, with contractor's representative and Departmental Representative to:
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Co-ordination with other building construction subtrades.
  - .4 Review manufacturer's written installation instructions and warranty requirements.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit 2 copies of WHMIS SDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
- .2 Indicate on drawings to indicate materials, finishes, dimensions construction and assembly details.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: manufacturers' field reports specified.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.
- .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
- .2 Details of operation, servicing and maintenance.
- .3 Recommended spare parts list.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
- .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect plumbing materials from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

.1 Floor Drains: to CSA B79.

.2 FD1: general duty; cast iron body, round, diameter: 75 mm, adjustable head, sediment basket, nickel bronze strainer, trap priming connection, integral seepage pan, and clamping collar.

2.2 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access Covers:
- .1 Floor Access: roundcast iron body and frame with adjustable secured nickel bronze top and:
  - .1 Plugs: bolted bronze with neoprene gasket.
  - .2 Cover for Unfinished Concrete Floors: cast iron or square, gasket, vandal-proof screws.

2.3 TRAP SEAL PRIMERS (TIMER TYPE)

.1 Electronic activated type, brass construction with "O" ring seals, 13 mm (NPT ½) female inlet & 13 mm (NPT ½) female outlet drip line connection with air female inlet & 13 mm (NPT ½) female outlet drip line connection with air gap, viewing holes, and removable filter screen. Trap primer shall have no flow adjustment. Operating range shall be 138 kPa (20 psi) to 861 kPa (125 psi). Operates on pre-set 24 h clock with manual override switch/test button. Unit shall have 120 V solenoid valve and calibrated manifold for equal water distribution. One (1) to five (5) drain taps per unit.

.2 Identify on as-built drawings the location of each trap seal primer.

.3 Ensure all trap seal primers are accessible for maintenance purposes and are connected to cold water line. Trap line shall be from top of cold water line and include a service valve.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for plumbing specialities and accessories installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.3 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada (NPC), and local authority having jurisdiction

.2 Install in accordance with manufacturer's instructions and as specified.

3.4 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.5 TESTING AND ADJUSTING

.1 General:
- .1 Test and adjust plumbing specialties and accessories in accordance with Section 01 91 13 - General Commissioning Requirements: General Requirements, supplemented as specified.

.2 Timing:
- .1 After start-up deficiencies rectified.
- .2 After certificate of completion has been issued by authority having jurisdiction.

.3 Adjustments:
.1 Verify that flow rate and pressure meet design criteria.
.2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.

.4 Floor drains:
.1 Check operations of flushing features.
.2 Check security, accessibility, removability of strainer.
.3 Clean out baskets.

.5 Access doors:
.1 Verify size and location relative to items to be accessed.

.6 Cleanouts:
.1 Verify covers are gas-tight, secure, yet readily removable.

.7 Pressure regulators, PRV assemblies:
.1 Adjust settings to suit locations, flow rates, pressure conditions.

3.6 CLOSEOUT ACTIVITIES

.1 Commissioning Reports: in accordance with Section 01 91 13 - General Commissioning Requirements: reports, supplemented as specified.

3.7 CLEANING

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.8 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by plumbing specialties and accessories installation.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 ASTM International (ASTM)
- .1 ASTM C564-20a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 CSA Group (CSA)
- .1 CAN/CSA-B70-19, Cast Iron Soil Pipe, Fittings and Means of Joining.

.3 National Research Council Canada (NRC)
- .1 National Plumbing Code of Canada 2015 (NPC).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:
- .1 Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 CAST IRON PIPING AND FITTINGS

.1 Buried sanitary minimum NPS 3, to: CAN/CSA-B70.
- .1 Joints:
  - .1 Mechanical joints:
    - .1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70 or ASTM C564.
    - .2 Stainless steel clamps.

PART 3 - EXECUTION

3.1 APPLICATION

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:
- .1 Ensure accessible and that access doors are correctly located.
- .2 Open, cover with linseed oil and re-seal.
- .3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system and effectively vented.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 05 01 - System Coordination/Short Circut/Device Evaluation Study & Arch Flash Hazard Analysis.

.2 Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

1.2 REFERENCE STANDARDS

.1 CSA Group
- .1 CSA C22.1-21, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations (25th Edition).
- .2 CSA C235-2019, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
- .1 IEEE 100 CD (2013), Standards Dictionary: Glossary of Terms and Definitions

1.3 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE 100 CD.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.
- .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
- .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .5 If changes are required, notify Departmental Representative of these changes before they are made.

.3 Certificates:
- .1 Provide CSA certified equipment and material.
- .2 Submit test results of installed electrical systems and instrumentation.
- .3 Permits and fees: in accordance with General Conditions of contract.
- .4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

1.5 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
  .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
  .2 Operating instructions to include following:
    .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
    .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
    .3 Safety precautions.
    .4 Procedures to be followed in event of equipment failure.
    .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:
  .1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  .2 Store and protect from nicks, scratches, and blemishes.
  .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CSA C235.

.2 Motors, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
  .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English.

2.2 MATERIALS AND EQUIPMENT

.1 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of Departmental Representative.

.2 Porcelain enamel signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:
- .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, matt white finish face, blackcore, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
- .2 Sizes as follows:

NAMEPLATE SIZES

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

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

2.7 WIRING IDENTIFICATION

.8 Identify wiring with permanent indelible identifying markings, numbered, on both ends of phase conductors of feeders and branch circuit wiring.

.9 Maintain phase sequence and colour coding throughout.

.10 Colour coding: to CSA C22.1.

.11 Use colour coded wires in communication cables, matched throughout system.

2.7 FINISHES

.12 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
.1 Paint indoor switchgear and distribution enclosures light gray.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.
.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.
.1 Local switches: 1400 mm.
.2 Wall receptacles:
.1 General: 300 mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings in accordance with Section 26 05 01 - System Coordination/Short Circut/Device Evaluation Study & Arch Flash Hazard Analysis.

3.7 FIELD QUALITY CONTROL

.1 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
.1 Systems: fire alarm.

.2 Carry out tests in presence of Departmental Representative.

.3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

3.8 CLEANING

.1 Progress Cleaning:
.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment

END OF SECTION

PART 1 - GENERAL

1.1 CODES AND STANDARDS

.1 Institute of Electrical and Electronics Engineers (IEEE)
- .1 IEEE 242-2001, IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
- .2 IEEE 1584b-2011, IEEE Guide for Performing Arc-Flash Hazard Calculations - Amendment 2.

.2 National Fire Protection Association (NFPA)
- .1 NFPA (Fire) 70E, Standard for Electrical Safety in the Workplace, 2021 Edition.

1.2 SUBMITTALS

.1 The short-circuit and protective device coordination studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

.2 The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. Two (2) bound copies of the complete final report shall be submitted, along with electronic pdf version.

.3 The report shall include the following sections:
- .1 Executive Summary.
- .2 Descriptions, purpose, basis and scope of the study.
- .3 Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties.
- .4 Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection.
- .5 Fault current calculations including a definition of terms and guide for interpretation of the computer printout.
- .6 Details of the incident energy and flash protection boundary calculations.
- .7 Recommendations for system improvements, where needed.
- .8 One-line diagram.

1.3 QUALIFICATIONS

.1 The short-circuit/device evaluation, protective device coordination and arc flash hazard analysis studies shall be performed or reviewed and sealed by a licensed Professional Electrical Engineer registered to practice in the Province of Ontario skilled in performing and interpreting the power system studies.

.2 The licensed Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer or an approved engineering firm.

.3 The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

.4 The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in the past year.

1.4 GENERAL

.1 Include in the tender all costs for preparation of a complete System Coordination/Short Circuit/ Device Evaluation Study and Arch Flash Hazard Analysis in accordance with IEEE 242, 'Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems', and IEEE 1584, 'Guide for Performing Arc-Flash Hazard Calculations'.

.2 The scope of the studies shall include:
- .1 The Study shall include all relevant distribution and protective devices within the following scope:
  - .1 Upstream from the local Utility feeder protection devices.
  - .2 Downstream to the affected branch circuit panels.
  - .3 Upstream from the existing generator feeder protection devices.

1.5 COORDINATION STUDY

.1 The work of the Coordination Study shall include:
- .1 Liaison with the local Utility for information on relays and other protective devices, and system and substation capacities which affect the coordination of this system for both primary and any standby feeders.
- .2 Liaison with distribution equipment and switchgear manufacturers to obtain actual trip curves of existing and proposed protective devices for new & existing equipment.
- .3 Sending a trained and qualified representative on site to gather data on existing equipment within the scope of the study; such as transformers, cables, and lengths, breakers, fuses, and all adjustable protective device settings. The information gathered will include the method of installation where such installation impacts upon the Study (e.g. method of cable installation reflecting upon the allowable ampacity of the cable).
- .4 Recommendations shall be included, listing all deficiencies within the scope of the study and proposing methods of correction for each deficiency.

.2 The Coordination Study report shall include the following:
- .1 Each Time-Current graph shall be printed in colour. The selected colours will allow the end-user to easily discriminate between different device curves, especially on complicated graphs where devices overlap.
- .2 The Time-Current curves shall be drawn on special log-log graphs with time coordinate range of 0.01 to 1,000 seconds and current coordinate ranges of 4 orders. Separate graphs are to be provided for phase and ground protection for each portion of the system. The entire distribution system shall be subdivided into portions so that the curve for each device clearly shows its relationship to associated upstream and downstream devices. The coordination study should separate the emergency power from the normal power distributions. Each graph for a portion of the system shall include/show the following:
  - .1 The portion of the distribution system represented by the devices on the graph shall be represented by a single line diagram drawn in the corner of the Time-Current coordination graph.
  - .2 Each device curve shall end at the 3 phase symmetrical fault level calculated for that bus.
  - .3 Cable, Bus, or Conductor damage curves shall be shown where appropriate. All Transformer inrush, damage and overload curves shall be shown.
  - .4 Motor starting curves and protective devices shall be shown for all motors larger than 75 HP.

.5 On the graphs, or on the same page as the graph, all protective device curves within the scope of the graph shall be shown with the following information:
.1 Relay curves with text indicating; Manufacturer, Type, Current Transformer size, Tap or Pickup setting, Time Dial settings, and curve type.
.2 Fuse curves with average melting curve for low voltage fuses and minimum melt and total clearing for high voltage fuses with text indicating; Manufacturer, Type, Ampacity, Voltage, and Speed.
.3 Static-Trip Breaker curves with text indicating; Breaker and Trip Unit Manufacturer and type, Current Transformer and Sensor Type, and all trip unit settings.
.4 Thermal-Magnetic Breaker curves with text indicating; Breaker type, Trip rating, and instantaneous trip settings.

.3 Include tables within the Study that clearly list all protective devices within the scope of the study and all associated information. These tables are to be based on settings established and noted in the coordination curves. The tables shall be logically arranged and grouped to effectively present the following information. The tables shall include:
.1 Relays; including manufacturer, type, curve, CT, and all protective settings.
.2 Transformers; including size, type, manufacturer, configuration, voltage, and impedance.
.3 Fuses; including manufacturer, type, ampacity, voltage, speed.
.4 Static Trip Units; including manufacturer, type, CT, sensor or plug, all protective settings.
.5 Thermal-Magnetic Trip Units; including manufacturer, rating, and instantaneous setting.
.6 Motor Protectors (Overloads); include manufacturer, type, rating, all protective settings.
.7 All protective devices shall be listed with clear descriptive text to identify their place within the distribution system.
.8 All protective devices shall have a reference to the Time-Current graph where they are shown.

.4 The tables shall list all existing and recommended settings of all protective devices within the scope of the study. This will allow the end-user to identify and plan for required changes to protective device settings, and to determine which settings have been implemented and modified.

1.6 SHORT CIRCUIT/DEVICE EVALUATION STUDY

.1 The work of the Short Circuit study shall include:
.1 Evaluation and documentation of three phase single phase & ground fault short circuit fault levels at all distribution buses, motor control centres and main panel board locations within the scope listed above.
.2 The output of the short circuit study shall be a printed tabulation of asymmetrical and symmetrical RMS short circuit current values for both interrupting duty and momentary duty, including X/R ratios.
.3 All significant sources and impedances shall be evaluated, including but not limited to, Utility and Emergency Sources, motors, cables and their lengths, transformers, reactors, and any other devices impacting upon the available short circuit.

.2 The work of the device evaluation study shall include:
.1 All pertinent interrupting devices within the scope of the job shall be listed with its interrupting rating or its series interrupting rating as applicable.
.2 A cross reference in table form shall be provided whether the protective devices at each bus are appropriate for the available fault current at each bus.

1.7 ARC FLASH HAZARD ANALYSIS

.1 Arc Flash Hazard Analysis:
.1 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA (Fire) 70E, Annex D.

.2 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centres, panelboards, busway and splitters) where work could be performed on energized parts.

.3 The Arc-Flash Hazard Analysis shall include all locations in the systems.

.4 Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm^2.

.5 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

.6 The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

.7 The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

.1 Fault contribution from induction motors should not be considered beyond 3-5 cycles.

.2 Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

.8 For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

.9 When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

.10 Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

.11 Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific situation.

.2 The electrical contractor shall ensure that the recommendations of the study are implemented as part of the contract.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 FIELD ADJUSTMENT

.1 Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

.2 Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

.3 Notify Owner in writing of any required major equipment modifications.

3.2 ARC FLASH WARNING LABELS

.1 The contractor of the Arc Flash Hazard Analysis shall provide a 89 mm x 127 mm (3.5 in.) thermal transfer type label of high adhesion polyester for each work location analyzed.

.2 All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.

.3 The label shall include the following information, at a minimum:
- .1 Location designation
- .2 Nominal voltage
- .3 Flash protection boundary
- .4 Hazard risk category, PPE
- .5 Incident energy
- .6 Working distance
- .7 Engineering report number, revision number and issue date.
- .8 Labels shall be machine printed, with no field markings.

.4 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
- .1 For the new fire pump system.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

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

1.2 DEFINITIONS

.1 SRS: acronym for Seismic Restraint System.

1.3 GENERAL DESCRIPTION

.1 This section covers design, supply and installation of complete SRS for all systems, equipment specified for installation on this project by Division 26. This includes, but is not limited to, electrical light fixtures, conduit, communications, electrical equipment and systems, both vibration isolated and statically supported.

.2 Cable restraint systems, rod stiffener clamps and seismic isolator capacities to be verified by an independent test laboratory. Connection materials and site specific designs to be by the Seismic Engineer. The Seismic Engineer may specify material and anchors provided by the contractor where this is appropriate. It is the contractors' responsibility to ensure that the Seismic Engineers' requirements and specification have been met.

1.4 REFERENCES

.1 Canadian Standards Association (CSA)
  .1 CSA S832-14 (R2019), Seismic Risk Reduction of Operational and Functional Components (OFCs) of Buildings.

.2 Ontario Regulation
  .1 ONTARIO OBC-2012, 2012 Ontario Building Code.

1.5 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Submit seismic restraint shop drawings, c/w seal of Professional Engineer registered in Province of Ontario, clearly identifying equipment/systems reviewed and the equipment/systems requiring restraint. Shop drawings must clearly show all forces transferred to structure.

.3 Seismic Design Engineer shall provide a spreadsheet identifying all equipment and systems requiring or not requiring seismic restraints and include all circulations.

.4 Submit additional copy of shop drawings and product data to project Structural Engineer for review of connection points to building structure.

1.6 MAINTENANCE DATA

.1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 26 05 00 - Common Work Results for Electrical.

1.7 SEISMIC FORCE

.1 The Importance Factor for this project is:
.1 I = 1.0 - All other buildings i.e.: Office & General Buildings.
Note: As per OBC.

PART 2 - PRODUCTS

2.1 SRS MANUFACTURER

.1 SRS to be from one manufacturer regularly engaged in production of same, 5 years experience.

.2 Acceptable materials: Korfund-Sampson, Mason Industries, Tecoustics, Vibra-Sonic Control, Vibron.

2.2 GENERAL

.1 Design to be by Professional Engineer specializing in design of SRS and registered in Province of Ontario. Division 26 to include all costs associated with this work as it relates to Division 26 installations.

.2 SRS to be fully integrated into, compatible with:
.1 Noise and vibration controls specified elsewhere in this project specification, telecommunications.
.2 Structural, mechanical, electrical design of project.

.3 During seismic event, SRS to prevent systems and equipment from causing personal injury, interfering with other systems, and from moving from normal position.

.4 Design and installation in accordance with OBC and CSA S832.

.5 SRS to provide gentle and steady cushioning action and avoid high impact loads

.6 SRS to restrain seismic forces in all directions.

.7 Fasteners and attachment points to resist same load as seismic restraints.

.8 SRS of conduit systems to be compatible with:
.1 Expansion, anchoring and guiding requirements.
.2 Equipment vibration isolation and equipment SRS.

.9 SRS utilizing cast iron, threaded pipe, other brittle materials not permitted.

.10 Attachments to RC structure:
.1 Use high strength mechanical expansion anchors.
.2 Drilled or power driven anchors not permitted.

.11 Seismic control measures not to interfere with integrity of firestopping.

2.3 SRS FOR STATIC EQUIPMENT, SYSTEMS

.1 Floor-mounted equipment, systems:
- .1 Anchor equipment to equipment supports.
- .2 Anchor equipment supports to structure.
- .3 Use size of bolts scheduled in approved shop drawings.

.2 Suspended equipment, systems:
- .1 Use one or combination of following methods:
  - .1 Install tight to structure.
  - .2 Cross-brace in all directions.
  - .3 Brace back to structure.
  - .4 Slack cable restraint system.
- .2 SRS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.
- .3 Hanger rods to withstand compressive loading and buckling.

2.4 SRS FOR VIBRATION ISOLATED EQUIPMENT

.1 Floor mounted equipment, systems:
- .1 Use one or combination of following methods:
  - .1 Vibration isolators with built-in snubbers.
  - .2 Vibration isolators and separate snubbers.
  - .3 Built-up snubber system approved by Engineer, consisting of structural elements and elastomeric layer.
- .2 SRS to resist complete isolator unloading.
- .3 SRS not to jeopardize noise and vibration isolation systems. Provide 4-8 mm clearance between seismic restraint snubbers and equipment during normal operation of equipment and systems.
- .4 Cushioning action to be gentle and steady by utilizing elastomeric material or other means in order to avoid high impact loads.

.2 Suspended equipment, systems:
- .1 Use one or combination of following methods:
  - .1 Slack cable restraint system.
  - .2 Brace back to structure via vibration isolators and snubbers.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install Seismic Restraint Systems in accordance with Seismic Engineer's and manufacturer's recommendations.

.2 Install SRS at least 25 mm from all other equipment, systems, services.

.3 Co-ordinate connections with all disciplines.

3.2 INSPECTION AND CERTIFICATION

.1 SRS to be inspected and certified by Manufacturer upon completion of installation.

.2 Seismic Design Engineer shall provide written report to Engineer certifying that SRS has been installed in accordance with the SRS drawings. The report shall bear the seal and signature of the SRS Design Engineer.

3.3 COMMISSIONING DOCUMENTATION

.1 Upon completion and acceptance of certification, hand over to Engineer complete set of construction documents, revised to show "as-built" conditions.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)
- .1 CSA C22.2 No. 18.4-15 (R2019) - Hardware for the Support of Conduit, Tubing, and Cable.
- .2 CAN/CSA-C22.2 No. 65-18, Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
- .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

PART 2 - PRODUCTS

2.1 MATERIALS

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

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

.3 Bushing stud connectors: to EEMAC 1Y-2 and NEMA to consist of:
- .1 Connector body and stud clamp for copper conductors .
- .2 Clamp for copper conductors.
- .3 Stud clamp bolts.
- .4 Bolts for copper conductors.
- .5 Sized for conductors.

.4 Clamps or connectors for armoured cable, TECK cable, mineral insulated cable, as required to: CSA-C22.2 No. 18.4.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and cables and:
- .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No. 65.
- .2 Install fixture type connectors and tighten to CAN/CSA-C22.2 No. 65. Replace insulating cap.
- .3 Install bushing stud connectors in accordance with EEMAC 1Y-2 and NEMA.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

.2 Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

PART 2 - PRODUCTS

2.1 BUILDING WIRES

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

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

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Conductors:
- .1 Grounding conductor: copper.
- .2 Circuit conductors: copper, size as indicated.

.3 Insulation:
- .1 Cross-linked polyethylene XLPE.
- .2 Rating: 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.7 Fastenings:
- .1 One hole aluminum straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables.
- .3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:
- .1 Watertight approved for TECK cable.

2.3 MINERAL-INSULATED CABLES

.1 Conductors: solid bare soft-annealed copper, size as indicated.

.2 Insulation: compressed powdered magnesium oxide or silicon dioxide to form compact homogeneous mass throughout entire length of cable.

.3 Outer covering: annealed seamless copper sheath, Type M1 rated 600 V, 250 degrees C.

.4 Overall jacket: none.

.5 Two hour fire rating.

.6 Connectors: watertight, field installed approved for MI cable.

.7 Termination kits: field installed approved for MI cable

2.4 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Connectors: anti short connectors.

PART 3 - EXECUTION

3.1 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:
  .1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.3 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable exposed, securely supported by straps or hangers.

3.4 INSTALLATION OF MINERAL-INSULATED CABLES

.1 Install cable exposed, securely supported by straps or hangers.

.2 Support 2 hour fire rated cables at 1 m intervals.

.3 Make cable terminations by using factory-made kits.

.4 Cable terminations: use thermoplastic sleeving over bare conductors.

.5 Do not splice cables unless indicated.

3.5 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 CSA Group
- .1 CSA C22.2 No. 41-13 (R2017), Grounding and Bonding Equipment.
- .2 CAN/CSA C22.2 No. 65-18, Wire connectors.

PART 2 - PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

.1 Copper compression connectors to CAN/CSA C22.2 No. 65 as required sized for conductors.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2 No. 41.

END OF SECTION

PART 1 - GENERAL

1.1 NOT USED

.1 Not used.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as required.

.3 Grounding conductors: bare stranded copper, soft annealed.

.4 Insulated grounding conductors: green, copper conductors.

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

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.8 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

END OF SECTION

PART 1 - GENERAL

1.1 NOT USED

.1 Not used.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

PART 3 - EXECUTION

3.1 INSTALLATION

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

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

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

.5 Fasten exposed conduit or cables to building construction or support system using straps.
- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.
- .1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels.

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

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

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

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

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

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)
  .1 CSA C22.1-21, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations (25th Edition).

PART 2 - PRODUCTS

2.1 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat turned edge covers.

PART 3 - EXECUTION

3.1 JUNCTION AND PULL BOXES INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)
  .1 CSA C22.1-21, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations (25th Edition).

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

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

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

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

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

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 CONDUIT BOXES

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

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

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

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

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

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

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

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

.5 Identify systems for outlet boxes as required.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
- .1 CAN/CSA C22.2 No. 18.3-12 (R2017), Conduit, Tubing, and Cable Fittings.
- .2 CSA C22.2 No. 83-M1985 (R2017), Electrical Metallic Tubing.

PART 2 - PRODUCTS

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings with expanded ends.

2.2 CONDUIT FASTENINGS

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

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

.3 Channel type supports for two or more conduits.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18.3, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Set-screw connectors and couplings for EMT.

2.4 FISH CORD

.1 Polypropylene.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

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

.2 Use electrical metallic tubing (EMT).

.3 Use rigid PVC conduit underground in corrosive areas.

.4 Use flexible metal conduit for connection to motors in dry areas.

.5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.6 Install conduit sealing fittings in hazardous areas.
- .1 Fill with compound.

.7 Minimum conduit size: 21 mm.

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

.9 Mechanically bend steel conduit over 21 mm diameter.

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

.11 Install fish cord in empty conduits.

.12 Remove and replace blocked conduit sections.
- .1 Do not use liquids to clean out conduits.

.13 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

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

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

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)
- .1 CSA C22.2 No. 5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Include time-current characteristic curves for breakers.

.3 Certificates:
- .1 Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 3 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
  - .1 Production certificate of origin must be submitted to Departmental Representative for approval.
- .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
- .3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
- .4 Production certificate of origin must contain:
  - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
  - .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.
  - .3 Contractor's name and address and person responsible for project.
  - .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
  - .5 Name and address of building where circuit breakers will be installed:
    - .1 Project title:
    - .2 End user's reference number:
    - .3 List of circuit breakers:

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, and circuit breakers: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.4 Common-trip breakers: with single handle for multi-pole applications.

.5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.6 Circuit breakers in existing switchboards shall be Masterpack NW08H2, c/w new frame. New brakes are 800A and shall be commissioned/adjusted to suit new fire pump.

2.2 THERMAL MAGNETIC BREAKERS

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

2.3 MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

.2 Refer to drawings for switchboard circuit breaker specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

.2 Adjust circuit breakers in accordance wit short circuit/coordination study.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

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

1.2 REFERENCE STANDARDS

.1 CSA Group
  .1 CSA-C22.2 No. 4-16 (R2020), Enclosed and Dead-Front Switches.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's instructions, printed product literature and data sheets for disconnect switches - fused and non-fused and include product characteristics, performance criteria, physical size, finish and limitations.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Non-fusible, disconnect switch in CSA enclosure, to CSA-C22.2 No. 4 size as indicated.

.2 Provision for padlocking in on-off switch position.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Quick-make, quick-break action.

.5 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.2 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:
- .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval review by Departmental Representative.
- .3 Photometric data to include: VCP Table where applicable spacing criterion.

PART 2 - PRODUCTS

2.1 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.2 LUMINAIRES

.1 As indicated in luminaire schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:
- .1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

.1 Support light fixture in accordance with seismic requirements.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

.1 Underwriter's Laboratories of Canada (ULC)
- .1 CAN-ULC-S524-2019, Standard for the Installation of Fire Alarm Systems.
- .2 CAN-ULC-S537-2019, Standard for Verification of Fire Alarm Systems.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for fire alarm devices and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario,Canada.
- .2 Indicate on shop drawings:
  - .1 Details for devices.
  - .2 Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.
  - .3 Step-by-step operating sequence, cross referenced to logic flow diagram.

1.3 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: submit operation and maintenance data for fire alarm system for incorporation into manual.

.2 Include:
- .1 Instructions for complete fire alarm system to permit effective operation and maintenance.
- .2 Technical data - illustrated parts lists with parts catalogue numbers.
- .3 Copy of approved shop drawings with corrections completed and marks removed except review stamps.
- .4 List of recommended spare parts for system.

PART 2 - PRODUCTS

2.1 DESCRIPTION

.1 Existing fire alarm is system Chubb Edwards EST.

2.2 WIRING

.1 Twisted copper conductors: rated 600 V.

.2 To control circuits: 14 AWG minimum, and in accordance with manufacturer's requirements.

2.3 AUTOMATIC ALARM INITIATING DEVICES

.1 Thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57 degrees C, rate of rise 8.3 degrees C per minute.

.2 Addressable thermal fire detectors, combination fixed temperature and rate of rise, non-restorable fixed temperature element, self-restoring rate of rise, fixed temperature 57 degrees C, rate of rise 8.3 degrees C per minute.
.1 Electronics to communicate detector's status to addressable module/transponder.

2.4 AUDIBLE SIGNAL DEVICES

.1 Bells: Surface mounted, single stroke, 150 mm.

2.5 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for fire alarm installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524.

.2 Locate and install detectors and connect to alarm circuit wiring. Mount detectors more than 1 m from air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.3 Install bells and connect to signalling circuits.

.4 Install end-of-line devices.

.5 Fire pump: wire alarm and supervisory switches and connect to addressable loop.

.6 Splices are not permitted.

.7 Provide necessary raceways, cable and wiring to make interconnections to terminal boxes, as required by equipment manufacturer.

.8 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.

.9 Identify circuits and other related wiring at central control unit, annunciators, and terminal boxes.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with CAN/ULC-S537.

.2 Fire alarm system:
- .1 Test such device and alarm circuit to ensure thermal detectors and fire pump transmit alarm to control panel and actuate general alarm.
- .2 Check annunciator panels to ensure zones are shown correctly.
- .3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of systems.
- .4 Addressable circuits system style DCLA:
  - .1 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals on each side of single open-circuit fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
  - .2 Test each conductor on all DCLA addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near midmost point of each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
- .5 Addressable circuits system style DCLB:
  - .1 Test each conductor on all DCLB addressable links for capability of providing 3 or more subsequent alarm signals on line side of single open-circuit fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.
  - .2 Test each conductor on all DCLB addressable links for capability of providing 3 or more subsequent alarm signals during ground-fault condition imposed near electrically most remote device on each link. Operate Acknowledge/Silence switch after reception of each of the 3 signals. Correct imposed fault after completion of each series of tests.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by fire alarm system installation.

END OF SECTION