Water Main System Upgrade
Project No: CSA17-M1
DRAWINGS AND SPECIFICATIONS
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Part 1 General

1.1 INTENT

.1 Intent of this Tender call is to obtain a firm price offer to install a new fire pump (supplied by Departmental Representative), at the David Florida Laboratory, 3701 Carling Avenue, Ottawa, Ontario, in accordance with these Documents.
.2 Some selective demolition is required to remove an old fire booster pump and some mechanical & electrical services to accommodate the installation of the new fire pump and associated accessories.
.3 Start-up, testing and commissioning shall be included in the contractor's scope of work.
The Fire Pump manufacturer has been retained to assist during start-up and commissioning, including completed start-up reports to be submitted to contractor and subsequently from contractor to Department Representative.
.4 Shop drawings shall be supplied by the Departmental Representative to the successful contractor within one (1) week of Award of Contract.
.5 The fire Pump will be located on site in an area designated by the Departmental Representative and in conformance with the Manufacturers off loading and storage recommendations. The contractor shall allow to move from storage location to the work site.

1.2 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 (NBC) and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirements shall apply.

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 with the exception of Building Permit. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having jurisdiction.
.2 Building Permit will be paid and provided by Departmental Representative.

1.5 PRECEDENCE

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

1.6 FIRE SAFETY REQUIREMENTS

.1 Comply with the National Building Code of Canada 2015 (NBC) for fire safety in construction and the National Fire Code of Canada 2015 (NFC) for fire prevention, fire fighting, and life safety in building in use.
.2 Fire Pump shall meet the requirements set out in NFPA 20.

1.7 CONTRACT DOCUMENTS

.1 Drawings and specifications are complementary, items shown or mentioned in one and not in the other are deemed to be included in the contract work.

.2 The contract documents are intended to describe complete fully functional systems although not all components are indicated.
.3 Discrepancies in the design documents, or doubt to the full intent of the design shall be brought to the Departmental Representative's attention prior to tender close. Failure to do this means, that the Contractor is fully aware and shall be responsible of design intent and requirements and shall provide fully functional and coordinated systems.

1.8 HAZARDOUS MATERIALS
.1 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials; and regarding labeling and the provision of Safety Data Sheets (SDS) acceptable to Human Resources Development Canada, Labour Program.
.2 For work in occupied buildings give the Departmental Representative 48 hours notice for work involving designated substances (Ontario Bill 208), hazardous substances (Canada Labour Code Part II Section 10)

1.9 WELDING AND CUTTING
.1 At least 48 hours prior to commencing cutting or welding, provide to Departmental Representative:
    .1 Completed hot work permit.
.2 Return hot work permit to Departmental Representative immediately upon completion of procedures for which permit was issued.
.3 A firewatcher shall be assigned when welding or cutting operations are carried out in areas where combustible materials within 10 m may be ignited by conduction or radiation. Fire watcher shall remain in area for a minimum period of one (1) hour following the completion of hot work.

1.10 FIELD QUALITY CONTROL
.1 Carry out work using qualified factory representatives in accordance with Provincial Act respecting manpower vocational training and qualifications.
.2 Permit employees registered in Provincial apprenticeship program to perform specific tasks only if under direct supervision of qualified licensed workers.
.3 Determine permitted activities and tasks by apprentices, based on level of training attended and demonstration of ability to perform specific duties.

1.11 EXAMINATION
.1 Examine site and conditions likely to affect work and be familiar and conversant with existing conditions.
.2 Manufacturer shall provide post delivery review with Department Representative of units both prior to unit off loading and once off loaded and submit both reports to Department Representative confirming unit is in good condition with no damage or issues from manufacturing, shipment or off loading.

1.12 STORAGE HANDLING OF MATERIALS INTENDED FOR REUSE
.1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
.2 Protect structural components not removed for demolition from movement or damage.
.3 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.
.4 Protect architectural, mechanical and electrical systems from damage.
.5 Separate and store materials produced during dismantling of structures in designated areas.

1.13 DISPOSAL OF WASTE

.1 In accordance with all applicable codes, standards and regulations. Separate and divert materials to a recycling facility where possible.
.2 Unless specified otherwise, materials for removal become Contractor's property and shall be taken from site.
.3 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
    .1 On-site source separation is recommended.
    .2 Remove co-mingled materials to off-site processing facility for separation.
.4 Transport materials designated for disposal to waste processing sites.
.5 Waste disposal bins shall be emptied by contractor prior to filling of bin to maximum permitted capacity. Contractor shall arrange for & dispose of contents of bins within 24 hours of notice by departmental representative should departmental representative deem bins unsafe or untidy.

1.14 PROTECTION
.1 Protect and seal adjacent work to prevent the spread of dust and dirt for the protection of workers, finished areas of work and adjacent laboratory facilities beyond the work areas.
.2 Protect finished work against damage until take-over.
.3 Protect all floor areas in mechanical room with layer of the following:
    .1 Flexible foam under pad
    .2 Oriented standard board (minimum 6mm thick)
.4 Areas used for access to construction site as a means of travel or for demolition shall be protected in similar fashion as mechanical room floor to prevent damage of floor surface.
.5 Protection of floors in Bay 3 and Large Loading dock by Departmental Representative to permit the contractor in using lifts for construction work as follows:
    .1 Flexible foam under pad
    .2 Oriented standard board (minimum 6mm thick)
    .3 Provide & seal clear heavy duty tarps full height of Bay 3 to enclose adjacent areas not in construction from contaminants.
.6 Protect operatives and other users of site from all hazards.

1.15 HOARDING
.1 Erect temporary site enclosure around work site in mechanical room & around perimeter of waste disposal bin.
.2 Hoarding to be in full compliance with requirements of the Ontario Health and Safety Act and Regulations - 1990 (OSHA)
    .1 In accordance with OSHA, where required, provide 1.8m high sturdy fence to protect personnel from hazards.
.3 Keep site fenced off at all times from general public. Only remove portion of fence to provide opening to site to accommodate access, minimize duration of opening, and immediately close when not required.
.4 Ensure site is fully enclosed when work force is not on site.
.5 Continually monitor condition of hoarding and make good repairs.
.6 Provide temporary hoarding in corridors during delivery of materials & removal of waste.

1.16 PROJECT CLEANLINESS
.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by other Contractors.
.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.
.3 Make arrangements with and obtain permits from Authorities Having Jurisdiction for disposal of waste and debris.
.4 Provide on-site dump containers for collection of waste materials and debris.

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

1.17 FINAL CLEANING
.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
.3 Remove waste products and debris including that caused by other Contractors.
.4 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site.
.5 Make arrangements with and obtain permits from Authorities Having Jurisdiction for disposal of waste and debris.
.6 Clean hardware and mechanical and electrical fixtures.
.7 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, walls, and floors.
.8 Vacuum clean and dust building interiors, behind grilles, louvers, screens, tops of roll up drum louvers, beams, and open web steel joist.
.9 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
.10 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds affected by work.
.11 Sweep and wash clean paved areas.
.12 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
.13 Upon completion remove temporary protection and surplus materials. Make good defects noted at this stage.

1.18 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, including emergency vehicles.
.3 Maintain vehicle and pedestrian access, including emergency vehicles to and from the site.
.4 Where security is reduced by work provide temporary means to maintain security.

1.19 SANITARY FACILITIES
.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
.2 Post notices and take precautions as required by local health authorities. Keep area free and premised in sanitary condition.
.3 Portable facility shall be outside in a secured area covered by hoarding in a location approved by Departmental Representative.

1.20 SITE STORAGE

.1 Storage and stockpile areas shall be equipped and maintained by the contractor.

.1 Storage and stockpile areas are to be contained entirely within the laydown/work area indicated.

.2 Contractor employee parking shall be contained within the indicated laydown/work area.

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

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

.4 Obtain and pay for use of additional storage or work areas needed for operations.

1.21 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.

1.22 EXAMINATION

.1 Examine site and conditions which will affect the work. Submission of tender shall be deemed as confirmation that tenderer has inspected site and is conversant with conditions, and shall not constitute additional costs as a result of site conditions.

.2 Verify existing conditions including but not limited to, structural elements, sprinkler piping and heads, roof drains and storm piping, electrical conduit and wiring, process utility piping, ductwork and other building services.

.3 The fact that not all existing conditions discussed in Item .2 above are shown on the drawings does not relieve the responsibility of coordinating the work with the existing construction.

1.23 SIGNS

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

1.24 ACCESS AND EGRESS

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

1.25 RECORDS

.1 As work progresses, maintain accurate records to show deviations from contract drawings. Just prior to Departmental Representative's inspection for issuance of final certificate of completion, supply to the Departmental Representative one (1) set of white prints with all deviations neatly inked in, maintaining separate colours for each major system. In addition, provide a complete colour scan of said final marked up drawings and submit each drawing in electronic PDF format to the Departmental Representative. The Departmental Representative will provide one set of clean white prints for this purpose.

.2 Drawings are to be updated at the end of each work period.

.1 Drawings are to be submitted for review by the Departmental Representative at the regularly scheduled construction project meetings.

.2 Store drawings on site in a clean dry area.

.3 Make drawings available for review when requested by Departmental Representative.

.4 Specifications: Mark each item to record actual construction including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed.

.2 Changes made by Addenda and Change Orders.

1.26 GUARANTEES AND WARRANTIES

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

.2 In accordance with Section 01 78 00 – Closeout Submittals

1.27 BUILDING SMOKING ENVIRONMENT

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

1.28 TRAFFIC MANAGEMENT PLAN

.1 Access to building will be through CRC campus Main Gate.

.2 Access to interior of David Florida Laboratory will be through stair G

.3 Access for equipment & tools will be through Large Loading Dock.

1.29 CONSTRUCTION SCHEDULE

.1 On award of contract submit to Departmental Representative within five (5) working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.2 Submit Project Schedule to Departmental Representative within five (5) working days of receipt of acceptance of Master Plan.

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.3 Departmental Representative will review and return revised schedules within five (5) working days.

- .1 Revise impractical schedule and resubmit within five (5) working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

.5 Develop detailed Project Schedule derived from Master Plan.

.6 When schedule has been reviewed by the Departmental Representative, take necessary measure to complete work within scheduled time. Any changes to schedule following approval must be authorized by the Departmental Representative.

.7 Carry out work during "regular hour" Monday to Friday from 07:00 to 18:00 hours, unless otherwise indicated or required to meet project schedule.

.8 Carry out the following work during "silent hours", as defined as Monday to Friday from 18:00 to 07:00 hours and anytime on Saturdays, Sundays, and statutory holidays:

- .1 To meet project schedule.
- .2 For building service interruptions, provide at least seventy-two (72) hours notice.

.9 All building operations in areas not under construction must be maintained during all phases of construction.

.10 Contractor to submit a written notice to the Departmental Representative with a minimum of seventy-two (72) hours notice for work to be carried out during “silent hours”, including the number, names of employees, name(s) of company(ies) and dates and times required for access to site.

.11 Definitions:

- .1 Construction Work Week: Monday to Sunday inclusive and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .2 Construction Start: First day that Contractor will have access to site for construction activities.
- .3 Construction Completion: Last day of construction access to site for Contractor, before which point, all construction activities including but not limited to erection, testing, commissioning, certification, painting, demolition, cleanup, etc. are to be completed.
- .4 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .5 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy

Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.12 Requirements:

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately ten (10) working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of the essence in this contract.

.13 Project schedule:

.1 Develop detailed Project Schedule.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.

.2 Shop drawings.

.3 Permits.

.4 Mobilization.

.5 Demolition

.6 New Work

.7 Start-Up, Testing and Commissioning.

.8 Final Inspections and Clean Up

.9 Turnover of site to Departmental Representative.

.10 Demonstration and training for Departmental Representative's personnel.

.11 Operational & maintenance manual submittals, etc.

.3 Allow in schedule for review of submittals by departmental representative.

.14 Project schedule reporting:

.1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress. Submit updated schedule to department representative weekly.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

.15 Project meetings:

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule. Contractor shall allow for weekly construction meetings. Department Representative shall determine if weekly or bi-weekly construction meetings shall be required during specific durations of the project.

1.30 COST BREAKDOWN

.1 Before submitting first progress claim and within one (1) week of award of contract, submit breakdown of Contract Amount in detail. Indicate material and labour costs separately for Division and system. After acceptance by Departmental Representative, cost breakdown will be used as the basis of progress payments.

.2 After acceptance by Departmental Representative, cost breakdown will be used as the basis of progress payments.

1.31 SUBMITTAL PROCEDURE

.1 General:

.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.
.11 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.
.12 Shop drawings for structural support of air handling unit to be stamped and signed by professional engineer licensed in the Province of Ontario.
.13 Submit the shop drawings for the following items:
    .1 Electrical breakers,
    .2 All valves,
    .3 Piping materials,
    .4 Any mechanical piping joint systems,
    .5 Seismic Support Details,
    .6 Support details,
    .7 System Identification,
    .8 Controls shop drawings including points list, sequences of operation, system architecture, components and actuators, etc.

.2 Shop drawings and product data:
.1 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.
.2 Allow five (5) working days for Departmental Representative's review of each submission.
    .1 Allow ten (10) working days for Departmental Representative’s review when large quantities of shop drawings are submitted.
.3 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.
.4 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.
.5 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.

.6 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 review and approval of submissions, verification of field measurements and compliance with Contract Documents.
.5 Details of appropriate portions of Work as applicable:
.1 Fabrication.
.2 General arrangement drawings, showing component parts, dimensions, including identified field dimensions, and operating and maintenance clearance i.e. access door swing spaces.
.3 Setting or erection details.
.4 Mounting details and dimensions.
.5 Capacities.
.6 Complete certified performance data for the specified application, with particular reference to rate of flow, operating pressure and temperatures, entering and leaving conditions of air or fluid, operating limitation, electrical characteristics etc.
.7 Standards.
.8 Operating weight.
.9 Electrical wiring diagrams, control panel boards, motor test data, motor starters and controls for electrically-operated equipment furnished by mechanical trades.
.10 Single line and schematic diagrams.
.11 Relationship to adjacent work.
.12 Finish.
.13 Gauge of materials.
.14 Vibration isolators and resilient hangers stating locations and weight distribution.
.6 After Departmental Representative's review, distribute copies.
.7 Submit single electronic format (pdf) of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request. Reviewed shop drawings will be returned to contractor.
.8 Submit single electronic format (pdf) of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
.9 Submit single electronic format (pdf) 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.

.10 Submit single electronic format (pdf) of certificates for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.11 Submit single electronic format (pdf) copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.12 Submit single electronic format (pdf) copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.13 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.14 Delete information not applicable to project.

.15 Supplement standard information to provide details applicable to project.

.16 Following review, 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.

.17 The review of shop drawings by the Departmental Representative is for sole purpose of ascertaining conformance with general design concept.

.1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

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

.3 Material safety data sheets (MSDS):

.1 Submit Material Safety Data Sheets (MSDS) for the following products. Indicate VOC emissions, prior to installation or use:

.1 Adhesives, caulking sealing, fireproofing or fire stopping compounds, paints, floor and wall patching or levelling materials, lubricants.

.2 MSDS to comply with Occupational Health and Safety requirements.

.4 Certificates and transcripts:

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

.5 Operation and maintenance instructions manuals:

.1 Submit single hard copy of draft Operation and Maintenance Instruction Manual to Departmental Representative for approval, compiled in the following format:

.1 Binders: vinyl, hard covered, 3 ‘D’ ring, loose leaf 219 x 279 mm with spine and face pockets. Project name and number must appear on binder face and spine.

.2 Cover: identify each binder with type or printed title “Operation and Maintenance Instructions”.

.3 Title Sheet:

.1 Labelled “Operation and Maintenance Instructions”.
.2 Date of submission; names.
.3 Name of project.
.4 Addresses, and telephone numbers of Contractor with name of responsible parties.
.5 Schedule of products and system, indexed to content of volume.

.4 Organize contents as instructional manual into applicable sections of work to parallel project specifications breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.

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

.6 When multiple binders are used correlate data into related consistent groupings.
.1 Identify contents of each binder on spine.

.7 Information in manuals is to be specific to this project. Generic information is unacceptable.

.2 Include the following information plus data specified:

.1 Installation and maintenance instructions for equipment and materials.

.2 Description: Operation of the equipment and systems defining start-up, shut-down and emergency procedures, and any fixed or adjustable set points that affect the equipment operation. Include nameplate information such as make, size and serial number. Include appropriate wiring diagrams, schematics, elevations, mounting requirements, and options included, etc. as it pertains to each system and/or device.

.3 Maintenance: Use clear drawings, diagrams or manufacturers’ literature which specifically apply and details the following:
.1 Lubrication products and schedules.
.2 Trouble-shooting procedures.
.3 Adjustment techniques.
.4 Operational checks. Supplier names with addresses and telephone numbers of points of contact; components supplied by them must be included in this section. Components must be identified by a description and manufacturer’s part number.

.4 Spare Parts: List all recommended spares to be maintained on site to ensure optimum efficiency. List all special tools appropriate for unique application. All parts/tools detailed must be identified as to manufacturer, part number and supplier.

.5 Shop Drawings: Include final complete reviewed set of shop drawings with all mark-ups, comments, and Contractor’s and Departmental Representative’s stamps. Indicate any changes made during fabrication and installation.

.6 As Built Documents: Include all final marked up Contract Drawings indicating any deviation from design including Addenda, Change Orders and other modifications to Contract.

.7 For each product or system:
.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.8 Guarantees and Warranties in accordance with Section 01 78 00 – Closeout Submittals.

.9 Material Safety Data Sheets (MSDS).

.10 Control Contractor’s Pre-Start-up, Start-up, Commissioning & Testing Field Reports.

.11 Inspection Certificates.

.12 Manufacturers’ Certificates.

.13 Training: refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 Within four (4) weeks of acceptance of draft manuals by Departmental Representative submit single electronic format (pdf) and three (3) sets of hard copies of Operation and Maintenance Instruction Manuals.

1.32 TESTING, INSPECTION AND COMMISSIONING

.1 Pre-Start-up to include but not limited to:

.1 Visually inspect all wiring, tubing, condensate drain, piping connections etc.

.2 Proper lubrication, balancing, levelling etc.

.3 Pump properly aligned tight on shaft and freely moving,

.4 Verify proper installation of all components not assembled in factory (i.e. pump, jockey pump, controllers, etc.)

.5 Verify installation of unit with proper clearances.

.6 Verify there are no leaks in the system.

.7 Verify all shipping bolts and other material have been removed, (fan, dampers etc.)

.8 Complete manufacturer's start-up report and submit to Department Representative.

1.33 DEMONSTRATION AND TRAINING

.1 The Manufacturer shall provide the services of factory trained instructors who will provide instruction to designated personnel in the adjustment, operation and maintenance, including pertinent safety requirements, of the equipment and system specified. The training shall be oriented toward the system installed rather than being general "canned" training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach.

.2 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the equipment location.

.3 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.

.4 Review contents of manual in detail to explain aspects of operation and maintenance.

.5 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

.6 Training shall be provided to Department Representative within fifteen (15) days of unit start-up.

1.34 SCHEDULING

.1 Submit to Departmental Representative within five (5) working days of Award complete shop drawing submission including production and delivery schedule.

.2 Carry out work during "regular hour" Monday to Friday from 07:00 to 18:00 hours, unless otherwise indicated. "Silent hours" are defined as Monday to Friday from 18:00 to 07:00 hours and anytime on Saturdays, Sundays, and statutory holidays.

.3 Manufacturer shall submit a written notice to the Departmental Representative with a minimum of ninety-six (96) hours notice for work to be carried out during "silent hours", including the number, names of employees, name(s) of company(ies) and dates and times required for access to site.

.4 Definitions:

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.3 Construction Work Week: Monday to Friday, inclusive, will provide five (5) day work week and define schedule calendar working days.

.4 Construction Start: First day following the Award of Contract.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Milestone: significant even in project, usually completion of major deliverable.

.7 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
.8 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

.5 Project milestones form interim targets for Project Schedule:

.1 Shop drawing submission & review for new Fire Pump within one (1) week of Award of Contract date.
.2 Allow one (1) week for Departmental Representative's review of each shop drawing submission.
.3 Manufacture of new Fire Pump completed within Twenty (20) weeks of Award of Contract date.
.4 Factory certification and delivery of new Fire Pump completed no later than Twenty (20) weeks of Award of Contract date. Notify and Coordinate exact date and time with Departmental Representative a minimum of ten (10) working days prior to delivery.
.5 Start-up, testing and commissioning following erection and installation (by others) of Fire Pump.
.6 Warranty for one (1) calendar year following delivery of Fire Pump.

1.35 TRAFFIC MANAGEMENT PLAN

.1 Access to building will be through CRC campus Main Gate.

1.36 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to protect from weather (e.g. heavy duty polyvinyl plastic covering), prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
.2 Remove and replace damaged products due to contractor movement of materials at own expense and to satisfaction of Departmental Representative.
.3 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Used touch-up materials to match original. Do not paint over name plates.

1.37 MANUFACTURER'S INSTRUCTIONS

.1 Department Representative will supply successful contractor with soft and hard copies of Fire Pump Installation and Operation manual.

1.38 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.39 FASTENINGS – EQUIPMENT

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

1.40 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
.2 Prevent electrolytic action between dissimilar metals and materials.
.3 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
.4 Keep exposed fastenings to a minimum, space evenly and install neatly.

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

1.41 SHOP DRAWINGS
.1 Submit for the Departmental Representative's review, one (1) copy of each shop drawing in electronic PDF format.
.2 The review is for the sole purpose of ascertaining conformance with the general design concept and does not mean approval of the design details inherent in the shop drawings, responsibility for which shall remain with the Manufacturer. Such review shall not relieve the Manufacturer of responsibility for errors or omissions in the shop drawings or of his/her responsibility for meeting all requirements of the Contract Documents.
.3 Do not commence manufacture or order materials before shop drawings are reviewed.
.4 Reference specification section 01 33 00-Submittal Procedures for additional information.

1.42 PRODUCT DATA
.1 Product data: manufacturers catalogue sheets, brochures, literature, performance charts and diagrams, used to illustrate standard manufactured products.
.2 Submit one (1) copy of product data in electronic PDF format.
.3 Delete information not applicable to project. Shop drawing shall be custom for this project.
.4 Cross-reference product data information to applicable portions of Contract Documents.

1.43 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.

1.44 PROTECTION OFWORK IN PROGRESS
.1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.45 EXISTINGUTILITIES
.1 When breaking into or connecting to existing services or utilities, execute Work at time directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants. Coordinate all Work affecting services of utilities in areas not under construction with Departmental Representative.
.2 Protect, and maintain existing active services.

1.46 WARRANTIES
.1 Deposit manufacturer's warranties with Departmental Representative.

1.47 CLEAN UP
.1 Site is to be cleaned each work day and kept free of clutter or debris. Department Representative will designate an area for the contractor to maintain bins for separation of waste and recycling. Collection and removal of the bins shall be the responsibility of the contractor.

1.48 TRANSPORTATION
.1 Pay costs of transportation of products required in performance of Work.
.2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.

1.49 MANUFACTURER’S INSTRUCTIONS
.1 Unless otherwise indicated in specifications install or erect projects 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 wiring, 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 reinstallation at no increase in Contract Price or Contract Time.

1.50 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 too standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.51 COORDINATION
.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.
.3 Coordinate the Work with all other Divisions, to ensure system compatibility, and to ensure schedules and requirements are maintained.
.4 Where perceived interferences occur, prepare detailed sketches indicating proposed solution for review and acceptance by Departmental Representative.

1.52 CONCEALMENT
.1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
.2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.53 FINAL INSPECTION
.1 Do not request final inspection until:
- .1 Deficiencies are less than twenty-five (25) items.
- .2 All systems have been tested and are ready for operation.
- .3 All air balancing has been completed, as applicable.
- .4 The Departmental Representative's operating personnel have been instructed in the operation of all systems and equipment.
- .5 The complete operation and maintenance data books have been delivered to the Departmental Representative.
- .6 All inspection certificates have been furnished including but not limited to seismic certification, City's final plumbing inspection.
- .7 All record drawings have been completed and approved.
- .8 All spare parts and replacement parts have been provided and receipt of same acknowledged.
- .9 The cleaning up is finished in all respects.
- .10 Upon completion of above, the Contractor is to request in writing for final site review with a minimal seventy-two (72)-hour notification.

.2 Final installation shall be subject to the approval of the Departmental Representative.

1.54 REMEDIAL WORK
.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.

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

Part 1 General

1.1 RELATED REQUIREMENTS
.1 Section 01 00 10 – General Instructions
.2 Section 21 30 00 – Fire Pumps

1.2 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 because of such default will be allowed.
.2 Do not procure materials or components until submittal review is complete.
.3 Present shop drawings and product data in SI Metric units.
.4 Where items or information is not produced in SI Metric units converted values are acceptable.
.5 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents & stating reasons for deviations.
.6 Manufacturer’s responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
.7 Manufacturer’s responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

1.3 SHOP DRAWINGS AND PRODUCT DATA
.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Manufacturer to illustrate details & performance of equipment to Department Representative.
.2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for installation of units.
.3 Allow five (5) working 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 & provide explanation for changes.
.6 Accompany submissions with transmittal letter, containing:
    .1 Date.
    .2 Project title and number.
    .3 Manufacturer’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 Supplier/Local Representative.
        .2 Manufacturer.

.4 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 General arrangement drawings, showing component parts, dimensions, including identified field dimensions, and operating and maintenance clearance i.e. access door swing spaces.

.3 Setting or erection details.

.4 Mounting details and dimensions.

.5 Capacities.

.6 Complete certified performance data for the specified application, with particular reference to rate of flow, operating pressure and temperatures, entering and leaving conditions of air or fluid, operating limitation, electrical characteristics and BHP requirements.

.7 Standards.

.8 Operating weight.

.9 Electrical wiring diagrams, control panel boards, motor test data, motor starters and controls for electrically-operated equipment furnished by mechanical trades.

.10 Single line and schematic diagrams.

.11 Finish.

.12 Gauge of materials.

.13 Vibration isolators stating locations and weight distribution.

.14 Controls (if required).

.15 Equipment operation and maintenance manuals.

.16 Equipment storage procedures and checklists.

.8 Submit single electronic format (pdf) of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.9 Submit single electronic format (pdf) copies of manufacturer’s instructions for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Pre-printed material describing installation of product, system or material, including special notices and Safety Data Sheets concerning impedances, hazards and safety precautions.

.10 Submit single electronic format (pdf) copies of Manufacturer's Pre-Start-up & Start-up Inspection Reports, Commissioning and Testing Reports.

.11 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.12 Delete information not applicable to project.

.13 Supplement standard information to provide details applicable to project.

.14 Following review and acceptance, copies will be returned, and fabrication 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 work may proceed.

.15 The review of shop drawings by the Departmental Representative is for sole purpose of ascertaining conformance with general design concept.

.1 This review shall not mean that Departmental Representative approves detail design inherent in shop drawings, responsibility for which shall remain with Manufacturer submitting same, and such review shall not relieve Manufacturer of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of Contract Documents.

1.4 MATERIAL SAFETY DATA SHEETS (MSDS)

.1 Submit Safety Data Sheets (SDS) for the following products. Indicate VOC emissions, prior to installation or use:

.1 Sealants.

.2 Lubricants.

.2 SDS to comply with Occupational Health and Safety requirements.

1.5 OPERATION AND MAINTENANCE INSTRUCTIONS MANUALS

.1 Contractor shall allow to submit Fire Pump draft Operation and Maintenance Instruction Manual to Departmental Representative for approval, compiled in the following format:

.1 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets. Project name and number must appear on binder face and spine.

.2 Cover: identify each binder with type or printed title "Operation and Maintenance Instructions".

.3 Title Sheet:

.1 Labelled "Operation and Maintenance Instructions".

.2 Date of submission; names.

.3 Name of project.

.4 Addresses, and telephone numbers of Supplier/Manufacturer with name of responsible parties.

.5 Schedule of products and system, indexed to content of volume.

.4 Organize contents as instructional manual into applicable Sections of work to parallel project specifications breakdown. Mark each Section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.

.5 Drawings: provide with reinforced punched binder tab.

.1 Bind in with text; fold larger drawings to size of text pages.

.6 When multiple binders are used correlate data into related consistent groupings.

.1 Identify contents of each binder on spine.

.7 Information in manuals is to be specific to this project. Generic information is unacceptable.

.2 Include the following information plus data specified:

.1 Installation and maintenance instructions for equipment and materials.

.2 Description: Operation of the equipment and systems defining start-up, shutdown and emergency procedures, and any fixed or adjustable set points that affect the equipment operation. Include nameplate information such as make, size and serial number. Include appropriate wiring diagrams, schematics, elevations, mounting requirements, options included, etc. as it pertains to each system.

.3 Maintenance: Use clear drawings, diagrams or manufacturers' literature which specifically apply and details the following:

.1 Lubrication products and schedules.

.2 Trouble-shooting procedures.

.3 Adjustment techniques.

.4 Operational checks. Supplier names with addresses and telephone numbers of points of contact; components supplied by them must be included in this Section. Components must be identified by a description and manufacturer's part number.

.4 Spare Parts: List all recommended spares to be maintained on site to ensure optimum efficiency. List all special tools appropriate for unique application. All parts/tools detailed must be identified as to manufacturer, part number and supplier.

.5 Shop Drawings: Include final complete reviewed set of shop drawings with all mark-ups, comments, and Manufacturer's and Departmental Representative's stamps. Indicate any changes made during fabrication.

.6 For each product or system:

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

.7 Guarantees and Warranties in accordance with Section 01 78 00 – Closeout Submittals.

.8 Safety Data Sheets (SDS).

.9 Manufacturers' Pre-Start-up, Start-up, Commissioning & Testing Field Reports.

.10 Manufacturers' Inspection Certificates.

.11 Training: refer to Section 01 00 10 – General Instructions.
.12 Within four (4) weeks of acceptance of draft manuals by Departmental Representative submit single electronic format (pdf) and three (3) sets of hard copies of Operation and Maintenance Instruction Manuals.

Part 1 General

1.1 COMPLIANCEREQUIREMENTS

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.3 Occupational Health and Safety Act, R.S.O. 1990
.4 CAN3-Z166.2 – Use and Handling of Powder Actuated Tools.

1.2 SUBMITTALS

.1 Make submittals in accordance with Section 01 00 10 – General Instructions and Section 01 78 00 – Closeout Submittals.
.2 Submit site-specific Health and Safety Plan: Within seven (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 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
.4 Submit copies of incident and accident reports.
.5 Submit WHMIS SDS - Safety Data Sheets in accordance with Section 01 00 10 – General Instructions.
.6 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.

1.3 FILING OF NOTICE

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

1.4 GENERALREQUIREMENTS

.1 Provide site specific safety hazard assessment related to project.
.2 Work at site will involve exposure to elevated heights (up to 22 meters).
.3 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.
.4 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns

1.5 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.
.3 Provide full time supervision for duration of Work.
.4 Complete Health and Safety Training Sessions and ensure that personnel not successfully completing required training are not permitted to enter site to perform Work.

1.6 UNFORSEENHAZARDS

.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 Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.7 POSTINGOF DOCUMENTS

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

1.8 CORRECTIONOFNON-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 noncompliance of health and safety issues identified.

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

1.9 POWDER ACTUATEDDEVICES

.1 Use powder actuated devices only after receipt of written permission from Departmental Representative and if so, comply with requirements of CAN3-Z166.2 – Use and Handling of Powder Actuated Tools.

1.10 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

Part 1 General

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:

- .1 Contract documents.
- .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUSMATERIALDISCOVERY

.1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative.

.2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental Representative.

.3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative.

1.3 BUILDINGSMOKINGENVIRONMENT

.1 Comply with smoking restrictions and municipal by-laws.

Part 1 General

1.1 RELATED REQUIREMENTS
.1 Section 01 00 10 – General Instructions
.2 Section 01 33 00 – Submittal Procedures
.3 Section 21 30 00 – Fire Pumps

1.2 SUBMITTALS
.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
.2 One (1) week after approval of equipment shop drawings by Department Representative, submit draft copy, one (1) hard and one (1) soft copy of Operation and Maintenance Instruction Manuals in English and French.
.3 Provide, maintenance materials and special tools of same quality and manufacture as products provided.

1.3 EQUIPMENT
.1 For each item of equipment and each system include description of unit or system, and component parts.
    .1 Give function, normal operation characteristics and limiting conditions.
    .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
.2 Include colour coded wiring diagrams.
.3 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
    .1 Include regulation, control, stopping, shut-down, and emergency instructions.
    .2 Include summer, winter, and any special operating instructions.
.4 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
.5 Provide servicing and lubrication schedule, and list of lubricants required.
.6 Include manufacturer's printed operation and maintenance instructions.
.7 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
.8 Provide control diagrams.
.9 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
.10 Include test and reports as specified in Section 01 00 10 – General Instructions and as per manufacturers recommendations.
.11 Provide temporary storage procedures and checklists to Department Representative.
.12 Additional requirements: as specified in individual specification Sections.

1.4 MATERIALS AND FINISHES
.1 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
.2 Additional requirements: as specified in individual specifications Sections.

1.5 MAINTENANCE MATERIALS
.1 Special Tools:

.1 Provide a single set of special tools for unique application required to perform maintenance on Fire Pump.
.2 Provide items with tags identifying their associated function and equipment.
.3 Deliver to site; place and turn over to Departmental Representative.

1.6 WARRANTIES

.1 Develop warranty management plan to contain information relevant to Warranties.
.2 Reference section 21 30 00 – Fire Pumps for additional warrantee information and requirements.
.3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel, including roles and responsibilities of personnel associated with warranty process, indicating points of contact and telephone number within the organization of Manufacturers, sub-Manufacturers, manufacturers and/or suppliers involved.
.5 Submit, warranty information during shop drawing review submission, to Departmental Representative for approval.
.1 Equipment warrantee shall begin the date of delivery to site and acceptance by Department Representative.
.6 Manufacturer to submit a written signed warranty stating that all systems and components have been manufactured & assembled correctly and meet the design requirements, and all material and labour deficiencies will be corrected, at no cost, for a standard period of one (1) year after delivery.
.7 Respond in timely manner to oral or written notification of required construction warranty repair work. Responses for warrantee claims shall be made in writing by Manufacturer to Department Representative.

Part 1 General

1.1 RELATEDREQUIREMENTS
.1 Section 23 05 05 – Installation of Pipework.
.2 Section 23 31 13 – Metal Ducts.

1.2 REFERENCES
.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
    .1 Safety Data Sheets (SDS).
.2 Underwriter's Laboratories of Canada (ULC)
    .1 ULC-S115-2005, Fire Tests of Fire stop Systems.

1.3 DEFINITIONS
.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
.4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of non-combustible construction or have "0" annular space in buildings of combustible construction.
    .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.4 SUBMITTALS
.1 Provide submittals in accordance with Section 01 00 10 – General Instructions.
.2 Samples:
    .1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for the project.

Part 2 Products

2.1 MATERIALS
.1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
    .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN- ULCS115 and not to exceed opening sizes for which they are.
    .2 Fire stop system rating: FT.
    .3 Equal to 3M caulk CP25 and putty 303.
.2 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
.3 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
.4 Sealants for vertical joints: non-sagging.

Part 3 Execution

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.

.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation.

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

3.2 INSTALLATION

.1 Installation of fire stops by trained manufacturer’s representative.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.3 SEQUENCES OFOPERATION

.1 Proceed with installation only when submittals have been reviewed by the Departmental Representative.

.2 Mechanical pipe insulation: certified fire stop system component.

.1 Ensure pipe insulation installation precedes fire stopping.

3.4 FIELDQUALITY CONTROL

.1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.

3.5 SCHEDULE

.1 Fire stop and smoke seal at:

.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

.2 Top of fire-resistance rated masonry and gypsum board partitions.

.3 Intersection of fire-resistance rated masonry and gypsum board partitions.

.4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.

.6 Around mechanical and electrical assemblies penetrating fire separations.

.7 Mechanical Ducts: greater than 129 cm^2.

.1 Fire-stopping to be applied in accordance with fire damper manufacturer’s instruction.

Part 1 General

1.1 GENERAL
.1 This section covers items common to all sections of Divisions 21.
.2 Coordinate location & installation of all equipment with all trades to ensure the equipment is serviceable.
.3 Prime mechanical contractor shall be responsible to ensure that all requirements of Divisions 21, 22, 23 & 25 are met and comply with all other divisions and contract documents.
.4 The word "provide" shall mean "supply and install".

1.2 EQUIPMENT INSTALLATION
.1 Unions, flanges and/or couplings: provide for Installation ease of maintenance and disassembly.
.2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer, Code or as indicated; whichever is the more stringent.
.3 Provide new materials and equipment of proven design, quality and of current models with published ratings for which replacement parts are readily available.
.4 Use product of one manufacturer unless otherwise specified, for equipment or material of the same type of classification.
.5 Unless otherwise specified, follow manufacturer's recommendations for safety, adequate access for inspection, maintenance and repairs.
.6 Permit equipment maintenance and disassembly with minimum disturbance to connecting piping and duct systems without interference with building structure or other equipment.

1.3 ANCHOR BOLTS & TEMPLATES
.1 Supply anchor bolts and templates for installation by other divisions.

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

1.5 ELECTRICAL
.1 Electrical work to conform to Division 26 including Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems. Refer to Division 26 for quality of materials and workmanship.
.2 Any costs associated with deviation of mechanical equipment rating affecting electrical Division 26 shall be carried by this contract.
.3 All control wiring & conduit associated with Building Automation System & HVAC controls shall be provided by Divisions 21, 22, 23 & 25 including power wiring to all control panels & other field mounted control devices. Emergency power circuits are provided by Division 26 in the vicinity of the power source.

1.6 PAINTING
.1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
.2 Prime and touch up marred finished paintwork to match original. Use primer or enamel to match original. Do not paint over nameplates.
.3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

.4 Hangers, supports and equipment fabricated from ferrous metals shall be given at least one coat of corrosion resistant primer paint before shipment to job site.
.5 Touch-up damaged surfaces of all mechanical equipment and materials, to the satisfaction of Engineer. Use primer or enamel to match original. Do not paint over nameplates.

1.7 SPECIAL TOOLS
.1 Provide one set of special tools required to service equipment as recommended by manufacturers.

1.8 WASTE MANAGEMENT & DISPOSAL
.1 Waste Reduction Work plan (WRW): Perform work in accordance with project's WRW.
If one does not exist, provide the following:
- .1 Identify opportunities for reduction, re-use and/or recycling of materials.
- .2 Post work plan or summary where workers on site are able to review it's content.

.2 Materials Source Separation Program (MSSP): Perform all work in accordance with project's MSSP. If one does not exist, provide the following:
- .1 Provide containers for collection of re-useable and/or recyclable materials.
- .2 Transport off-site salvaged materials to authorized recycling facility or to users of material for re-use.

.3 Disposal of Waste: Disposal of waste, volatile materials, mineral spirits, oil, paint thinner, etc. into waterways, storm or sanitary sewers is prohibited.
.4 Storage, Handling and Protection:
- .1 Store materials for re-use in a secure area as directed by project manager, where they will not be damaged. Provide protection of materials as necessary.
- .2 Unless otherwise specified, removed materials become the Contractor's property. Contractor shall be responsible for transport & delivery of non-salvageable items to a licensed disposal facility.

1.9 DEMONSTRATION OF OPERATING & MAINTENANCE INSTRUCTIONS
.1 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.
.2 Where specified elsewhere in Divisions 21, 22, 23 & 25, manufacturers to provide demonstrations and instructions.
.3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.
.4 Instruction duration time requirements as specified in appropriate sections.
.5 Where deemed necessary, Owner may record these demonstrations on video tape for future reference.
.6 Furnish trained instructors to instruct Owner's operating staff in the operation, maintenance and adjustment of all mechanical equipment; and, instruct personnel on any changes to or modifications of any equipment made under terms of the guarantee.
.7 The instructions shall take place during regular working hours before systems are accepted and turned over to Owner's staff.
.8 Ensure that the Owner's operating personnel have received and been given opportunity to review the Operating and Maintenance Manuals. Prior to commencing instruction. Allow two full days on site for review of these manuals with Owner’s personnel & for their instruction in operation & maintenance of all mechanical equipment.

1.10 CLOSEOUT SUBMITTALS
.1 Submit operation and maintenance data for incorporation into manual.
.2 Operation and maintenance manual (O&M) to be approved by, and final copies deposited with, Engineer before final inspection.

.3 For all equipment listed in O&M manuals provide a schedule detailing the supplied component, name, address & phone no. of equipment vendor, parts supplier and warranty agent.
.4 Operation data to include:
.1 Control schematics for each system.
.2 Description of each system and its controls.
.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
.4 Operation instruction for each system and each component.
.5 Description of actions to be taken in event of equipment failure.
.6 Valves schedule and flow diagram.
.5 Maintenance data shall 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.
.6 Performance data to include:
.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
.2 Equipment performance verification test results.
.3 Special performance data as specified elsewhere.
.7 Approvals:
.1 Submit electronic format (pdf) copy of draft Operation and Maintenance Manual to Engineer for approval. Submission of individual data will not be accepted unless so directed by Engineer.
.2 Make changes as required and re-submit as directed by Engineer. Upon acceptance by Engineer submit three (3) copies of O&M manuals to Owner.
.8 Additional data: Prepare and insert additional data into operation and maintenance manual when the need becomes apparent during demonstrations and instructions specified above.

1.11 ACCEPTABLE PRODUCTS
.1 Design is based on first manufacturer's name under acceptable products. Subsequent manufacturer's names indicate that those named are acceptable providing they meet specifications and space limitations and are subject to acceptance by Shop Drawing Review.

1.12 SHOP DRAWINGS & PRODUCT DATA
.1 Submit single electronic copy of shop drawings and product data along with transmittal Hard copy shop drawings shall not be accepted.
.2 Shop drawings and product data shall show:
.1 Mounting arrangements.
.2 Operating and maintenance clearances. e.g. access door swing spaces.
.3 Shop drawings and product data shall be accompanied by:
.1 Detailed drawings of bases, supports, and anchor bolts.
.2 Manufacturer to certify as to current model production.
.3 Certification of compliance to applicable codes.
.4 The information to be indicated on manufacturers' shop drawings submitted for review shall include the following:
.1 General arrangement drawings showing component parts. Where the equipment proposed, or a component part thereof, includes modifications to a manufacturers' standard to meet the requirements of a specification, a complete assembly drawing must be submitted.
.2 Overall dimensions, roughing-in dimensions and clearance dimensions of all major components.
.3 Mounting details and dimensions.

.4 Complete certified performance data for the specified application with particular reference to rate of flow, operating pressure and temperatures, entering and leaving conditions of air or fluid, operating weights, operating limitation, electrical characteristics.
.5 Gauge of fabricated material and finish specification.
.6 Vibration isolators and resilient hangers stating locations and weight distribution.
.7 Electrical wiring diagrams, control panel boards, motor test data, motor starters and controls for electrically-operated equipment furnished by mechanical trades.

.5 Review of shop drawings or detail drawings will not relieve the obligation of ensuring that the equipment, materials, or layouts meet the functional requirements of the specifications, and that all necessary mounting space and clearance requirements are met. Thus, the Engineer's review is for assistance only.

.6 No equipment will be accepted on the job site without shop drawings having been reviewed by the Engineer.

1.13 AS-BUILT DRAWINGS

.1 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).

.2 Submit soft & hard copy to Engineer for approval and make corrections as directed.

.3 Submit completed reproducible as-built drawings and CD-ROM with Operating and Maintenance Manuals.

1.14 WARRANTY

.1 Unless indicated otherwise provide two (2) years warranty starting at substantial completion for all new systems including materials, equipment & labour.

1.15 ELECTRONIC DRAWINGS

.1 ProEng Consulting will agree to supply the mechanical drawings in the form of electronic documents for the project to the contractor for the convenience of the contractor in carrying out its work. The contractor shall sign a License Agreement and pay the sum in the amount of $500.00 for the administration cost.

1.16 CUTTING, PATCHING & CORING

.1 Provide cutting, patching and coring of all walls, ceiling & concrete slabs and other surfaces as required for mechanical work. Check with Owner or Building Management prior to core drilling and cutting of structure regarding building requirements and policies. Provide notification, clearance & protection.

.2 The following procedure shall be followed for cutting & core drilling:

.1 Contractor to coordinate and summarize all new cores and openings in building structure. Contractor to investigate on site and locate any existing available hole which may be re-used for new systems.
.2 Contractor to prepare a layout sketch showing all existing openings & holes and required new openings & holes, with size and locations to the closest grid line in both directions, and submit for review and approval by the architect & structural engineer.
.3 Structural engineer to provide written report outlining acceptance of the openings, as well as specific requirements for reinforcing at each location.
.4 Contractor to proceed with reinforcing tracing as per report and scanning for electrical conduit. Scanning to be completed using ground penetrating Radar (GPR) technology.
.5 Contractor shall identify at each location prior to coring and cutting the location, direction and layer of each reinforcing bar and conduit.

.6 Any core or opening where reinforcing steel was cut during the cutting & coring process must be retained on site, and the Contractor must inform the Engineer with the following information: size of the reinforcing bar, reinforcing layer location (top steel or bottom slab steel) and direction of the bar (east - west or north - south).

.3 Patch and make good surfaces cut, damaged or disturbed, to Engineer's approval. Match existing material, colour, finish and texture or as indicated otherwise.

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

1.17 TRADE QUALIFICATIONS

.1 The work shall be carried out by licensed plumbers, sheet metal workers & controls contractors with minimum five years experience who hold Ontario Certificates of Qualifications, and current Contractor's license.

.2 Installation methods and materials to be of strictest quality, and conform to Canadian General Standards Board, Canadian Standards Association, Ontario Building Code and all Local and Provincial Codes and Standards. Discrepancy in Codes to mean strictest rule applies.

.3 The ratio of Journeymen to Apprentices shall not exceed the ratio in the Trade Qualifications and Apprenticeship Act of Ontario.

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.1 All Bidders will be required to list the mechanical sub-trades for the part of work as listed below at Tender close. Once submitted, no changes will be permitted without the written consent of the Departmental Representative.

	NAME
Prime Bidder	_____
MECHANICALSUB-TRADE:	
.1 Fire Protection Contractor: (if not prime)	_____
ELECTRICAL SUB-TRADE:	
.1 Electrical:	_____
.2 Fire Alarm:	Chubb Edwards

Tenderer's Signature or if Tender is submitted by an incorporated company its seal attested by the hands of its proper officers

Signature/Seal

Part 1 General

1.1 REFERENCES

.1 National Fire Prevention Association (NFPA)

.1 NFPA 13, Standard for the Installation of Sprinkler Systems.

Part 2 Products

2.1 ABOVE GROUND PIPING SYSTEMS

.1 Provide fittings for changes in direction of piping and for connections.

.1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will be permitted.

2.2 PIPE, FITTINGS AND VALVES

.1 Pipe:

.1 Ferrous: to NFPA 13.

.2 Copper tube: to NFPA 13.

.2 Fittings and joints to NFPA 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 Fittings: ULC approved for use in wet pipe sprinkler systems.

.4 Sprinkler pipe and fittings: metal.

.3 Valves:

.1 ULC listed for fire protection service.

.2 Gate valves: open by counter clockwise rotation.

.4 Pipe hangers:

.1 ULC listed for fire protection services in accordance with NFPA.

2.3 SUPERVISORY SWITCHES

.1 General: to NFPA 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.

2.4 PRESSURE GAUGES

.1 ULC listed and to Section 23 05 19.01 Thermometers and Pressure Gauges – Piping Systems.
.2 Maximum limit of not less than twice normal working pressure at point where installed.

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 13 and NFPA 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.

Part 1 General

1.1 REFERENCES

.1 National Fire Protection Association (ANSI/NFPA):

- .1 NFPA 13, Standard for the Installation of Sprinkler Systems.
- .2 NFPA 25, Water-Based Fire Protection Systems Handbook.
- .3 Underwriters' Laboratories of Canada (ULC)

1.2 QUALITY ASSURANCE

.1 Test Reports:

- .1 Submit certified test reports for packaged pre-action system from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .2 Test hydrostatically to meet requirements of fire protection system to which it will be connected.

.2 Certifications:

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

.3 Instruction:

- .1 Provide manufacturer's installation instructions.

.4 Qualifications:

- .1 Installer: company or person specializing in pre-action systems with documented experience & approved by manufacturer.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with manufacturer’s written instructions.
.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 PRE-ACTION SYSTEM

.1 Packaged, ULC listed, pre-action system with deluge valve double interlock.
.2 General Description: Riser check valve shall isolate the deluge valve from the system air pressure. The deluge valve shall utilize a solenoid valve and a dry pilot actuator in a series configuration. The system air pressure shall hold the dry pilot actuator closed, whereas the solenoid valve shall remain closed until it is electrically energized by an automatic control, upon signal from a fire detection device or manual pull station.
.3 Pre-action system shall automatically actuate upon two independent events occurring. The solenoid valve must be opened upon automatic operation of the fire detection initiating circuit or manual operation of pull station and the sprinkler system piping must lose air pressure due to operation of one or more sprinklers.
.4 Cast or ductile iron, flanged or grooved end type, sized to suit water main.
.5 Components:

- .1 Accelerator.
- .2 Air maintenance device with low pressure alarm.
- .3 Alarm pressure switch with supervisory capability.
- .4 Test valve and associated piping.
- .5 Drain valve.

.6 Electrical tripping device.
.7 Shut off valve - OS & Y with tamper-proof device wired back to fire alarm panel.

.6 Provide valve complete with internal components that are replaceable without removing valve from installed position.

.7 Compressor:

.1 Riser mounted oil less air compressor.
.2 UL 1450 listed for fire Protection.
.3 60 PSI max pressure rating
.4 Factory pre-set pressure switch
.5 Pre-wired and pre-tested
.6 Permanently lubricated bearings
.7 Electrical: Single phase, 60 Hz, 208V, 1.2 kW.

.8 Provide free-standing cabinet to provide enclosure for the pre-action system.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTION

.1 Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Provide written report verifying compliance to manufacturer's recommendations in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Report to Department Representative. This is to occur at a separate date and time than delivery as directed by the Department Representative.
.2 Manufacturer shall allow to provide one (1) field service consisting of a field inspection of the product installation to confirm it is in accordance with manufacturer's instructions and for start-up, testing and commissioning.
.3 Manufacturer shall allow to submit start-up report to Department Representative.

.2 Site Tests:

.1 Field test pre-action system in accordance with NFPA 13. Testing to 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 authority having jurisdiction.
.3 Develop, with Departmental Representative assistance, detailed instructions for O & M installation.

Part 1 General

1.1 REFERENCES

.1 National Fire Protection Association (ANSI/NFPA):

- .1 NFPA 20, Standard for the Installation of Stationary Fire Protection.
- .2 Underwriters' Laboratories of Canada (ULC)

1.2 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.
- .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.

.2 Qualifications:

- .1 Manufacturer: company or person specializing in fire pumps with documented experience & approved by manufacturer.

Part 2 Products

2.1 FIRE PUMP

.1 Packaged, ULC, CSA listed and labelled vertical in line fire pump and controller.
.2 Cast iron casing, bronze impeller, carbon steel shaft, bronze sleeve & mechanical seal. Pump shall be supplied loose.
.3 Furnish not less than 150% of rated capacity at not less than 65% of rated head. The shutoff total head of the pump shall not exceed 120% of the total rated head.
.4 Motor: standard efficiency vertical close coupled open drip proof (ODP) motor with 1.15 service factor.
.5 Mounting: pump, jockey pump, relief valve, jockey pump controller and fire pump controller shall be shipped loose for field assembly, by others.
.6 Materials and construction: to NFPA 20.
.7 Capacity: 1000 usgpm @ 70 psi (actual peak zone flow 1248 usgpm @ 68 psi)
.8 Accessories to NFPA 20 requirements and in addition:

- .1 1xCasing relief valve 3/4" n.p.t.
- .2 2x88mm pressure relief gauges

2.2 PRESSURE MAINTENANCE (JOCKEY) PUMP

.1 Horizontal regenerative turbine type, with cast iron casing and bronze impeller and mechanical seals.
.2 Jockey pump motor shall be standard open drip-proof (ODP) horizontal motor with a 1.15 service factor, mounted on a steel base with flexible coupling and guard.
.3 Jockey pump shall be controlled by an automatic jockey pump controller with full voltage starter.

.4 The jockey pump shall start on a pressure drop in the system. The jockey pump will boost the system pressure back to the normal setting on the pressure switch and stop immediately.
.5 The fire pump shall automatically start on a further pressure drop or on a jockey pump failure
.6 Capacity: 15 usgpm @ 80 psi
.7 Accessories: To NFPA 20.

2.3 FIRE PUMP CONTROLLER
.1 Starting method: Full voltage across the line.
.2 Typical voltage applied at start: 100%.
.3 Inrush current: 6 x normal load current
.4 Starting torque: 100%
.5 No. of contactors: 1 at 100% of horsepower
.6 Minimum ampacity of motor conductors: 3 at 125% x 100% of full load current.
.7 Standards, listings, approvals & certifications: Built to NFPA 20, UL218 – Fire Pump Controllers, UL 1008 – Automatic Power Transfer Switches for Fire Pump Controllers, CSA C22.2 No. 14 Industrial Control Equipment.
.8 NEMA 12 enclosure.
.9 Limitations: Across the line starting only, horsepower rating of maximum 30hp, can only be installed where acceptable by the authority having jurisdiction.
.10 Surge Suppression: Surge arrestor rated to suppress surges above line voltage.
.11 Disconnecting Means: Circuit breaker (inverse time non-adjustable) rated between 150% and 250% of motor full load current.
.12 Emergency Start Handle: Push and slide to lock, Across the line start (direct on line).
.13 Electrical Readings: Voltage phase to phase (normal power), amperage of each phase when motor is running.
.14 Pressure Readings: Continuous system pressure display, cut-in and Cut-out pressure settings.
.15 Pressure & Event Recorder: Pressure readings with date stamp, event recording with date stamp, under regular maintained operation, events can be stored in memory for up to 5 years, data viewable on operator interface display screen, downloadable by USB port to external memory device.
.16 Pressure Sensing: Pressure transducer for fresh water application, pressure sensing connection 1/2" Female NPT, rated for 0-500PSI working pressure (standard display at 0-300PSI), internally mounted.
.17 Visual indications: Power available, motor run, periodic test, manual start, deluge valve start, remote automatic start, remote manual start, emergency start, pump on demand/automatic start, low discharge pressure, pump room temperature, lockout.
.18 Visual Alarms: Pump room alarm, pump on demand, motor trouble, power loss, fail to start, low water level, low suction pressure, phase reversal, phase unbalance, phase loss L1, phase loss L2, phase loss L3, low pump room temperature, control voltage not healthy, overcurrent, undercurrent, under voltage, overvoltage, invalid cut-in, service required.
.19 Remote Alarm Contacts: Power available, phase reversal, motor run, common pump room alarm (overvoltage, under voltage, phase unbalance, low pump room temperature, high pump room temperature) common motor trouble (overcurrent, undercurrent, fail to start).
.20 Operator Interface: Embedded microcomputer with software PLC logic, 7.0" colour touch screen, upgradable software, multi-language.
.21 Building Automation System Interface:
    .1 Contact for general alarm
.22 Operation:
    .1 Automatic start:
        .1 Start on pressure drop
        .2 Remote start signal from automatic device
    .2 Manual start:
        .1 Start push button

.2 Run test push button
.3 Deluge valve start
.4 Remote start from manual device

.3 Stopping:
.1 Manual with stop pushbutton
.2 Automatic after expiration of minimum run timer

.4 Timers (field adjustable):
.1 Minimum run timer (off delay)
.2 Sequential start timer (on delay)
.3 Periodic test timer

.5 Actuation (visual indication):
.1 Pressure
.2 Non-pressure

.6 Mode (visual indication):
.1 Automatic
.2 Non-Automatic

2.4 AUTOMATIC POWER TRANSFER SWITCH

.1 Surge Suppression: Surge arrestor rated to suppress surges above line voltage.
.2 Disconnecting means: Circuit breaker (inverse time non-adjustable) rated between 150% and 250% of motor full load current.
.3 Visual Indications: Alternate (emergency) isolating switch in the OFF position, Alternate (emergency) voltage phase to phase, Transfer switch in normal position, Transition timers.
.4 Visual Alarms: Transfer switch trouble, Alternate power phase reversal, Alternate isolating switch open/tripped, Alternate circuit breaker open/tripped.
.5 Transfer switch test pushbutton.
.6 Bypass for re-transfer and generator shutdown.
.7 Electrically operated and mechanically held in the normal or alternate position.
.8 Provision for manual operation.
.9 Remote Alarm Contacts: Isolating switch in the OFF position, Transfer switch in normal position, Transfer switch in alternate (emergency) position.
.10 Time Delays: Momentary normal power outage override (factory set at 3 sec – field adjustable 1 to 3 sec), Alternate (emergency) power available delay (factory set at 3 sec - field adjustable 1 to 3 sec), Transfer trouble delay (factory set at 20 sec - field adjustable 1 to 60 sec), Retransfer to normal (factory set at 5 min - field adjustable 1 to 20 min), Generator cool down (factory set at 5 min - field adjustable 1 to 20 min).
.11 Voltage Sensing: Transfer to alternate (normal power dropout) 85% of nominal – field adjustable 0 to 100%, Phase reversal transfer to alternate, Retransfer to normal (normal power pickup) 90% of nominal - field adjustable 0 to 100%.
.12 Generator Start Connection: SPDT-8A-250V.AC.

2.5 ASSEMBLY

The fire pump, fire pump controller, jockey pump, jockey pump controller and specified accessories shall be shipped loose.

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 DELIVERY

.1 Fire pump and all accessories are to be delivered in one shipment. Multiple shipments are not acceptable.

.2 Manufacturer shall arrange and pay for all fees including but not limited to shipping, duties, tariffs and taxes to site.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Provide written report verifying compliance to manufacturer’s recommendations in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Report to Department Representative. This is to occur at a separate date and time than delivery as directed by the Department Representative.

.2 Manufacturer shall allow to provide one (1) field service consisting of a field inspection of the product installation to confirm it is in accordance with manufacturer's instructions and for start-up, testing and commissioning.

.3 Manufacturer shall allow to submit start-up report to Department Representative.

.2 Site Tests:

.1 Field test each fire pump, driver and controllers in accordance with NFPA 20.

Testing to 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 authority having jurisdiction.

.3 Develop, with Departmental Representative assistance, detailed instructions for O & M installation.

Part 1 General

1.1 QUALITY CONTROL
.1 ISO 9000
.2 CSA

1.2 GENERAL REQUIREMENTS
.1 Use standard conduit box termination with slot screwdriver compression connector block unless otherwise specifically stated.
.2 Operating conditions -0° to 32°C with 10 – 90% RH (non-condensing) unless otherwise specifically stated.

Part 2 Products

2.1 None.

Part 3 Executions

3.1 GENERAL
.1 All 120v (line voltage) controls by div-26. All 24vdc (low voltage) controls by div-25.
.2 Provide EMT conduit c/w steel couplings and fittings for control wiring in exposed or exterior locations. Refer to electrical specifications for installation details.
.3 Provide FT-6 plenum rated cable for control wiring in concealed areas.
.4 Install equipment, piping, wiring, conduit parallel to building lines (i.e., horizontal, vertical, and parallel to walls) Provide sufficient slack and flexible connections where necessary to allow for vibration of piping and equipment.
.5 Install all equipment in readily accessible locations.
.6 Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
.7 Adhere to all manufacturers' wiring recommendations.
.8 Materials shall be non-corrosive in the location installed.
.9 All control wiring shall be tagged at each end.
.10 Telephone or similar communication-type wire not acceptable for control wiring purposes.
.11 Do not place control wiring in conduits containing 120 VAC or higher voltage power wiring.

Part 1 General

1.1 RELATED REQUIREMENTS
.1 This section covers items common to all sections of Division 26, and 28.
.2 Coordinate location and installation of all equipment with all trades to ensure the equipment with all trades to ensure the equipment is serviceable.
.3 The word “provide” shall mean “supply and install”, unless noted otherwise.

1.2 REFERENCES
.1 Provide complete installation in accordance with the latest edition of the Ontario Electrical Safety Code and Electrical Bulletins.
.2 Comply with the following additional codes as a minimum:
- .1 CSA Standards.
- .2 ULC Standards.
- .3 Ontario Building Code – Latest Edition.
- .4 National Building Code.
- .5 Fire Code.
- .6 NFPA.

1.3 DEFINITIONS
.1 Inspection authorities shall mean Electrical Safety Authority.
.2 Supply authority shall mean Hydro Ottawa.
.3 Provide shall mean supply, install, test and commission.

1.4 DESIGN REQUIREMENTS
.1 Operating voltages to: CAN3-C235-83.
.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
.3 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
.4 Language operating requirements: provide identification nameplates and labels for control items in English and French.
.5 Use one nameplate or label for each language.

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

1.6 TIME AND COMPLETION
.1 Commence work upon notification of acceptance of offer, or as outlined in the approved construction schedule.
.2 Verify equipment delivery times immediately and notify Departmental Representative within two (2) weeks of contract award of any deliveries which would affect schedule.

1.7 FIRE AND SAFETY REQUIREMENTS
.1 Comply with National Building Code (Part 8, Health and Safety Measures at Construction and Demolition Sites) and Provincial Regulations for Construction Projects.

1.8 EXISTINGSERVICES
.1 Existing services required for work may be used by the Contractor with the Departmental Representative's written consent. Ensure capacity is adequate prior to imposing additional loads. Connect and disconnect at own expense and responsibility.
.2 Notify the Departmental Representative a minimum of 72 hours in advance of intended interruption of services; obtain requisite permissions.
.3 Keep duration of these interruptions to a minimum. Carry out all interruptions during silent hours or as approved by the Departmental Representative in writing.
.4 Any unscheduled disruption to services to be immediately reinstated.
.5 Existing fire alarm and security systems are to remain fully functional, throughout, provide conduit and wire as required to maintain services during construction.

1.9 DEMOLITION
.1 Disconnect and make safe all systems to be demolished by other Divisions. Refer to other Divisions for extent.
.2 Maintain existing remaining circuits, systems, etc., which pass through construction/demolition areas. Provide additional wire and conduit as required to maintain systems. Additional wire and conduit to be concealed when construction is completed.
.3 Reinstate immediately, any existing remaining systems, inadvertently interrupted during construction or demolition.
.4 Remove all redundant wiring and conduit in ceiling spaces, (i.e. power.).

1.10 PROTECTION
.1 Protect access areas through existing building (lobby, elevator, corridor stairwell, etc.) from damage. Clean area daily or more frequently if directed by Departmental Representative.
.2 Protect exterior areas (roof, walls, etc.) against damage during handling of new and removed materials.
.3 Repair and make good all damaged equipment, etc. to satisfaction of the Departmental Representative.
.4 Protect stored materials; work in process and finished work against damage until takeover.
.5 Protect adjacent areas against spread of dust and dirt beyond work areas.
.6 Protect operatives and other users of site from all hazards.

1.11 CUTTING, PATCHING AND MAKING GOOD
.1 Provide cutting and patching of 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 or as indicated otherwise.
.4 Provide dust tight screens or partitions to localize dust generating activities and for protection of finished areas of work, workers and public.
.5 Scan slabs before coring or drilling deeper than 25 mm. Provide all required notification, clearance and protection for scanning process. Adjust coring and drilling locations as necessary to avoid rebar and conduits.

1.12 CO-ORDINATION
.1 Coordinate the work with all other Divisions, especially Divisions 21, 23 and 25, to ensure systems compatibility, and to ensure schedules and requirements are maintained.
.2 Where perceived interferences occur, prepare detailed sketches indicating proposed solution for review and acceptance by Departmental Representative.

.3 The contract documents are intended to describe complete fully functional systems although not all components are indicated. Division 26 shall provide all required conduits, wiring, equipment, etc. to provide fully functional systems which meet the design intent.

1.13 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
.2 Pay associated fees.
.3 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.
.4 Furnish Certificates of Acceptance from Electrical Inspection Department and authorities having jurisdiction on completion of work to Departmental Representative and include in manuals. Final payment will not be made until certificates have been submitted.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00 – Common Product Requirements.
.2 Equipment and material to be new CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.
.3 Factory-assemble control panels and component assemblies.

2.2 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, black core, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws.

Nameplate	Sizes		
Size 1	10 x 50 mm	1 line	3mm 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: electronically printed, self-adhesive plastic labels with 6 mm high letters unless specified otherwise.
.3 Wording on nameplates and labels:

.1 To indicate volts, phase, amps, HP, etc.
.2 To be submitted to Departmental Representative prior to manufacture for approval.

.4 Allow for average of twenty-five (25) letters per nameplate.
.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
.6 Disconnects, starters, contactors and variable frequency drives: indicate equipment being controlled and voltage, Size 3.
.7 Terminal cabinets and pull boxes: indicate system and voltage, Size 3.
.8 All circuit protective devices to be c/w a lamicoid label mounted inside door of device listing all fuse type and ratings, circuit breaker settings and minimum interrupting ratings.

2.3 WIRING IDENTIFICATION
.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
.2 Maintain phase sequence and colour coding throughout.
.3 Colour code: to CSA C22.1.

2.4 CONDUIT AND CABLE IDENTIFICATION
.1 Colour code conduits, boxes and metallic sheathed cables.
.2 Code with plastic tape at points where conduit or cable enters wall, ceiling, or floor, and at 6 m intervals.
.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
120/208 V	Blue	
120/240 V	Grey	
277/480 V	Black	
347/600 V	Purple	
Grounding	Brown	
Building controls	Orange	
Fire alarm	Red	

2.5 TRADE QUALIFICATIONS
.1 The work shall be carried out by licensed electricians with minimum five years experience who hold Ontario Certificates of Qualifications, and current Contractor's license.
.2 Installation methods and materials to be of strictest quality, and conform to Canadian General Standards Board, Canadian Standards Association, Ontario Building Code and all Local and Provincial Codes and Standards. Discrepancy in Codes to mean strictest rule applies.
.3 The ratio of Journeymen to Apprentices shall not exceed the ratio in the Trade Qualifications and Apprenticeship Act of Ontario.

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

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

2.8 MANUFACTURERS AND CSA LABELS
.1 Visible and legible after equipment is installed.

2.9 WARNING SIGNS
.1 As specified and to meet requirements of Electrical Inspection Department and Departmental Representative.

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

Part 3 Execution

3.1 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: 1200 mm.

.4 Disconnects, splitters: as required by Code or as indicated.

3.2 CONDUIT AND CABLE INSTALLATION

.1 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.3 Provide all required accessories, inserts, hangers, toggle bolts, support channels, anchors etc. as required to complete systems.

3.3 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to values and settings, as per approved coordination study.

3.4 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panel boards with normal loads operating. Do tests after space is fully occupied and operational. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment, after space is fully occupied and operational.

.3 Submit, at completion of work, report listing phase and neutral currents on panel boards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

.2 Protective Device Coordination Study

.1 Prepare coordination time-current characteristic curves to determine the required settings/sizes of the protective devices to maximize selectivity. The utility upstream protective device feeding the facility shall be maintained as the upper limit for coordination. These settings shall be obtained by the preparer, along with any other protective device setting requirements. The coordination curves shall be prepared on log-log paper and illustrate adequate clearing times between series devices. The curves shall be created through the use of the study software package, but must reflect actual protective devices to be installed. Adequate time-current curves shall be generated to depict coordination. In addition, protective device characteristics shall be suitably determined to reflect calculated short-circuit levels at the location.

.2 A narrative analysis shall accompany each coordination curve sheet and describe the coordination and protection in explicit detail. All curve sheets shall be multicolor for improved clarity. Areas lacking complete coordination shall be highlighted and reasons provided for allowing condition to remain or provide solution to resolve situation. System coordination, recommended ratings, and setting of protective devices shall be accomplished by a registered professional electrical engineer with a minimum of eight years of current experience in the coordination of electrical power systems.

.3 The following information shall be provided on all curve sheets.
.1 Device identification and associated settings/size.
.2 Voltage at which curves are plotted.
.3 Current multiplier.
.4 ANSI frequent fault damage curve.
.5 Cable insulation damage curves.
.6 Transformer inrush point.
.7 Single-line for the portion of the system.
.8 Motor starting profiles (where applicable).

.3 Conduct and pay for following tests:
.1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
.2 Circuits originating from branch distribution panels.
.3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.5 Insulation resistance testing.
.1 Check resistance to ground before energizing.
.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.
.4 Submit test results for Departmental Representative's review.
.5 Hot spot testing:
.1 After 24 hours of operation under full load, perform infrared tests on all cable terminations and connections and all transformer, panel and breaker connections, to ensure the integrity of the system.
.2 Tests to be carried out by using an infrared camera.
.3 Terminations and/or connections failing tests shall be replaced immediately as part of the contract.

.6 Perform tests prior to energizing electrical or mechanical systems.

3.5 FIRE AND SMOKE STOPPING

.1 Provide fire and smoke stopping where conduits, cables, trays, etc., penetrate floor slabs or fire rated walls with an approved ULC listed putty, equal to 3M caulk CP25 and putty 303.

.2 In accordance with Section 07 84 00 – Fire Stopping.

3.6 SPRINKLER-PROOF EQUIPMENT

.1 Provide sprinkler-proof equipment in all areas to the local authorities' requirements.

Part 1 General

1.1 RELATED REQUIREMENTS
.1 Section 21 05 01 – Common Work Results for Mechanical.
.2 Section 26 05 00 – Common Work Results for Electrical.

1.2 REFERENCES
.1 Canadian Standards Association (CSA):
- .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.1HB-12, CE Code Handbook, an Explanation of Rules of the Canadian Electrical Code, Part 1.
- .3 CSA C22.2 No. 18.2-06, Non-metallic Outlet Boxes.
- .4 CSA C22.2 No. 18-98 (R2003), Outlet Boxes, Fittings, and Associated Hardware.
- .5 CSA C22.2 No. 40-M1989 (R2009), Cut-out, Junction and Pull Boxes.
- .6 CSA C22.2 No. 41-07, Grounding and Bonding Equipment (Bi-National Standard, with UL 467).
- .7 CSA C22.2 No. 56-04 (R2009), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .8 CSA C22.2 No. 65-03 (R2008), Wire Connectors (Tri-National Standard, with UL 486A-486B and NMX-J-543-ANCE-03).
- .9 CSA C22.2 No. 83-M1985 (R2008), Electrical Metallic Tubing.
- .10 CSA C22.2 No. 83.1-07, Electrical Metallic Tubing – Steel (Tri-National Standard, with UL 797 and NMX-J-536-ANCE-2007).
- .11 CSA C22.2 No. 0.4-04 (R2009), Bonding of Electrical Equipment.

.2 Underwriters Laboratories (UL):
- .1 UL 1 11th Edition (2005), Standard for Flexible Metal Conduit.

1.3 SHOPDRAWINGS
.1 Submit shop drawings and product data in accordance with Section 01 00 10 – General Instructions.

1.4 OVERCURRENTPROTECTION
.1 Confirm overcurrent protection requirements of equipment supplied by Divisions 21, 23, 25 and 26 prior to installation.

1.5 LOCATION OF CONDUIT
.1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

Part 2 Products

2.1 EXTERNAL ENCLOSED BREAKERS
.1 Provide enclosed breaker mounted to Unistrut support.
- .1 Enclosure:
  - .1 Manufacturer: Square D
  - .2 Enclosure shall be sized to accommodate breaker and all necessary accessories.
- .2 External Breaker:
  - .1 Manufacturer: Square D
  - .2 Model: MJL36350

.3 Voltage: 600V
.4 Amperage: 350A
.5 Phase: 3
.6 Wires: 3
.7 kAIC Rating: 25kA

2.2 CABLES AND REELS

.1 Provide cables on reels or coils.

.1 Mark or tag each cable and outside of each reel or coil, to indicated cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

.2 Each coil or reel of cable to contain only one continuous cable without splices.

.3 Identify cables for exclusively dc applications.

2.3 BUILDINGWIRES

.1 Conductors: stranded for 10AWG and larger. Minimum size: 12 AWG (including ground wires).

.2 Copper conductors: size as indicated:

.1 For applications up to 250 V: with thermoplastic insulation type RW90 rated at 600V.

.2 For applications up to 600 V: with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.3 Mineral Insulated Cables:

.1 2-hour fire rated cables.

.2 Sheath: seamless soft-drawn copper

.3 Insulation: Highly compressed magnesium oxide (MgO)

.4 Conductor Type: Copper

.5 Insulation Voltage Rating: 600V

.6 Conductor Size: As indicated on drawings

.7 Jacket: Low-smoke, zero halogen polyolefin (refer to locations as indicated on drawings)

.8 Continuous Exposure Temperature: 482°F

.9 Maximum Exposure Temperature: 1850°F

.10 Mineral Insulated Cables shall come complete with all required termination kits, splice kits, caution labels, mounting accessories, etc.

.11 Termination Kit:

.1 Description: Kit used to field terminate single and multi-conductor cables conductor copper sheathed MI wiring cables.

.2 Termination Type: Field Termination (for two cable ends):

.3 Termination Temperature Rating: 221°F

.4 Gland Connector Material: Brass

.5 Cable Configurations: For single and multi-conductor cables

.6 Tail:

.1 AWG size: supplied shall be the same size as the conductor within MI cable being terminated.

.2 Length: Tail length shall be 36" (91cm) for each end of cable termination.

.3 Material: PVC Sleeving

.7 Termination shall be sized for size and number of conductors in MI cable being terminated.

.8 Area Classification: Nonhazardous

.12 Field Installed Fire-Rated Splice (FIFRS)

.1 Description: High temperature splice protected by an endothermic mat assembly 2 Hour fire protection rating

.2 Continuous Exposure Temperature: 221°F

.3 Maximum Exposure Temperature: 1850°F

.4 Cable configurations: All single and multi-conductor cables
.5 Size: Shall be sized properly for MI cable being spliced
.6 Material Splice: Copper barrel with brass gland connector
.7 Splice and Cable Sleeve: Endothermic Mat

2.4 CONDUITS
.1 Rigid galvanized steel threaded conduit.
.2 Electrical metallic tubing EMT, with steel set screw couplings and connectors.
.3 Liquid-tight flexible metal conduit.

2.5 CONDUITFASTENINGS
.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 One piece universal strut clamps to secure conduit to struts.
.3 Beam clamps to secure conduits to exposed steel work.
.4 Channel type supports for two or more conduits at 1.5 m oc.
.5 Six mm diameter threaded rods to support suspended channels.

2.6 CONDUITFITTINGS
.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
.2 Factory “ells” where 90 degree bends are required for 25 mm and larger conduits.

2.7 FISH CORD
.1 Polypropylene.

2.8 CONDUIT BOXES GENERAL
.1 Size boxes in accordance with CSA C22.1HB.
.2 102 mm square or larger outlet boxes as required for special devices.
.3 Gang boxes where wiring devices are grouped.
.4 Blank cover plates for boxes without wiring devices.
.5 347 V outlet boxes for 347 V switching devices.
.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.9 JUNCTION AND PULL BOXES
.1 Size boxes in accordance with CSA C22.1HB
.2 Construction: welded steel enclosure.
.3 Covers Flush Mounted: 25mm minimum extension all around.
.4 Covers Surface Mounted: screw-on flat covers.

2.10 WIRE AND BOX CONNECTORS
.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required. Equal to T&B-PT Series.
.2 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
.1 Connector body and stud clamp for stranded copper conductors.
.3 Clamps or connectors for armoured cable as required.

2.11 SUPPORTCHANNELS
.1 U shape, size 41 x 41 mm, 2.7 mm thick, surface mounted or suspended.
.2 Equal to Unistrut, Burndy, Hilti or Cantruss.

Part 3 Execution

3.1 INSTALLATION

.1 Confirm equipment locations and sizes as indicated on plans to ensure equipment will fit.
.2 Secure floor and wall mounted equipment plum and square.
.3 Connect supply and load feeders from all equipment.
.4 Check factory made connections for secureness and electrical continuity.
.5 Ensure adequate clearances around equipment for ventilation requirements and code.
.6 Provide auxiliary equipment and connections as required.
.7 Provide typed, dated panel directory for each affected panel board on this project.
.8 Provide permanently mounted lamacoid (red background with white lettering) identify Fire Pump normal power means of disconnect on main switchboard.

3.2 EQUIPMENTGROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following, transformers, starters, variable speed drives, disconnects, frames of motors, motor control centres, control panels, distribution panels and conduits etc.
.2 Make grounding connections in radial configuration only, with connections terminating at a single grounding point. Avoid loop connections.
.3 Bond single conductor, metallic armoured cables to cabinet at supply end with conductive plate, and provide non-metallic entry plate at load end.
.4 Provide continuous ground conductor for raceways, outlets, and junction boxes for all systems.
.5 Provide a ground conductor for all non-conductive raceways.
.6 Ground all systems raceways, provide ground bushings.

3.3 EXTERNAL ENCLOSED BREAKERS

.1 Disconnect feeder serving 600A load bank breaker in splitter above 1500kW Generator.
.2 Provide four (4) split lugs in existing Generator splitter.
.3 Install external 350A 3-Pole enclosed breaker on unistrut support securely fastened to floor.
.4 Provide connection from external 350A 3-Pole enclosed breaker to new split lugs c/w conduit and wiring as identified on drawings.
.5 Provide permanently mounted lamacoid (red background with white lettering) identifying breaker as Fire Pump means of disconnect from emergency power.

3.4 CONDUITSYSTEMS

.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 except in where indicated or specified elsewhere.
.3 Use liquid tight flexible metal conduit for connection to motors and for connection to equipment in damp, wet or corrosive locations.
.4 Minimum conduit size: 21 mm.
.5 Bend conduit cold. Replace conduit if kinked or flattened more than $1/10_{th}$ of its original diameter.
.6 Mechanically bend steel conduit over 21 mm dia.
.7 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.
.8 Dry conduits out before installing wire.
.9 Run parallel or perpendicular to building lines.
.10 Run conduits in flanged portion of structural steel.
.11 Group conduits wherever possible on channels.
.12 Do not pass conduits through structural members.
.13 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

.14 Ream raceways to remove burrs.
.15 Install fish cord in empty conduits.
.16 Provide fish cord in all empty raceways.

3.5 WIRING
.1 Install RW-90 conductors in raceways except as otherwise indicated.
.2 Installation of type AC-90 will not be.
.3 Leave minimum 200 mm length of conductor at junction and outlet boxes.
.4 Splices shall not be pulled into conduits.
.5 Provide approved wire pulling lubricants for cable installations in conduits.
.6 Mineral insulated cables shall be installed as per manufacturer's installation guidelines. Ensure minimum of 100% of the cable diameter between each conductor to avoid de-rating.
.7 Mineral insulated cables shall have caution labels provided and installed as per manufacturer's installation guidelines.
.8 Field splices shall be completed as indicated on drawings and as per manufacturer's installation guidelines.
.9 Connect mineral insulated cables to new Fire Pump ATS, Fire Pump Controller, Generator Controller, and External Enclosed Breaker as identified on drawings.
.10 Mineral insulated cable shall be pulled through individual PVC conduits in existing duct bank. Refer to detail 3/E3 for more information.

3.6 JUNCTION, PULL BOXES AND CABINETS
.1 Install pull boxes in inconspicuous but accessible locations. Coordinate interferences with Mechanical Trades.
.2 Mount cabinets with top not higher than 2m above finished floor except where indicated otherwise.
.3 Install pull boxes as required by CSA C22.1.

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

3.8 FASTENINGSAND SUPPORTS
.1 Secure equipment to hollow masonry, tile and plaster surfaces with lead anchors or nylon shields.
.2 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
.3 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.
    .4 One piece universal strut clamps to secure conduit to struts.
.4 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.
.5 For surface mounting of two or more conduits use channels at 1.5 m occasional spacing.
.6 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.7 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
.8 Do not use wire lashing or perforated strap to support or secure raceways or cables.
.9 Do not use support or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
.10 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer’s installation recommendations.

Part 1 GENERAL

1.1 RELATED REQUIREMENTS
.1 Section 21 05 01 – Common Work Results for Mechanical.
.2 Section 26 05 00 – Common Work Results for Electrical.

1.2 SUMMARY
.1 Section Includes:
- .1 Materials and installation for fire alarm systems.
- .2 Trouble signal devices.
- .3 Power supply facilities.
- .4 Automatic alarm initiating devices.
- .5 Supervisory Valves and Flow Switches monitoring Fire Pump

1.3 REFERENCES
.1 Underwriter's Laboratories of Canada (ULC)
- .1 CAN/ULC-S524-06, Standard for the Installation of Fire Alarm Systems.
- .2 CAN/ULC-S537-04 – Standard for the Verification of Fire Alarm Systems.

.2 National Fire Protection Agency
- .1 NFPA 72- 2013, National Fire Alarm and Signaling Code.
- .2 NFPA 20-2007 – Standard for the Installation of Stationary Pumps for Fire Protection

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

1.5 QUALITYASSURANCE
.1 Qualifications:
- .1 Installer: company or person specializing in fire alarm system installations with 5-years documented experience or approved by fire alarm panel manufacturer.
- .2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.

Part 2 PRODUCTS

2.1 SUSTAINABLE REQUIREMENTS
.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

2.2 WIRING
.1 Wire for low voltage DC circuits:
- .1 No. 14 AWG minimum solid copper conductor
- .2 Mineral insulated conductors where noted.

.2 Insulation 90 degrees C minimum with nylon jacket.
.3 Colour code wiring.

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 systems in accordance with CAN/ULC-S524.

.2 With the exception of mineral insulated conductors, all wiring shall be installed in EMT conduit, the last 600mm between junction box and supervisory valve or flow switch which shall be permitted to be connected with flexible 27mm conduit.

.3 Connect alarm circuits to main fire alarm control panel.

.4 Connect signaling circuits to main fire alarm control panel.

.5 Connect signaling wiring between fire pump and generator.

.6 Install end-of-line devices.

.7 Pre-action cabinet sprinkler system: wire alarm and supervisory switches and connect to control panel.

3.3 FIELD QUALITY CONTROL

.1 Site Tests:

- .1 Perform tests in accordance with CAN/ULC-S537.
- .2 Fire alarm system:
  - .1 Simulate grounds and breaks on alarm and signaling circuits to ensure proper operation of system.
  - .2 Class B circuits.
    - .1 Test each conductor on circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.
    - .2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 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.

3.4 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

3.5 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.