advanced building solutions

CANADIAN MUSEUM OF CIVILIZATION CORPORATION
Infocom HACS Air Cooled Cooling System

Specifications
Electrical – Submitted for Tender

2013-05-15
Project : 7013-004

CANADIAN MUSEUM OF CIVILIZATION CORPORATION

100, LAURIER STREET

GATINEAU (QUÉBEC)

K1A 0M8

PROJECT: CMCC-12-021 INFOCOM HACS AIR COOLED COOLING SYSTEM

DIVISION 26

ELECTRICAL

Issued for Tender
May 15, 2013

PROJECT : CMCC-12-021: INFOCOM HACS AIR-COOLED COOLING SYSTEM

ELECTRICAL

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Part 1 General

1.1 RELATED SECTIONS

.1 Division 01-General Requirements

1.2 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

.1 Provide fire and smoke stop systems consisting of a material, or combination of materials installed to maintain the integrity of the Fire Resistance Rating of the fire separation by maintaining an effective barrier against the spread of flame, smoke, heat and/or hot gases through penetrations, blank openings, construction joints, or at perimeter fire containment in or adjacent to the Fire Separation in accordance with the requirements of the National Building Code.

.2 This section specifies firestopping material and/or systems intended to act as a fire stop and smoke seal system to protect against the passage of fire, hot gases and toxic smoke within fire separation for the Fire Resistance Rating of a wall, floor, ceiling or roof assemblies for any through-penetration item, membrane penetration poke-through termination device, blanks, gaps, voids or any un-penetrated joint or opening, to form a draft-tight barrier within or between construction assemblies and act to retard the passage of flame, smoke and toxic gases.

.3 Only tested fire and smoke stop systems shall be used in specific locations as follows and also as indicted in the schedule of firestop locations, including Item 3.4:

.1 Service Penetrations for the passage of duct, cable tray, conduit, piping, electrical bus ways and raceways, empty/blank openings through vertical fire separations (walls and partitions), horizontal that have a fire separation (floor/ceiling assemblies), and vertical service fire separation shaft walls and partitions.

.2 Openings between structural separation sections of walls or floors that have a fire separation.

.3 Joints between the bottom of walls or wall-to-wall joints.

.4 Joints between the top of walls and ceilings, or floor and roof assemblies, slip joint or concrete shrinkage joint detail.

.5 Mechanical and electrical recessed boxes through fire resistant membranes.

.6 Expansion joints in vertical and horizontal fire separations.

.7 Systems installed to allow and be designed to accommodate movement (expansion) in all joints as indicated on architectural/structural drawings and specifications and plumbing pipes and sprinkler pipes that require movement during the activation of these systems.

.8 Openings around structural members which penetrate horizontal and vertical fire separations and their fire resistant membranes.

.4 All fire separations to have a Fire Resistance Rating to them as indicated on drawings. All Non-rated Fire Separations to be assigned a 60-minute Fire Resistance Rating or an F-Rating of 1-hour minimum. Both sides of a non-rated fire separation to have a tested fire and smoke stop system applied, to match or exceed the F-rating, as indicated.

.5 All multiple service penetration through a fire separation must have a minimum space equal to the same size of the smallest pipe or greater, minimum 50mm, between pipes to be considered an individual services penetration. Penetrations where the space between penetrating items is less than 50mm or as indicated will be classified as a multi-penetrations and a square or rectangular framed out opening shall be constructed (as indicated in the Fire Stopping Detail Drawings) around the penetrations with a fire and smoke stop system applied to the entire opening.

1.3 RELATED WORK

.1 Fire stopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Division 21, 22, 23 and 26 respectively.

.2 Firestopping is to be inspected and evaluated as per ASTM 2174 Standard Practice for On-Site Inspection of Installed Firestops. Reports shall be submitted to the Engineer for review and that the standard has been met.

1.4 REFERENCES

.1 Underwriters Laboratories of Canada (ULC)

.1 ULC-S115-11, Fire Tests of Firestop Systems.

.2 Canadian Forces Fire Marshal Directives

.1 FMD-4003-Fire Protection and Life Safety Engineering Design.

.3 CAN 4S115-M.2005 or ASTM E814 Test Requirements

.4 Standard Test Method for Fire-Resistive Joint Systems, ASTM E1966 under designation UL 2079.

.5 Cyclic movement and measuring the minimum and maximum joint width of Architectural Joint Systems, ASTM E1399.

.6 Test Requirements: ASTM E2307, “Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-Storey Test Apparatus”.

.7 Standard Tests Method for Surface Burning Characteristics of Building Materials, CAN/ULC S102M or ASTM E84.

.8 Method for Fire tests of Building Construction and Materials CAN/ULC S101 or ASTM E119.

.9 International Firestop Council Guidelines (IFC) for Evaluating Firestop Systems Engineering Judgements.

.10 International Firestop Council (IFC)Inspection Guideline and ASTM E2174-04, Standard Practice for On-Site Inspection of Installed Firestop Systems and ASTM E2393-04, Standard Practice for on-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.

.11 M.O.P. Manual of Practice, (MOP) Guideline as set out by the Firestop Contractors International Association (FCIA).

.12 The National Research Council of Canada, Best Practice Guide On Firestops and Fire Blocks and Their Impact On Sound Transmission, 2007 3rd Draft.

.13 National Building Code and the Provincial Building Code of the Province that the Authority Having Jurisdiction is responsible for.

.14 NFPA 101-Life Safety Code

.15 Canadian Electrical Code

.16 Approval standard for approval of Firestop Contractor FM 4991, Factory Mutual Research Corporation.

1.5 QUALITY ASSURANCE

.1 Work is to be undertaken by experienced Site Supervisor in their trade of material or system being used with a minimum of five (5) working years of experience utilizing that material/system, and shall provide a list of not less than five (5) successfully completed of similar scope and scale.

.2 All workers including the site supervisor shall be certified by the manufacturer of the products and systems proposed for the Installation of this product. Proof of this certification will be required 48-hours after award of the project.

.3 Firestop sub-trade to be a member of the Firestop Contractors International Association (FCIA) and be in good standing with this association. Contractor to provide within 48 hours after award of the project proof of their association of the FCIA.

.4 Manufacturer shall ensure that their Fire Protection Engineers will oversee the project, and have a minimum five (5) years experience on the manufacturers design systems.

.5 Manufacturers shall provide a letter in writing within 48 hours after award of the project that the Engineered Judgements shall be provided by their Fire Protection Engineer(s) as required to suit building conditions. All Engineered Judgements shall conform to IFC guidelines and the manufacturer shall be a member in good standing with the IFC or FCIA. Proof of membership to the IFC or FCIA shall be submitted within 48 hours after award of the project.

.6 A Manufacturer’s Qualified National or Local representative to be on-site during initial mock-up installation of firestop systems to ensure the mock-ups have been installed based on the approved design system listings and to train appropriate sub-contractor personnel in proper selection and installation procedures.

.7 Firestop Systems do not re-establish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

.8 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a Manufacturer's Engineered Judgement derived from similar ULC or cUL system designs or other tests will be submitted to local Authorities Having Jurisdiction for their review and approval prior to installation. Engineered Judgement drawings must follow requirements set forth by the International Firestop Council Guidelines.

.9 A single source of Manufacturer Product shall be used on this project. Materials of different manufacturers shall not be acceptable, unless the manufacturer can not provide a design listed system for a particular firestop installation, another manufacturer shall be used to avoid providing an Engineer Judgement.

1.6 SAMPLES

.1 Submit samples in accordance with Section 01 00 10 – General Instructions.

1.7 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 00 10 – General Instructions.

.2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

.3 Submit Shop Drawings/Design System Listings, product data and Material Safety Data Sheets (MSDS) in accordance with Section 01 00 10 – General Instructions. All manufacturer product data and MSDS items must show that their information has been updated on a regular basis. The submitted literature must bear a date that is less than two (2) years old from the date received by the Engineer, otherwise it will be rejected. Additionally, the following product data on each proposed product shall be submitted:

.1 Technical data on out-gassing; off-gassing and age testing.

.2 Curing time.

.3 Chemical compatibility to other construction materials.

.4 Provide Certification by the Manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's) and are non-toxic to building occupants.

.1 According to ASTM E595.

.2 Test Method: Environmental Protection Association, EPA Method 24.

.3 Indoor Environmental Quality: Volatile Content: below 250 g/l.

.4 **DO NOT** use silicone firestops.

.5 Design System Listings shall show proposed material, including technical data, reinforcement, anchorage, fastenings and method of installation. Construction details shall accurately reflect actual job conditions.

.6 Manufacturer may submit product data for materials and prefabricated devices, provided that descriptions are sufficient for identification at job site. Include Manufacturer's printed instructions for installation.

.7 Provide ULC or cUL Design System Listings complete with product literature and MSDS sheets on each system for each application, for each area as indicated.

.8 When more than one product is specified for the firestop Design Listing System or more than one backing/daming material is indicated, the firestop trade shall circle the item that they have chosen to use on this project.

.9 Provide a list (matrix) of products, identifying the following for each.

.1 Product name.

.2 Shelf life (expiry date).

.3 Life expectancy.

.4 Temperature range for installation.

.5 Humidity range for installation.

.10 Where there is no specific tested Design System Listings available by the chosen Project Manufacturer for particular firestop configuration, the Firestopping Sub-Trade shall review all other manufacturers in North America to attempt to obtain a Design System Listing, failing to obtain a system, the Firestopping Sub-Trade shall obtain from the Manufacturer an Engineered Judgement (EJ) for submittal. Each EJ shall come with a drawing of the proposed system, a description of the system, Project Name and Room Name/Number that the EJ is located in, copies of all referenced Design Listings and signed/dated by the Manufacturer's Fire Protection Engineer. Note: Once the EJ has been reviewed, the Contractor shall submit the EJ to the Authority Having Jurisdiction (AHJ) for final approval.

.11 Engineering Judgements (EJ's)

.1 EJ's shall be issued in lieu of tested systems when a tested Design Listing is not available for the current on site conditions.

.2 EJ's shall be issued only by firestop manufacturer's qualified technical personnel or, in concert with the manufacturer, by a knowledgeable registered Professional Engineer, or Fire Protection Engineer, or an independent testing agency that provides listing services for firestop systems.

.3 EJ's shall be based upon interpolations of previously tested firestop systems that are either sufficiently similar in nature or clearly bracket the conditions upon which the judgement is to be given. Additional knowledge and technical interpretations based upon accepted engineering principles, fire science and fire testing guidelines (e.g. ASTM E2031- Standard Guide for Extension of Data from Fire Endurance Tests) may also be used as further support data.

.4 EJ's shall be based upon full knowledge of the elements of the construction to be protected and understanding of the probable behavior of that construction and the recommended firestop system protecting it were they to be subjected to the appropriate Firestop Standard Fire Test method for the required fire rating duration.

.5 EJ's shall be limited to the specific conditions and configuration upon which the engineering judgement was rendered and should be based upon reasonable performance expectations for the recommended firestop system under those conditions.

.6 EJs shall be accepted only for a single specific job and location and should not be transferred to any other job or location without thorough and appropriate review of all aspects of the next job or location's circumstances.

.7 EJ's shall be accepted in jurisdictions that permit Alternative Methods per applicable building Codes.

.12 Submit design listings / shop drawings as follows:

.1 Submit design listing/ shop drawings in accordance with section 01 00 10 – General Instructions.

.2 Bind shop drawings in a minimum of seven (7) vinyl hard covered Acco Customized three D-ring binders for 215 x 280mm size paper. Note: Binders not to be more than 2/3 full.

.3 Enclose title sheet, labeled "Fire and Smoke Stop System Drawing Design System Listings", project name, date and installation company name and Manufacturer of products name. Insert title in front and spine of binder.

.4 Include a Table of Contents at the front of each binder.

.5 Provide a list of each proposed Design Listing and corresponding service penetration type or joint type in a matrix spreadsheet schedule, indicating floor and wall system, including rating for each.

.6 Provide a list of each proposed Design Listing with approximate total quantity or amounts of each listing per floor on separate sheet.

.7 Each penetration shall be numbered corresponding to the exact same number of the plate penetration no. that is identified in Item No. 2.1.12.

.8 Organize each floor, wall and ceiling area indicating each room number, labeled with tabs of celluloid covers fastened to hard paper dividing sheets.

.9 Provide copies of all fire and smoke stop system ULC or cUL Design No. listings for each penetration type for all areas located.

.10 Provide product data, MSDS and all other technical data information required as indicated in Item No. 1.6.

.11 Provide certifications of each installer proposed on working on the Project.

1.8 PRODUCT DATA

.1 Submit product data in accordance with Section 01 00 10 – General Instructions.

.2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials undamaged in manufacturer's clearly labelled, unopened containers, identified with brand, type, and ULC or cUL label, complete with batch number, manufacturing date and shelf life expiry date.

.2 All products that are delivered to site, must have a minimum of 75% of its shelf life still remaining on it, from date of delivery on site, otherwise the product will be rejected and removed from the site.

.3 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

.4 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

.5 Comply with recommended procedures, precautions or remedies described in Material Safety Data Sheets (MSDS) as applicable.

.6 Do not use damaged or expired material.

1.10 ENVIRONMENTAL REQUIREMENTS

.1 Do not install firestopping when ambient or substrate temperatures are outside limits permitted by Manufacturers or when substrates are wet, due to rain, frost, condensation, or other causes.

.2 Maintain this minimum temperature before, during and for three (3) days after installation of materials.

.3 Ventilate firestopping per Manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

.4 During installation, provide masking and drop sheets to prevent firestopping materials from contaminating any adjacent surfaces.

.5 Do not use materials that contain flammable solvents.

.6 Water based products are unacceptable in wet areas or areas that may be subject to occasional flooding.

1.11 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

1.12 SUBMITTALS

.1 Submit the following documentation to support Sustainable Considerations:

.1 Product Data. – MSDS, Spec Sheet, Product Label, post consumer and post industrial recycled content, weight, VOC compliance, Environmental Certification if available. (materials)

1.13 MOCK-UP

.1 Submit Mock-Ups in accordance with Section 01 00 10 – General Instructions.

.2 After Design System Listings Shop Drawings are reviewed by the Engineer, the Pre-Construction meeting is held and one-week prior to actual commencement of construction, provide field sample mock-up of each proposed ULC or cUL system for this project for Engineer review. This mock-up shall also include if required, work by other trades, to

provide the required finish work, such as steel stud / gypsum board trade framing out multi-penetrations openings.

.3 Mock-up locations shall be directed by the Engineer.

.4 Once mock-ups have been completed and materials have had adequate time to properly cure, notify the Engineer to perform their review. Minimum 48 hours is required to be given to the Engineer.

.5 Reviewed mock-ups shall become the standards of workmanship and material against which installed work will be checked. Reviewed and approved mock-ups may be used in final construction.

.6 Install identification penetration plate no. adjacent to each penetration.

.7 Local or National representation from the manufacturer shall be present during the Engineer mock-up review.

.8 The Engineer shall provide Observation and Destructive Tests to each Mock-Up to ensure the mock-up firestop system meets or exceeds the approved Design System Listing. The Firestop Sub-Trade to include for all costs of these mock-ups, including cutting or removing the system to allow for visual review and then the replacement or re-installation of the system.

.9 Upon completion of the review, the National and Local representative shall provide in writing to the Engineer that their review finds the mock-ups acceptable by the manufacturer and meets or exceeds the ULC or UL design system listing requirements for each mock-up application.

.10 Retain and maintain mock-ups during construction in an undisturbed condition as a standard for judging completed unit of work. Accepted mock-ups in an undisturbed condition at time of Substantial Performance may become part of completed unit of work.

1.14 DEFINITIONS

.1 **Firestops**: specially tested materials or combination of materials used to establish or re-establish the integrity of a fire rated wall, floor, ceiling or roof assembly or other partition after the structure has been breached for the through-penetration of building service items or to close off openings left due to construction methods to prevent or limit the spread of fire, heat, gasses and smoke.

.2 **Through-penetration**: opening or foreign material, pipes, conduits, ducts, cable trays, cable, wire, structural components or any other element passing completely through an opening in a fire rated barrier/assembly such that the full thickness of the rated material(s) is breached either in total or in part.

.3 **Membrane penetration**: any penetration of a fire rated barrier that breaches one side but does not pass completely through to the other side, including recessed electrical devices.

.4 **System**: the combination of specific materials and/or devices, including the penetrating item(s) required to complete the firestop, as tested by an independent third party test facility.

.5 **Barrier/Assembly**: a wall, floor, ceiling or roof assembly or other partition with a fire-smoke rating of 0, 1, 2, 3 or up to 4-hours.

.6 **Fire Resistive Joint**: any joint or opening, whether static or dynamic, within or between adjacent sections of fire rated interior or exterior walls, floors, ceilings or roof decks.

.7 **Fireblocking:** Building materials installed to resist the free passage of flame, smoke and noxious gases to other areas of the building through concealed spaces.

.8 **Perimeter Fire Barrier System**: The perimeter joint protection that provides fire resistance to prevent the passage of fire from floor to floor within the building at the opening between the exterior wall assembly and the floor assembly.

.9 **Intumescent**: Materials that expand with that to seal around objects threatened by fire.

.10 **F-Rating**: the time a firestop, penetrating item, building, material, firestop material, can withstand direct flame without a burn through as tested to CAN4-S115 /ULC-S115 or ASTM E814/UL 1479.

.11 **T-Rating**: the amount of time a through-penetration firestop limits the temperature rise on the cold side-outside the test furnace – as tested to CAN4-S115 /ULC-S115 or ASTM E814/UL 1479.

.12 **L-Rating Water Leakage Test**: introduced by Underwriters Laboratories on August 9, 2004 for systems tested and listed in accordance with ANSI/UL 1479.

.13 **Non-Rated Fire Separations:** to be a separation that prevents the passage of fire and smoke for time period that allows the fire suppression system to be activated and contain the fire. For the purpose of this project, all Non-Rated Fire Separations as indicated on drawings to be assigned a minimum time of 60-minutes Fire Resistance Rating and shall be fire stopped on both sides of the fire separation.

.14 **Single Penetration**: one service penetration through a fire separation.

.15 **Multi-Penetration**: two or more service penetration through a fire separation where the minimum space between pipes must exceed 50mm and where sizes of pipe are larger than 50mm, the space must be larger than the largest pipe between. (Example, one – 100mm diameter pipe and one – 150mm diameter pipe, the space between pipes must be greater than 150mm or otherwise the penetration will be considered a multi-penetration, when passing through a fire rated gypsum board partition.) These gypsum board partitions must be framed out on all four sides with studs to match the ULC Design Wall of Floor System and the annular space must be boarded with rated gypsum board to match the ULC Design Wall or Floor System.

1.15 DAILY WORK SHEETS

.1 Firestop sub-trade, superintendent shall keep a daily log of all activities on site during the course of construction. The Engineer to distribute a copy of proposed sample sheet for firestop sub-trade to utilize during the course of construction at the start up meeting.

.2 Engineer shall make periodic reviews of these worksheets during the course of construction.

1.16 AS-BUILTS

.1 Firestop sub-trade, shall provide as-built drawings, project manual schedules and firestop drawing details on site and make them available for periodic review by the Engineer.

.2 These drawings, schedules and details shall be marked up on weekly basis showing all alterations, changes and confirmation of each Design Listing in relationship to the project schedules when provided as part of the bid document.

.3 The sample sheet schedule for floors, walls and ceilings are attached to this section pages PRIOR TO THE END OF THE SPECIFICATION SECTION.

.4 All service penetrations or joints through each reference wall, floor and ceiling shall be indicated in the corresponding schedules. All information shall be recorded by indicating and imputing all required descriptions for each column based on the actual on-site condition. These schedules shall be turned over to the Engineer at the end of the project for electronic imputing for the owner maintenance use.

.5 Submit as-builts as per Section 01 00 10 – General Instructions.

1.17 WARRANTY

.1 For the Work of this Section 07 84 00 – Firestopping the 12 months warranty period prescribed in subsection GC32.1of General Conditions "C" is extended to 24 months.

.2 Manufacturers shall warrant work of this Section against defects and deficiencies in the product material for a period of 24 months. Promptly correct any defects or deficiencies, which become apparent within warranty period at no expense to Owner.

.3 Fire and smoke stop system Contractor hereby warrants workmanship on material installation for period of 24 months. Promptly correct any defects or deficiencies, which become apparent within warranty period at no expense to Owner.

1.18 MAINTENANCE DATA AND MATERIAL

.1 Provide Operation and Maintenance Data and Material for Fire and Smoke-Stop Systems to incorporate into the Manual as specified in Section 01 00 10 – General Instructions.

.2 Incorporate the following materials in the Operation and Maintenance Manual:

- .1 Material Safety Data Sheets (MSDS).
- .2 Product literature of each product used on this project.
- .3 Approved Design Listings and Engineer Judgements.
- .4 Matrix schedule indicating all Design Listings and EJs and matching them to the penetration or joint type. Included in this schedule shall be a quantity of each Design Listing/EJ on each floor.
- .5 Daily Worksheets.
- .6 Certification:
  - .1 Manufacturers Certification cards of each installer that performs installation on the project.
  - .2 Written certification of FCIA Association.

.3 Written letters from the Manufacturers accepting installing during:

.1 Mock-ups

.2 Substantial Performance

.7 Warranty: .1 Manufacturers warranty .2 Fire Stop Sub-Trade warranty.

.8 Life expectancy of each product installed on this project. List date of installation for each product and when the month / year of the expected expiration of each product.

.9 Firestopping schedules when applicable with the incorporation of all assembly identification penetration plate numbers and all Design Listings indicated. (Hard copies and electronic format, CD).

.10 Construction and progress photographs Section 01 10 00.

.3 Contractors to provide a mark-up as-built of all schedules when applicable, to the Engineer two (2) weeks prior to requesting total performance on the Project. The Engineer will incorporate these changes to the schedule (including adding assembly identification penetration plate numbers and Design Listings) and provide back to the contractor, an electronic CD format copy and a hard copy for submission of Operation and Maintenance Manual.

Part 2 Products

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with ULC-S115-11: Fire Tests of Firestop Systems or ASTM E814.

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke, water and gases in compliance with requirements of ULC-S115-11 or ASTM E814and not to exceed opening sizes for which they are intended, in accordance with ULC or cUL Design Numbers or other Design System Listings acceptable to the Authority having Jurisdiction.

.2 Firestop system rating: shall be flexible to allow for movement of building structure (refer to architectural and structural drawings) and penetrating items without affecting the adhesion or integrity of the system.

.2 Fire-stop Methods:

.1 Method 1: non-combustible, semi-rigid, felt; minimum density 65 kg per cu/m_2; depth 100 mm, length 1200 mm; width as required. Blanket type fire-stop to be listed, and labelled in accordance with file Guide 40-U19.13. Impale - clips; galvanized wire or 25 mm x 0.65 mm thick galvanized steel Z-clips with dimensions to match location of fire stop material and width of opening being sealed.

.2 Method 2: as per Method 1, without impale - clips.

.3 Method 3: Hose stream UL/cUL (Underwriters Laboratories USA) labeled.

.4 Method 4: Hose stream, fluid, gas and fire resistant elastomeric seal or non-shrink foam cement mortar proprietary certified assembly of a listed manufacturer.

.5 Methods 1 to 4: Methods used can be as per manufacturer's instructions, provided that their system employed meets or exceed the requirements of ULC/CAN4-S115-M2005 or ASTM E814

.3 Mechanical or Electrical service: penetration assemblies; certified by ULC in accordance with CAN4S115-M2005 or ASTM E814 and listed in the ULC Guide No. 40 U19.

.4 Service-penetration firestop components: certified by ULC in accordance with CAN4S115-M2005 or ASTM E814 and listed in the ULC Guide No. 40 U19.

.5 Sleeves shall only be used in concrete block and cast-in-place concrete assemblies and then only if the sleeve is built into the assembly. Sleeves shall not be installed where penetrations are made following construction of an assembly.

.6 All firestop material is to be from one manufacturer.

.7 The firestop installer is to be registered in good standing with the Firestop Contractors International Association (FCIA) or CFFM approved equivalent for at least two years prior to contract award.

.8 Fire-resiststance rating of installed fire-stopping assembly not less than fire-resistance rating of surrounding substrate assembly (floor/wall etc). Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.9 In addition to NBC requirements the Engineer requires firestopping to be installed at :

.1 Head of wall joints;

.2 The point of intersections between dissimilar fire separation assemblies- ie between concrete block and gypsum;

.3 Penetrations through any membrane forming part of a fire separation;

.4 Structural penetrations and

.5 Floor-perimeter firestop systems. Until ULC listed firestop systems are available for curtain-wall installation. UL listed systems are acceptable for this application.

.10 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal, or non-shrink foam cement mortar: do not use cementitious or rigid seal at such locations.

.11 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal. Do not use a cementitious or rigid seal at such locations.

.12 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.13 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.14 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.15 Sealants for vertical joints: non-sagging and having a flame spread of not more than 25 and a maximum smoke development classification of 100 for walls and 50 for ceilings.

.16 Assembly identification penetration plate all fire/smoke stop systems that are installed are required to be identified by assembly adhesive label over a piece of 0.9 mm (20 gauge) aluminium metal backer plate; all plates to be adhered to walls/floors by acceptable adhesive to the backside of the plate. Lettering on all plates shall be printed as follows:

.1 Plate Penetration No.:
.2 Floor Level:
.3 Room no.:
.4 Product:
.5 ULC or cUL System
.6 Fire Rating Required: hour(s)
.7 Firestopping Contractor's Name:
.8 Phone no. of Firstopping Contractor:
.9 Installer's Name:
.10 Date of Installation:
.11 Re-penetration by:

.17 Penetration plate shall state that the fill material around the penetration is a fire stop system and it shall not be disturbed except by authorized personnel.

.18 Fire Separation (Barrier) Markings: All vertical fire separations within ceiling spaces to be identified by continuously painted red 75mm high stencil along upper wall. Marking to be painted 600 mm below horizontal fire separation or roof structure unless otherwise indicated. Final location to be determined on-site. Refer to drawings for locations of fire separations and rating required. Each rating shall be indicated every 6000 mm o.c. with 75 mm high red painted lin in between. A schedule of Fire separations/and Symbol to designate Fire Resistant rating is to be used.

Schedule of Fire Separations

	Symbol	**Fire Resistance Ration**
.1	-- N/R --	Non-Rated Fire Separation
.2	-- 1.0 --	1 Hour Fire Separation
.3	-- 1.5 --	1.5 Hour Fire Separation
.4	-- 2.0--	2 Hour Fire Separation
.5	-- 3.0 --	3 Hour Fire Separation
.6	-- 4.0 --	4 Hour Fire Separation

2.2 PRODUCT SYSTEMS

.1 Single source responsibility: obtain firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.

.1 Materials of different manufacturers shall not be intermixed on the project.

.2 Acceptable manufacturers. .

.1 AD Fire Protection Systems Inc.
.2 Hilti Fire Stop Systems.
.3 3M Fire Protection Products
.4 Tremco, Tremstop, Firestop Systems
.5 Rectorseal, Biofireshield or Metacaulk

2.3 ACCEPTABLE FIRE STOP APPLICATORS

.1 *DEPARTMENT to provide acceptable fire stop applicators in Gatineau Area.*

Part 3 Execution

3.1 EXAMINATION

.1 Verify substrate conditions, previously installed are acceptable for product installation in accordance with manufacturer's instructions and approved design system listings for each condition.

.2 Ensure that opening / annular space does not exceed the maximum and minimum size or dimensions that is indicated on the approved Design Listing.

.3 Verify that all joints, service penetrating elements and supporting devices/hangers have been properly installed as indicated on Approved Design Listings. All temporary lines and markings have been removed to meet the approved Design System Listings for each condition has been identified.

.4 Verify that the proposed Firestopping system is composed of components that are compatible with each other, the substrates forming the openings, and the items, if any, penetrating the firestopping under conditions of application and service, as demonstrated by firestopping manufacturer based on testing and field experience.

.5 Ensure no additional items have been installed through opening that does not appear on the approved Design Listing.

.6 Ensure areas that are to be firestopped are accessible for proper application and conditions are suitable for installation of a firestop system. All areas must also be accessible for inspection.

.7 Report in writing to the Engineer any defective surfaces or conditions affecting the firestop system installation, immediately and prior to commencing any installations.

.8 Proceed only when defected surfaces or conditions have been corrected.

.9 Ensure temperature within the areas of installation meets or exceeds the minimum temperature range for the products that will be installed in those areas, as based on the manufacturer's recommendations for a minimum two days prior and three days after installation.

.10 Beginning of installation means acceptance of site conditions.

3.2 PREPARATION

.1 Protect adjacent work areas and finish surfaces from damage during product installation.

.2 Provide drop sheets or other satisfactory coverings for protection of adjacent areas in accordance with safe and good work practices.

.3 In areas to be fire stopped ensure that sub state and service penetrations are clean, dry and frost free.

.4 Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work. Remove tape as soon as it is possible to do so without disturbing the firestopping seal with substrates.

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

.6 Prepare surfaces in contact with firestopping materials and smoke-seals to manufacturer's instructions.

.7 Maintain insulation around pipes and ducts penetrating fire separation. Confirm that fire stop system has been tested with actual pipe or duct insulation penetrating fire separation that is indicated in the approved ULC or UL Design System Listing.

.8 Surfaces to which firestop materials are to be installed, shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

.9 Ensure that multi-penetration openings have been framed and boarded out, all around the annular openings as indicted in the Firestopping Detail Drawings prior to preparing the opening.

.10 Confirm that the temperature and humidity conditions during and after installation are being maintained as per manufacturers' recommendations.

.11 One certified Fire-Stopping installer is to install all fire-stopping on this project. Co-ordinate all requirements with all penetrations, including structural locations, mechanical and electrical locations.

.12 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

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

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

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

3.3 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with manufacturer's instructions and rated system as tested to ULC/CAN4-S115, and ULC or UL Design System Listings.

.2 Coordinate with other Sub-Trades to assure that all pipes, conduit, cable and other items which penetrate fire separations have been permanently installed prior to installation of firestop systems.

.3 Schedule the work to assure that fire separations and all other construction that conceals penetrations are not erected prior to the installation of fire and smoke stop systems.

.4 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.

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

.6 Tool or trowel exposed surfaces to a neat finish.

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

.8 Seal all voids between new fire rated wall assemblies and new or existing building walls to form a draft-tight barrier and act to retard the passage of flame, toxic gases and smoke.

.9 Install firestop material to obtain fire resistance rating not less than the fire resistance rating of surrounding floor and wall assembly.

3.4 INSPECTION

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

.2 Examination of all fire stopping required by Certified personnel contracted by the contractor.

.3 An examination of the fire-stopping system shall determine if the assembly is installed as per its ULC listing

.4 Firestopping is to be inspected and evaluated as per ASTM2174 Standard Practice for On-Site Inspection of Installed Firestops. Reports shall be submitted to the Engineer for review and that the standard has been met.

.5 Destructive testing is to be included, and subsequent repair of installation of fire-stopping, so that the standards are met.

.6 The reviews and inspections are to occur, and be reported to the Engineer prior to “close-up” to confirm assembly components and installation configuration.

.7 The firestopping sub-trade shall do all cutting and removal of the systems for visual review from the Engineer and local manufacturer’s Representative. Once the review is completed and accepted the firestopping sub-trade shall replace the firestop system with new. All costs for cutting removing and replacement shall be included in the base bid.

.8 Firestopping Sub-Trade shall include for a minimum of 2% of each Design Listing for each area of 90m2 (based on ASTM E2174) for such exploratory reviews per approved Design System Listings. Perimeter Joints shall have a minimum cut test every 15 meters (based on ASTM #2393). Bottom and top of wall joints, wall to wall joints and building expansion joints shall have a minimum cut test every 15 meters.

3.5 SCHEDULE

.1 Firestop 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 The point of intersection between dissimilar fire separation assemblies.

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

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

.6 Penetrations through fire-resistance rated floor slabs.

.7 Penetrations through any membrane forming part of a fire separation

.8 Structural penetrations.

.9 Head of wall joints.

.10 Openings and sleeves installed for future use through fire separations.

.11 Around mechanical and electrical assemblies penetrating fire separations.

.12 Rigid ducts: greater than 129cm^2: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

.13 Around electrical boxes that penetrate through the membrane of a fire separation as required under NBC 2010.

3.6 INSTALLING FIRESTOP JOINT SYSTEMS

.1 Install joint fillers to provide support of firestop materials during application and at the position required to provide the cross-sectional shapes and depths of installed firestop material relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

.2 Install systems by proven techniques that result in firestop materials as recommended by the manufacturer:

.1 directly containing and fully wetting joint substrates.

.2 completely filling recesses provided for each joint configuration.

.3 providing uniform, cross-sectional shapes and depths relative to joint width that optimize movement capability.

.4 Tool non-sag firestop materials immediately after their application and prior to the time skinning begins. Form smooth, uniform beads of configuration indicated or required to:

.1 produce fire-resistance rating

.2 to eliminate air pockets

.3 to ensure contact and adhesion with sides of joint.

3.7 INSTALLATION OF ASSEMBLY IDENTIFICATION PENETRATION PLATE

.1 Install adjacent to all through wall/floor service penetrations firestopped and at joint penetrations. Provide one assembly identification plate per penetration opening and one assembly identification plate at every 6000mm along wall/floor joints.

.2 Penetration plate shall be completely filled out and installed prior to requesting substantial performance.

.3 Clean substrate prior to applying penetration plate.

.4 Securely apply penetration plate to substrate, by providing adequate adhesive.

3.8 REPAIRS AND MODIFICATIONS

.1 Identify damaged or re-entered seals requiring repair or modification.

.2 Remove loose or damaged materials. If penetrating items are to be added, remove sufficient material to insert new elements. Cause no damage to the balance of the seal.

.3 Ensure that surfaces to be sealed are clean and dry. Install materials in accordance with specified installation requirements herein. Use only materials approved by manufacturer as suitable for repair of original seal. Do not mix different manufacturer's products.

3.9 MANUFACTURER'S FIELD QUALITY

.1 Representative from Manufacturer shall perform periodic observations of firestopping systems:

.1 Examine firestop penetration seals for proper installation, labelling, adhesion and curing as may be appropriate for the respective seal material.

.2 Keep areas of work accessible and notify Engineer, code authorities and/or designated inspectors of work completion released for Engineer review.

.3 Document completion and observation as required.

3.10 CLEAN UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.11 SAMPLE FIRESTOPPING SCHEDULE

Ref No.	Drwg No.	Room No.	Wall type	ID Plate No.	Photo Number	Description	Size	FS No.	Design No.	Penetration Notes

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 00 10 – General Instructions.

.2 Section 07 84 00 – Firestopping.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

.2 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations. ESA OESC-2012, Québec Electrical Safety Code, 2010 Edition, Electrical Safety Authority 2012.

.3 CAN/CSA-C22.3 No. 1-10, Overhead Systems.

.4 CAN3-C235-83(R2006), Preferred Voltage Levels for AC Systems, 0 to 50,000V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE 100-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition. Institute of Electrical and Electronics Engineers.

.2 IEEE 1122–1998, IEEE Standard for Digital Recorders for Measurements in High Voltage Impulse Tests.

1.3 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE 1122.

1.4 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

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

.4 Use one nameplate for each language.

1.5 SUBMITTALS

.1 Submittals: in accordance with Section 01 00 10 – General Instructions.

.2 Product Data: submit WHMIS MSDS.

.3 Shop drawings:

.1 Submit drawings with dimensioned layouts.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, panels, accessories and other items that must be shown to ensure co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 If changes are required, notify the Engineer of these changes before they are made.

.4 Quality Control: in accordance with Section 01 00 10 – General Instructions.

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Manufacturer's Field Reports: submit to Engineer manufacturer's written report, within five (5) days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.6 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 00 10 – General Instructions.

.2 Qualifications: Electrical Work to be carried out by qualified, licensed electricians or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings:

.1 In accordance with Section 01 00 10 – General Instructions.

.2 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.

.1 Upon completion of Work, after cleaning is carried out.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Engineer with schedule within two (2) weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instructions.

1.8 SYSTEM START-UP

.1 Instruct Engineer and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.9 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 00 10 – General Instructions.

.2 Material and equipment to be CSA certified.

.3 Factory assemble control panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

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

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of the Electrical Code.

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

2.4 WIRING TERMINATIONS

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

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: lamicoid 3 mm engraving sheet melamine, matt white finish face, black lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Sizes as follows:

NAMEPLATE SIZES

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

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

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

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

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

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. ___" as directed by Engineer.

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

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

.9 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered 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 coding: to CSA C22.1.

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

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling and at five meter intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
Low voltage	Brown	
Normal power up to 250 V	Yellow	
Emergency power up to 250 V	Yellow	Red
Normal 347/600 V	Blue	
Emergency 347/600 V	Blue	Red
Controls	Grey	
Fire Alarm	Red	
Voice & Data	Green	

2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

.1 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

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

3.3 CONDUIT AND CABLE INSTALLATION

.1 Cut openings in the building walls or floors as required to install new cables and conduits.

.2 Prior to cutting, carry out x-ray inspection and locate sleeves in accordance with Section 01 00 10 - General Instructions.

.3 Install new cables and conduits in openings provided in enclosure walls. Coordinate all installation with enclosure manufacturer.

.4 Install steel sleeves through cut openings in floor slab. Sleeves to extend 150 mm above floor level. Secure sleeve with a suitable steel floor flange and clamp.

.5 Seal openings and provide fire stopping in accordance with Section 07 84 00 – Firestopping.

3.4 LOCATION OF OUTLETS

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

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

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

.4 Locate outlets under raised floor as indicated on the drawings.

3.5 MOUNTING HEIGHTS

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

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

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Panelboards: as required by Code or as indicated.

.2 Receptacles: 400 mm.

.3 Light switches: 1200 mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.7 FIELD QUALITY CONTROL

.1 Conduct following tests in accordance with Section 01 00 10 – General Instructions.

.1 Power generating and distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: Fire Alarm Systems.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.2 Carry out tests in presence of Engineer.

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

.4 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.

3.8 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 00 10 – General Instructions.

.2 Section 26 05 00 – Common Work Results for Electrical.

.3 Section 26 05 21 – Wires and Cables (0-1000 V).

.4 Section 26 05 32 – Outlet Boxes, conduit Boxes and Fittings.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.18-98 (R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CAN/CSA C22.2 No.65-03 (R2008), Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused wiring materials from landfill to metal recycling facility as approved by the Engineer.

Part 2 Products

2.1 MATERIALS

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

.2 Copper long barrel compression connector as required by conductor size.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded round copper conductors.

.2 Clamp for stranded round copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.4 Insulation (tubing, boots and end caps)

.1 Heat shrink insulators:

.1 Moisture proof

.2 Thermally stabilized cross-linked polyolefin

.3 Self-sealing adhesive insulator with 3 to 1 expansion

.4 Rated 1000 V, 90°C.

.5 Clamps or connectors for armoured cable, flexible conduit as required to: CAN/CSA-C22.2 No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA C22.2 No.65.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2..

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 00 10 – General Instructions

.2 Section 07 84 00 – Firestopping.

.3 Section 26 05 00 – Common Work Results for Electricity.

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

.5 Section 26 05 29 - Hangers and Supports for Electrical Systems.

.6 Section 26 05 31 - Splitters, Junctions, Pull Boxes and Cabinets.

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

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

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM B33-04, Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.

.2 ASTM B172-01a(2007)e1, Standard Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors.

.3 ASTM B174-02(2007)e1, Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors

.2 Canadian Standards Association (CSA International)

.1 CSA C22.1-09, Canadian Electrical Code, Part 1 (21st Edition), Safety Standard for Electrical Installations

.2 CSA C22.2 No. 0.3-09, Test Methods for Electrical Wires and Cables.

.3 CAN/CSA-C22.2 No. 131-07, Type TECK 90 Cable.

.3 Insulated Cable Engineers Association, Inc. (ICEA), National Electrical Manufacturer's Association (NEMA)

.1 ANSI/NEMA WC70-2009 / ICEA-S-95-658-2009, Para 4.1.11. Power Cables, 2000 Volts or Less for the Distribution of Electrical Energy.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 00 10 – General Instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal all packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductor material (wire in conduit): Annealed commercial grade, 98% conductivity, copper. #14 to #10 AWG solid; #8 and larger - stranded.

.2 Unless otherwise shown on the drawings or specified herein, provide conductors for circuits protected at 40 amperes and higher with insulation as follows:

.1 At 250 V and lower, RW90

.2 At greater than 250 V and less than 750 V in sizes up to #3 AWG = RW90

.3 For wiring systems at greater than 250 V and less than 750 V in sizes above #3 AWG, RWU 90 1000V.

.4 For circuits protected at less than 40 amperes Copper conductors: size as indicated, with thermoplastic insulation type TWU or TWH, as indicated, rated at 600 V.

.5 Colour Coding:

.1 Two (2) conductors, (1 phase): 1 black, 1 white

.2 Three (3) conductor, (1 phase): 1 black, 1 red, 1 white

.3 Three (3) conductor, 3 phase: 1 red (phase A), 1 black (phase B), 1 blue (phase C)

.4 Four (4) conductor, (3 phase): 1 red (phase A), 1 black (phase B), 1 blue (phase C), 1 white (neutral)

.5 Ground wire: green

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V, as indicated.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking galvanized steel.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

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

.2 Channel type supports for two or more cables at 900 mm centers or cable tray, as indicated.

.3 Threaded rods: 6 mm dia. to support suspended channels, or cable tray.

.8 Connectors:

.1 Watertight approved for TECK cable

2.3 ARMOURED CABLES

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

.2 Type: AC90.

.3 Armour: interlocking type fabricated from galvanized steel strip.

.4 Connectors: malleable steel

2.4 CONTROL CABLES

.1 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW with shielding of tape coated with paramagnetic material over all conductors and overall covering of PVC jackets or interlocked armour of flat galvanized steel and overall PVC jacket.

.2 600 V stranded annealed copper conductors, sizes as indicated with PVC insulation type TW, where indicated, with shielding of magnetic tape over all conductors and overall covering of thermoplastic jacket with sheath of interlocked armour and jacket over sheath of PVC.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

3.2 INSTALLATION OF CONDUCTORS IN CONDUIT

.1 Conductors:

.1 Minimum wire size shall be #12 AWG unless otherwise specified.

.2 The current carrying capacity of the circuit conducts shall be equal to or better than shown on the drawings.

.3 Neutral Wire: full capacity continuous throughout its length.

.4 When load or breaker ratings are greater than 15A, the conditions shall be as indicated or of capacity equal to the load or breaker trip size as determined by the Canadian Electrical Code.

.5 Provide pigtails at all outlets for fixtures and wiring devices. All neutrals and branch circuits shall be connected in each outlet box to avoid a break in the neutral or the circuit wire when fixture or wiring device is disconnected.

.6 All branch circuit connections shall be made with an approved connector applied with a proper tool.

.7 Run a green insulated ground wire in all power and branch circuit EMT conduits. At each junction, pull and outlet box make a 360° loop of the stripped (insulation) uncut conductor under the ground screws.

.2 Testing and Commissioning:

.1 Complete the following insulation resistance tests on the new feeders:

.1 Megger circuits, feeders and equipment up to 350 V with a 500-V instrument.

.2 Megger 350-600-V circuits, feeders and equipment with a 1000-V instrument.

.3 Check resistance to ground before energizing.

.4 Carry out the tests in the presence of the Engineer.

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

.6 Submit the typewritten test results for the Engineer’s review.

3.3 INSTALLATION OF TECK CABLE 0-1000V

.1 Install cables in cabletroughs.

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

3.4 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit, underground ducts, as indicated.

.2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

.2 Canadian Standards Association, (CSA International).

.1 CSA C22.2 No. 41-07, Grounding and Bonding Equipment

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal all packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MATERIALS

.1 Grounding equipment to: CSA C22.2 No. 41.

2.2 EQUIPMENT

.1 System and circuit, equipment, grounding conductors, bare stranded copper, un-tinned, soft annealed, un-armoured, Size #3/0 AWG.

.2 Insulated grounding conductors to Section 26 05 21 – Wires and Cables (0 – 1000V).

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

.1 grounding and bonding bushings,

.2 protective type clamps,

.3 compression type conductor connectors,

.4 bonding jumpers, straps,

.5 pressure wire connectors

.6 compression-type bonding and connections with pure wrought-copper compression devices, factory filled with inhibiting compound or with appropriate all bronze or copper mechanical devices and shall meet current CSA C22.2 No.41.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install the complete permanent, continuous system and circuit, equipment, grounding systems including conductors, connectors and accessories as indicated to conform to the requirements of the Engineer and the local Authority Having Jurisdiction over installation.

.2 Install connectors to the manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

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

.5 Soldered joints are not permitted.

.6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or exterior of flexible conduit.

.7 Make grounding connections in radial configuration only.

.8 Bond single conductor, metallic armoured cables to cabinet at supply end and provide non-metallic entry plate at load end.

.9 Provide a separate green-insulated ground conductor in every feeder and branch conduit.

.10 Provide separate green-insulated ground conductor in every conduit to all devices and fixtures.

.11 Ground panels and transformers to local ground bus. Connect each ground bus to the building ground loop at the nearest location.

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to the neutral of the secondary 600-V system as indicated.

3.3 GROUNDING BUS

.1 Ground to electrical equipment with insulated stranded copper conductor size 2/0.

3.4 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to the following list. Service equipment, transformers, switchgear, frames of motors, starters, enclosure and metal cladding work, and distribution panels.

3.5 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.

.2 Perform ground continuity and resistance tests using method appropriate to the site conditions and to the approval of the Engineer and local Authority Having Jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Test all joints including threaded conduits connection used as ground.

DC resistance shall be no greater than 5 milliohms per joint or connection.

.5 Submit the test report to the Engineer.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

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

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

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal all packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 Provide galvanized steel support channels.

.2 U-shaped, size 37 x 25 mm thick, surface mounted and suspended as required.

2.2 THREADED ROD HANGERS

.1 Provide galvanized steel threaded rod hangers throughout.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to solid masonry with lead anchors.

.2 Secure equipment to poured concrete with self-drilling expandable inserts.

.3 Secure equipment to hollow masonry walls with toggle bolts.

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

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

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

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

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

.6 Suspended support systems.

.1 Support individual cable or conduit runs with 12 mm diameter threaded rods and spring clips.

.2 Support two (2) or more cables or conduits on channels supported by 12 mm diameter threaded rod hangers where direct fastening to building structure is impractical.

.7 For surface mounting of two (2) or more conduits, use channels at 1500 mm OC spacing.

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 00 10 – General Instructions.

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

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

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 00 10 – General Instructions.

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Provide shop drawings: in accordance with Section 01 00 10 – General Instructions.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instructions.

Part 2 Products

2.1 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

Part 3 Execution

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Only main junction and pull boxes are indicated on drawings. Provide pull boxes so as not to exceed 30 m or three (3) 90^{o} elbows of conduit run between pull boxes and not more than two (2) 90^{o} elbows in feeder conduits, unless bends are long sweep type.

.2 Install pull boxes in inconspicuous, but accessible locations.

3.2 IDENTIFICATION

.1 Install Size 2 identification labels indicating system name, voltage and phase in accordance with Section 26 05 00 – Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 00 10 – General Instructions.

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

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

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-12 Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations

.2 CAN/CSA C22.2 18-98 (R2003), Outlet Boxes, Conduit Boxes, and Fittings.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 00 10 – General Instructions.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instructions.

Part 2 Products

2.1 BOXES, OUTLETS, CONDUIT BOXES

.1 Outlet boxes, conduit boxes and fittings are based on CSA C22.2 No. 18.

.2 Size boxes in accordance with CSA C22.1, Canadian Electrical Code, Part 1

.3 Outlet conduit and junction boxes - general:

.1 100 mm square or larger outlet boxes as required for special devices.

.2 Gang boxes where wiring devices are grouped.

.3 Blank cover plates for boxes without wiring devices.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm unless otherwise indicated. 100 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 100 mm square outlet boxes with extension and plaster rings for flush-mounting devices in finished walls.

2.3 FITTINGS FOR THINWALL CONDUIT

.1 All couplings and connectors at the sprinkler-proof equipment shall be steel-compression type (binding collar). For all other applications, steel set screw-type couplings and connectors shall be used. Cast type will not be acceptable.

2.4 FITTINGS -GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of foreign materials.

.3 Conduit outlet bodies for conduit up to 30 mm and pull boxes for larger conduits.

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

2.5 CONDUIT BOXES

.1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for outlets connected to surface-mounted conduit.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent the entry of construction material.

.3 For flush installations, mount outlets flush with the finished wall using plaster rings to permit wall finish to come within 5 mm of opening.

.4 Provide correct size of openings in boxes for conduit and armoured cable connections. Reducing washers not allowed.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

.2 Section 26 05 21 - Wire and Cables (0 - 1000 V).

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

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CAN/CSA C22.2 No.18-98 (R2003), Outlet Boxes, Conduit Boxes and Fittings.
- .2 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .3 CSA C22.2 No. 83-M1985 (R2008), Electrical Metallic Tubing.
- .4 CSA C22.2 No. 211.2-06, Rigid PVC (Unplasticized) Conduit.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 00 10 – General Instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal all packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 CONDUITS

.1 Electrical metallic tubing with couplings to CSA C22.2 No. 83.

.2 Flexible and liquid-tight flexible metal conduit: to CSA C22.2 No.56.

.3 Rigid PVC conduit: to CSA 22.2 No. 211.2.

.4 Galvanized rigid conduit to CSA C22.2 No. 18

2.2 CONDUIT FASTENINGS

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

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

.3 Channel type supports for two (2) or more conduits at 1500 mm OC.

.4 12 mm diameter galvanized threaded rods to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings for raceways: to CSA C22.2 No. 18.

.2 Fitting manufactured for use with conduit specified.

.3 Factory "ells" where 90^{o} bends are required for 25 mm and larger conduits.

.4 All couplings and connectors at the sprinkler-proof equipment shall be steel-compression type (binding collar). For all other applications, steel set screw-type couplings and connections shall be used. Set screw and cast types will not be acceptable**.**

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions

Part 3 Execution

3.1 INSTALLATION

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

.2 Conceal conduits except in mechanical and electrical service rooms.

.3 In finished areas, run wiring concealed, except as otherwise specified or indicated on the drawings. Run exposed conduit neatly, parallel to building lines and maintain maximum headroom.

.4 Use EMT conduit for all feeders and branch wiring within enclosures and in the building.

.5 Use 600 mm liquid-tight flexible metal conduit for primary and secondary connection to dry-type transformers.

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

.7 Mechanically bend steel conduit over 20 mm diameter.

.8 Install polypropylene fish cord in all empty conduits.

.9 Where conduits become blocked, remove and replace blocked section.

.10 Dry conduits out before installing wire.

.11 Provide expansion fittings at all building and shield expansion joints.

3.2 SURFACE CONDUITS

.1 Line up all exposed raceways, parallel and at right angles to the building walls. Set plumb and level equipment accurately and align hanger rods. Function and appearance shall be to the Engineer's satisfaction.

.2 Locate conduits behind infrared or gas-fired heaters with 1500 mm clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on recessed channels. Surface or suspended channels may be used if unavoidable.

.5 Do not pass conduits through structural members except as indicated and only with the Engineer’s permission for each case.

3.3 MINIMUM CONDUIT SIZE

.1 The minimum conduit size shall be 20 mm.

3.4 EXPANSION FITTINGS

.1 Conduit expansion fittings shall be provided on all conduits crossing structural expansion joints.

.2 Install expansion fittings perpendicular to expansion joint.

3.5 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

.1 CSA G40.20-04/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

1.3 DEFINITIONS

.1 Operational Functional Components (OFCs) are non-structural building components, including architectural finishes, building service components (mechanical, plumbing, electrical and telecommunications) and building contents.

.2 Importance Categories for Buildings: buildings (and their respective OFCs) are defined by the National Building code of Canada 2010.

.1 For seismic design, the importance categories for buildings are defined as normal, high and post disaster.

.2 For seismic design of OFCs, the importance categories are defined as normal , high and post-disaster with OFCs being nominally impacted after a design seismic event and repairable within two to three days and post-disaster with OFCs being fully functional after a design seismic event.

.3 SRS: acronym for Seismic Restraint System.

1.4 GENERAL DESCRIPTION

.1 This section covers design, supply and installation of complete SRS for all systems, equipment specified for installation on this project. This includes electrical light fixtures, transformers, battery, diesel generators, fire protection, conduit, communications, electrical equipment and systems, both vibration isolated and statically supported.

.2 SRS to be fully integrated into, compatible with:

.1 Noise and vibration controls specified elsewhere in this project specification.

.2 Structural, mechanical, electrical design of project.

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

.4 Design to be by Professional Engineer specializing in design of SRS and registered in Province of Quebec. Include all costs associated with this work as it relates to the electrical installations. Submit design sketches c/w professional stamp prior to start of installations, c/w installation requirements.

1.5 DESIGN CRITERIA

.1 Seismic restraint design for OFCs to meet National Building Code of Canada 2010, National Fire Code 2010 and National Plumbing Code 2010.

.2 Building is defined as a 'post disaster building' with an importance factor 1c=1.5. Foundation class is Fa=.5 for a Class 'A' soil. Spectral response factor is for Ottawa with a Sa(.2)=.66 and a peak ground acceleration of .42.

1.6 SUBMITTALS

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

.2 Submittals to include:

.1 Full details of design criteria.

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

1.7 MAINTENANCE DATA

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

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.3 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SRS MANUFACTURER

.1 SRS to be from one manufacturer regularly engaged in production of same.

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

2.2 GENERAL

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

.2 SRS to restrain seismic forces in all directions.

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

.4 SRS of conduit systems to be compatible with:

.1 Expansion, anchoring and guiding requirements.

.2 Equipment vibration isolation and equipment SRS.

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

.6 Attachments to reinforced concrete structure:

.1 Use high strength mechanical expansion anchors.

.2 Drilled or power driven anchors not permitted.

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

2.3 SRS FOR STATIC EQUIPMENT, SYSTEMS

.1 Floor-mounted equipment, systems:

.1 Anchor equipment to equipment supports.

.2 Anchor equipment supports to structure.

.3 Use size of bolts scheduled in approved shop drawings.

.2 Suspended equipment, systems:

.1 Use one or combination of following methods:

.1 Install tight to structure.

.2 Cross-brace in all directions.

.3 Brace back to structure.

.4 Slack cable restraint system.

.2 SRS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.

.3 Hanger rods to withstand compressive loading and buckling.

2.4 SRS FOR VIBRATION ISOLATED EQUIPMENT, SYSTEMS

.1 Floor mounted equipment, systems:

.1 Use one or combination of following methods:

.1 Vibration isolators with built-in snubbers.

.2 Vibration isolators and separate snubbers.

.3 Built-up snubber system approved by Engineer, consisting of structural elements and elastomeric layer.

.2 SRS to resist complete isolator unloading.

.3 SRS not to jeopardize noise and vibration isolation systems. Provide 4-8 mm clearance between seismic restraint snubbers and equipment during normal operation of equipment and systems.

.4 Cushioning action to be gentle and steady by utilizing elastomeric material or other means in order to avoid high impact loads.

.2 Suspended equipment, systems:

.1 Use one or combination of following methods:

.1 Slack cable restraint system.

.2 Brace back to structure via vibration isolators and snubbers

Part 3 Execution

3.1 INSTALLATION

.1 Attachment points and fasteners:

.1 To withstand same maximum load that seismic restraint is to resist and in all directions.

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

.3 Miscellaneous equipment not vibration-isolated:

.1 Bolt through house-keeping pad to structure.

.4 Co-ordinate connections with all disciplines.

3.2 INSPECTION AND CERTIFICATION

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

.2 Provide written report stamped by professional Engineer licensed in Quebec to Engineer with signed certificate of compliance with the SRS design requirements

3.3 COMMISSIONING DOCUMENTATION

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 00 10 – General Instructions.

.2 Section 01 79 00 – Demonstration and Training.

.3 Section 01 91 13 – General Commissioning (Cx) Requirements.

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

.5 Section 26 05 28 - Grounding – Secondary.

1.2 SHOP DRAWINGS

.1 Refer to Section 01 00 10 – General Instructions.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.47-M90 (R2007), Air-Cooled Transformers (Dry-Type).

.2 CSA C9-02 (R2007), Dry-Type Transformers.

.2 National Electrical Manufacturers Association (NEMA).

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 00 10 – General Instructions.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal all packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 TRANSFORMERS

.1 Use transformers of one manufacturer throughout the project.

.2 Design:

.1 Three-phase step-down transformers shall have the following characteristics:

1. Three phase - 600-Volt delta connected primary (high-voltage) and Wye connected secondary windings, voltage as indicated on the drawings.

.2 The secondaries shall be brought out to the terminal board for connection of the grounded neutral on the 3-ph, 4-wire systems.

.3 All transformers shall be distribution class and shall comply with the following parameters:

.1 Type: ANN.

.2 C.S.A.: C9, C22.2 No.47.

.3 Insulation: Class H.

.4 Design: 150°C design temperature rise by resistance.

.5 kVA Ratings: as indicated on drawings.

.6 Voltage Class: 1.2 kV.

.7 BIL Rating: 10 kV.

.8 Windings: copper.

.9 Magnetizing Inrush: maximum - 12 times rms F.L. value.

.10 Taps: 4 - 2½% (2FCAN, 2FCBN)

.11 Sound Level: 45 dBA maximum.

.12 Enclosure: ventilated, EEMAC 2, removable metal front panel.

.13 Finish: ASA 61 grey air dry.

.14 Mounts: anti-vibration between core coil frame and the enclosure frame.

2.2 EQUIPMENT IDENTIFICATION

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

.2 Label Size: 7

.3 Refer to drawings for nameplate wording designations. Example as follows:

.1 Transformer T-EPPA 30 kVA 600 volts to 120/208 volts fed from DP-EA feeding BP-EPPA.

Part 3 Execution

3.1 INSTALLATION

.1 Mount dry-type transformers on wall, mount where shown on the drawings.

.2 Ensure adequate clearance around transformer for ventilation.

.3 Install transformers in level upright position.

.4 Remove shipping supports only after transformer is installed and just before putting into service.

.5 Loosen isolation pad bolts until no compression is visible.

3.2 CONNECTIONS

.1 Make primary and secondary connections shown on the drawings with liquid-tight flexible metal conduits.

.2 Energize transformers immediately after installation is completed, where practicable.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 00 10 – General Instructions.

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

.3 Section 26 28 16.02 - Moulded-Case Circuit Breakers.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.2 No. 29-M1989 (R2004), Panelboards and Enclosed Panelboards.

1.3 SHOP DRAWINGS

.1 Refer to Section 01 00 10 – General Instructions.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity provisions, enclosure dimension, and panel locking.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal all packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No. 29 and product of one manufacturer.

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer’s nameplate must show fault current that panel including breakers has been build to withstand.

.2 250 and 600 volt panelboards: bus and breakers rated for symmetrical interrupting capacity as follows:

.1 240 volt 10,000 amps.

.2 600 volt 42 kA RMS symmetrical..

.3 Sequence phase bus with odd numbered breakers on left and even on right, with each breaker identified by permanent number of identification as to circuit number.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Copper bus with full size neutral.

.6 Mains suitable for bolt-on breakers.

.7 Finish trim and door baked grey enamel, with hinged cover.

.8 Supply two (2) keys for each panelboard and key panelboards alike.

2.2 BREAKERS

.1 Breakers to Section 26 28 16.02 – Moulded Case Circuit Breakers.

.2 Main breaker: separately mounted on top or bottom of the panel to suit the cable entry.

.3 Panelboards shall be supplied with breakers as described on drawings.

2.3 EQUIPMENT IDENTIFICATION

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

.2 Nameplate for each panelboard Size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards Size 2 engraved as indicated.

.4 Complete circuit directory with a type-written legend showing location and load of each circuit.

2.4 MATERIALS

.1 Panelboards to be the product of one manufacturer.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.

.2 Install surface- and recessed-mounted panelboards as indicated. Provide steel channel. Use masonry anchors to attach panelboards to interior wall partitions. Perforated steel channel not acceptable.

.3 Mount panelboards to height given in Section 26 05 00 – Common Work Results for Electrical or as indicated.

.4 Connect loads to circuits as indicated.

.5 All breakers shall be tested and test reports submitted.

3.2 PANELBOARD DIRECTORY SHEETS

.1 Complete a new panelboard directory sheet for each distribution and each branch circuit panelboard.

.2 Panelboard directory sheets are to be completed in English only.

.3 Using a laser jet printer, print all complete electronic panelboard directory sheets and panelboard cards, as described later herein, on quality white bond paper. Provide a sample of the paper and printing process to the Engineer for review and approval.

.4 Use the template format designated for this purpose. Refer to the sample form in this section.

.5 As work progresses, bring any anomalies to the attention of the Engineer and seek written clarification.

.6 The template will be provided to the Contractor in electronic format in MS WORD, or as approved by the Engineer.

.7 Complete all fields of the panelboard directory sheet in typewritten form. Properly centre and align the information entered.

.8 Adjust the template to suit the number of spaces in the panelboard.

.9 Fill in the fields as the information becomes available.

.10 Enter specific descriptive information with regard to the type of device(s), room location(s), etc. Vague terminology is not acceptable.

.11 Enter the information on spare circuit breakers and empty spaces. Differentiate between the two.

.12 Make corrections to the directory sheets as directed by the Engineer where the descriptive information is found to be inadequate.

3.3 PANELBOARD DIRECTORY CARDS

.1 Complete a new directory card for each panelboard in the format shown on the samples in this section.

.2 Panelboard directory cards are to be completed in English only.

.3 The template will be provided to the Contractor in electronic format in MS WORD, or as approved by the Engineer.

.4 Insert a copy of the directory card in a plastic pocket on the inside face of its door, or as applicable, on the face of the branch panels and CDP. Supply and install the plastic pockets of a quality acceptable to the Engineer. Cut the printed panelboard directory sheets to fit in the plastic sleeve.

PANELBOARD DIRECTORY SHEET

PANEL DESIGNATION.....
NUMBER OF POLES.....
SYSTEM VOLTAGE.....
MAINS CAPACITY.....

PANEL LOCATION.....
MOUNTING.....

DESCRIPTION	BREAKER AMP	POLE	NO.		NO.	BREAKER AMP	POLE	LOAD	DESCRIPTION
			1	A	2				
			3	B	4				
			5	C	6				
			7	A	8				
			9	B	10				
			11	C	12				
			13	A	14				
			15	B	16				
			17	C	18				
			19	A	20				
			21	B	22				
			23	C	24				
			25	A	26				
			27	B	28				
			29	C	30				
			31	A	32				
			33	B	34				
			35	C	36				
			37	A	38				
			39	B	40				
			41	C	42				
			43	A	44				
			45	B	46				
			47	C	48				
			49	A	50				
			51	B	52				
			53	C	54				
			55	A	56				
			57	B	58				
			59	C	60				

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

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

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No. 42-99 (R2004), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No. 42.1-00 (R2004), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55- M1986 (R2008), Special Use Switches.

.4 CSA-C22.2 No.111-00 (R2005), General-Use Snap Switches (Bi-national standard, with UL 20), includes Updates No. 2 and No. 3 (2004), Update No. 4 (2008).

1.3 SHOP DRAWINGS

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

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal all packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole, three-way, switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Brown toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA Type 5-15 R, 125 V, 15 A, U ground, with the following features:

.1 Brown nylon-moulded housing. Red colour for all emergency circuits, orange for work stations.

.2 Suitable for No.10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight (8) back-wired entrances, four (4) side-wiring screws.

.5 Triple-wipe contacts and riveted grounding contacts (100% nickel plated).

2.2 COVER PLATES

.1 Cover plates for wiring devices.

.2 Cover plates from one manufacturer throughout the project.

.3 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height in accordance with Section 26 05 00 - Common Work Results for Electrical as indicated.

.2 Receptacles:

.1 Install receptacles in gang-type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at the height specified in Section 26 05 00 – Common Work Results for Electrical.

.3 Cover plates:

.1 Protect the cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 00 10 – General Instructions.

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

.3 Section 26 24 16.01 - Panelboards Breaker Type.

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 00 10 – General Instructions.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No.5-09, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489 and NMX-J-266-ANCE-2010).

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal all packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Provide moulded-case circuit breakers to CSA 22.2 No. 5.

.2 Provide automatic moulded-case circuit breakers in panelboards as indicated on the drawings and herein specified. Breaker sizes and trips as scheduled, or indicated on the one-line diagram.

.3 Use bolt-on moulded-case circuit breakers, quick-make, quick-break type for manual and automatic operation with temperature compensation for 40^{o}C ambient.

.4 Breakers shall be common trips with single handle for multi-pole application.

.5 In panelboards, moulded-case circuit breakers to operate automatically by means of thermal and magnetic-tripping devices to provide inverse time current tripping under overload conditions and instantaneous magnetic tripping for short circuit protection.

.6 Magnetic instantaneous trip elements to operate only when the value of the current reaches 10 to 12 times the breaker trip setting.

.7 Breaker minimum interrupting rating (symmetrical RMS values) shall not be less than indicated in Section 26 24 16.01 – Panelboards Breaker Type.

.8 All breakers used for switching lighting circuits to be CSA approved for the application.

2.2 SOLID STATE TRIP BREAKERS

.1 Moulded case circuit breaker to operate by means of solid state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, long time, short time and instantaneous tripping for phase and ground fault short circuit protection.

.2 Long time pick-up setting is adjustable from 0.5 – 1.0 x In = Ir in increments of 0.01.

.3 Long time delay setting is adjustable from 2 – 24 seconds in 0.1 second increments.

.4 Short time pick-up setting is adjustable from 1.5 – 10 x Ir in increments of 0.1.

.5 Short time delay setting is adjustable from 0.1 – 0.5 seconds in 0.01 second increments.

.6 Instantaneous pick-up setting is adjustable from 2 – 8 x Ir in increments of 0.1.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

3.2 TESTING AND COMMISSIONING

.1 Using the manufacturers proprietary test set check breakers and test to confirm operation within published tolerances and set each breaker in accordance with the co-ordination study.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 00 10 – General Instructions.

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

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA C22.2 No.4-04, Enclosed and Dead Front Switches.

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 00 10 – General Instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instructions.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Engineer

.5 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Non-fusible, horsepower rated, disconnect switch in CSA Enclosure 1, to CSA C22.2 No.4.

.2 Provision for padlocking in on-off switch position by three locks.

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

.4 Quick-make, quick-break action.

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

2.2 EQUIPMENT IDENTIFICATION

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

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

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 00 10 – General Instructions.

.2 Section 26 05 00 – Common Work Results for Electrical.

.3 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.14-05, Industrial Control Equipment. Includes Update No. 3 (2008)

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2000 (R2008), Industrial Control and Systems: General Requirements.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 00 10 – General Instructions.

.2 Include schematic, wiring, interconnection diagrams.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.

.2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by the Engineer.

Part 2 Products

2.1 AC CONTROL RELAYS

.1 Control Relays: to CSA C22.2 No.14 and NEMA ICS 1.

.2 Convertible contact type: contacts field convertible from NO to NC, types as indicated as follows: electrically held; permanent magnet latched; double-voltage type with sliding barrier to permit access to contacts only or coil only; with solid state timer. Coil rating: voltage and burden (VA) as indicated. Contact rating: voltage and current as indicated.

.3 Sealed contact type: electrically held permanent magnet latched with poles and front mounted contact block to provide additional poles. Coil rating: voltage and burden (VA) as indicated. Contact rating: voltage and current as indicated.

.4 Universal pole type: electrically held type with poles, convertible from NO to NC by changing wiring connections. Coil rating: voltage and burden (VA) as indicated. Contact rating: voltage and current as indicated.

.5 Fixed contact plug-in type: general purpose or low coil current heavy duty with multiple poles. Coil rating: voltage and burden (VA) as indicated. Contact rating: voltage and current as indicated.

2.2 RELAY ACCESSORIES

.1 Standard contact cartridges: normally-open - convertible to normally-closed in field.

2.3 SOLID STATE TIMING RELAYS

.1 Construction: AC operated electronic timing relay with solid-state timing circuit to operate output contact. Timing circuit and output contact completely encapsulated to protect against vibration, humidity and atmospheric contaminants.

.2 Operation: on-delay or off-delay.

.3 Potentiometer: self contained to provide time interval adjustment.

.4 Supply voltage: as indicated, AC, 60 Hz.

.5 Temperature range: minus 20 degrees C to 60 degrees C.

.6 Output contact rating: maximum voltage 300 V AC or DC. Current: NEMA ICS 1 – 10 A minimum.

.7 Timing ranges: minimum 0.1 s, maximum 60s.

2.4 INSTANTANEOUS TRIP CURRENT RELAYS

.1 Enclosure: CSA Type 1 or open type in custom or motor control equipment.

.2 Contacts: NO, NC automatic reset with adjustable tripping point.

.3 Control: 3 wire, with provision for shorting contacts during accelerating period of motor.

.4 Contact rating: NEMA ICS 1 – 10 A minimum.

2.5 PUSHBUTTONS

.1 Illuminated, heavy duty oil tight. Operator recessed with 1-NO and 1-NC 120 V contacts rated at 10 A, AC, labels as indicated. Stop pushbuttons coloured red, provision for padlocking in depressed position labelled "stop". Emergency stop with red mushroom head.

2.6 SELECTOR SWITCHES

.1 Maintained 2 or 3 position labelled as indicated; heavy duty oil tight; operator’s standard knob, contact arrangement as indicated, rated 10 V, 120 VA, AC.

2.7 INDICATING LIGHTS

.1 Heavy duty oil tight, transformer LED type, push-to-test, lens colours: as indicated, supply voltage, lamp voltage and V, labels as indicated.

2.8 CONTROL AND RELAY PANELS

.1 CSA Type 1 sheet steel enclosure with hinged padlockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

2.9 CONTROL CIRCUIT TRANSFORMERS

.1 Single phase, dry type.

.2 Primary: 60 Hz ac and secondary voltages as indicated.

.3 Rating: as indicated or required for control circuit burden.

.4 Secondary fuse: select for short circuit protection.

.5 Close voltage regulation as required by magnet coils and solenoid valves.

2.10 TERMINAL STRIPS

.1 For installation in terminal cabinets

.2 Terminals strips to be heavy duty industrial screw-type rated 600 volts, mechanical pressure type with self-locking provision

.3 Material: current carrying parts – copper; phenolic base.

Part 3 Execution

3.1 INSTALLATION

.1 Install pushbutton stations, control and relay panels, control devices and interconnect.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Upon completion of sectional test, undertake group testing.

.4 Check out complete system for operational sequencing.

END OF SECTION