

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 01.

**1.2                ADMINISTRATIVE**

- .1        Submit to Contract Administrator submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2        Do not proceed with Work affected by submittal until review is complete.
- .3        Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4        Where items or information is not produced in SI Metric units converted values are acceptable.
- .5        Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6        Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7        Verify field measurements and affected adjacent Work are co-ordinated.
- .8        Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .9        Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .10      Keep one reviewed copy of each submission on site.

**1.3                SHOP DRAWINGS AND PRODUCT DATA**

- .1        The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2        Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.
- .3        Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4        Allow for review of each submission.

- .5 Adjustments made on shop drawings by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
- .6 Make changes in shop drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, in duplicate, containing:
  - .1 Date.
  - .2 Project title and number.
  - .3 Contractor's name and address.
  - .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
- .8 Submissions include:
  - .1 Date and revision dates.
  - .2 Project title and number.
  - .3 Name and address of:
    - .1 Subcontractor.
    - .2 Supplier.
    - .3 Manufacturer.
  - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
  - .5 Details of appropriate portions of Work as applicable:
    - .1 Fabrication.
    - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
    - .3 Setting or erection details.
    - .4 Capacities.
    - .5 Performance characteristics.
    - .6 Standards.
    - .7 Operating weight.
    - .8 Wiring diagrams.
    - .9 Single line and schematic diagrams.
    - .10 Relationship to adjacent work.
- .9 After Contract Administrator's review, distribute copies.
- .10 Submit electronic copy and 6 print copies of shop drawings for each requirement requested in specification Sections and as Contract Administrator may reasonably request.
- .11 Submit electronic copy and 6 print copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Contract

- Administrator where shop drawings will not be prepared due to standardized manufacture of product.
- .12 Submit electronic copy and 6 print copies of test reports for requirements requested in specification Sections and as requested by Contract Administrator .
  - .13 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
    - .1 Testing must have been within 3 years of date of contract award for project.
  - .14 Submit electronic copy and 6 print copies of certificates for requirements requested in specification Sections and as requested by Contract Administrator.
    - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
    - .2 Certificates must be dated after award of project contract complete with project name.
  - .15 Submit electronic copy and 6 print copies of manufacturers instructions for requirements requested in specification Sections and as requested by Contract Administrator.
    - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
  - .16 Submit electronic copy and 6 print copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Contract Administrator.
  - .17 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
  - .18 Submit electronic copy and 6 print copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Contract Administrator.
  - .19 Delete information not applicable to project.
  - .20 Supplement standard information to provide details applicable to project.
  - .21 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
  - .22 The review of shop drawings by Public Works and Government Services Canada (PSPC) is for sole purpose of ascertaining conformance with general concept.
    - .1 This review shall not mean that PSPC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

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

#### **1.4 SAMPLES**

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to KGS Group at 865 Waverley St., Winnipeg, MB R3T 5P4.
- .3 Notify Contract Administrator in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
- .6 Make changes in samples which Contract Administrator may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

#### **1.5 MOCK-UPS**

- .1 Erect mock-ups in accordance with 01 45 00- Quality Control.

#### **1.6 PHOTOGRAPHIC DOCUMENTATION**

- .1 Submit electronic copy of colour digital photography in jpg format, standard resolution monthly with progress statement.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints:
  - .1 Viewpoints and their location as determined by Contract Administrator.
- .4 Frequency of photographic documentation: as directed by Contract Administrator.

#### **1.7 CERTIFICATES AND TRANSCRIPTS**

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

### **Part 2 Products**

#### **2.1 NOT USED**

- .1 Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1                Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 01.

**1.2                REFERENCE STANDARDS**

- .1            Canadian Construction Documents Committee (CCDC)
  - .1            CCDC 2-94, Stipulated Price Contract.

**1.3                INSPECTION**

- .1            Allow Contract Administrator access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2            Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Contract Administrator, or law of Place of Work.
- .3            If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4            Contract Administrator will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Contract Administrator shall pay cost of examination and replacement.

**1.4                INDEPENDENT INSPECTION AGENCIES**

- .1            Independent Inspection/Testing Agencies will be engaged by Contract Administrator for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Contract Administrator.
- .2            Provide equipment required for executing inspection and testing by appointed agencies.
- .3            Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4            If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Contract Administrator at no cost to Contract Administrator. Pay costs for retesting and reinspection.

**1.5                ACCESS TO WORK**

- .1            Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2            Co-operate to provide reasonable facilities for such access.

**1.6 PROCEDURES**

- .1 Notify appropriate agency and Contract Administrator in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

**1.7 REJECTED WORK**

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Contract Administrator as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Contract Administrator it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, The City will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Contract Administrator.

**1.8 REPORTS**

- .1 Submit 4 copies of inspection and test reports to Contract Administrator.
- .2 Provide copies to subcontractor of work being inspected or tested and/or manufacturer or fabricator of material being inspected or tested.

**1.9 TESTS AND MIX DESIGNS**

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Contract Administrator and may be authorized as recoverable.

**1.10 MOCK-UPS**

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations as specified on drawing acceptable to Contract Administrator.
- .3 Prepare mock-ups for Contract Administrator review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, Contract Administrator will assist in preparing schedule fixing dates for preparation.

- .6 Remove mock-up at conclusion of Work or when acceptable to Contract Administrator.
- .7 Mock-ups may remain as part of Work.
- .8 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

**1.11 MILL TESTS**

- .1 Submit mill test certificates as requested.

**1.12 EQUIPMENT AND SYSTEMS**

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**



**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 01.

**1.2                REFERENCE STANDARDS**

- .1            Canadian Construction Documents Committee (CCDC)
  - .1            CCDC 2-94, Stipulated Price Contract.
- .2            Within text of each specifications section, reference may be made to reference standards.
- .3            Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .4            If there is question as to whether products or systems are in conformance with applicable standards, Contract Administrator reserves right to have such products or systems tested to prove or disprove conformance.
- .5            Cost for such testing will be borne by Contract Administrator in event of conformance with Contract Documents or by Design-Builder in event of non-conformance.

**1.3                QUALITY**

- .1            Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2            Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3            Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4            Should disputes arise as to quality or fitness of products, decision rests strictly with Contract Administrator based upon requirements of Contract Documents.
- .5            Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6            Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

**1.4                AVAILABILITY**

- .1            Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify

Contract Administrator of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

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

### **1.5 STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Contract Administrator.
- .9 Touch-up damaged factory finished surfaces to Contract Administrator satisfaction. Use touch-up materials to match original. Do not paint over name plates.

### **1.6 TRANSPORTATION**

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by The City will be paid for by Contract Administrator. Unload, handle and store such products.

### **1.7 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so Contract Administrator will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, Contract Administrator to require removal and re-installation at no increase in Contract Price or Contract Time.

**1.8 QUALITY OF WORK**

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Contract Administrator if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties. Contract Administrator reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Contract Administrator, whose decision is final.

**1.9 CO-ORDINATION**

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

**1.10 CONCEALMENT**

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

**1.11 REMEDIAL WORK**

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

**1.12 LOCATION OF FIXTURES**

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Contract Administrator of conflicting installation. Install as directed.

**1.13 FASTENINGS**

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

**1.14 FASTENINGS - EQUIPMENT**

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

**1.15 PROTECTION OF WORK IN PROGRESS**

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval Contract Administrator.

**1.16 EXISTING UTILITIES**

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and pedestrian and vehicular traffic and/or building occupants.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 01.

**1.2                REFERENCE STANDARDS**

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

**1.3                ADMINISTRATIVE REQUIREMENTS**

- .1            Pre-warranty Meeting:
  - .1            Convene meeting one week prior to contract completion with Contract Administrator to:
    - .1            Verify Project requirements.
    - .2            Review warranty requirements and manufacturer's installation instructions.
  - .2            Consultant Contract Administrator to establish communication procedures for:
    - .1            Notifying construction warranty defects.
    - .2            Determine priorities for type of defects.
    - .3            Determine reasonable response time.
  - .3            Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
  - .4            Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

**1.4                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2            Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, four final copies of operating and maintenance manuals in English.
- .3            Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4            Provide evidence, if requested, for type, source and quality of products supplied.

**1.5                FORMAT**

- .1            Organize data as instructional manual.
- .2            Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279mm with spine and face pockets.

- .3 When multiple binders are used correlate data into related consistent groupings.
  - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by process flow, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
  - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format on USB.

## **1.6 CONTENTS - PROJECT RECORD DOCUMENTS**

- .1 Table of Contents for Each Volume: provide title of project;
  - .1 Date of submission; names.
  - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
  - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
  - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
  - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00- Quality Control.

## **1.7 AS -BUILT DOCUMENTS AND SAMPLES**

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

- .6 Field test records.
- .7 Inspection certificates.
- .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
  - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
  - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
  - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Contract Administrator.

## **1.8 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS**

- .1 Record information on set of blue lineopaque drawings, and in copy of Project Manual, provided by Contract Administrator.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
  - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
  - .1 Measured depths of elements of foundation in relation to finish first floor datum.
  - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
  - .4 Field changes of dimension and detail.
  - .5 Changes made by change orders.
  - .6 Details not on original Contract Drawings.
  - .7 Referenced Standards to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

**1.9 FINAL SURVEY**

- .1 Submit final site survey certificate, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

**1.10 EQUIPMENT AND SYSTEMS**

- .1 For each item of equipment and each system include description of unit or system, and component parts.
  - .1 Give function, normal operation characteristics and limiting conditions.
  - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
  - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
  - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00- Quality Control.
- .15 Storage tank inspection documentation, registration, forms, decommissioning and removal in accordance with CEPA SOR/2008-197.
- .16 Additional requirements: as specified in individual specification sections.



**1.11 MATERIALS AND FINISHES**

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
  - .1 Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: as specified in individual specifications sections.

**1.12 MAINTENANCE MATERIALS**

- .1 Spare Parts:
  - .1 Provide spare parts, in quantities specified in individual specification sections.
  - .2 Provide items of same manufacture and quality as items in Work.
  - .3 Deliver to site; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Contract Administrator.
    - .2 Include approved listings in Maintenance Manual.
  - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
  - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
  - .2 Provide items of same manufacture and quality as items in Work.
  - .3 Deliver to site; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Contract Administrator.
    - .2 Include approved listings in Maintenance Manual.
  - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
  - .1 Provide special tools, in quantities specified in individual specification section.
  - .2 Provide items with tags identifying their associated function and equipment.
  - .3 Deliver to site; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Contract Administrator.
    - .2 Include approved listings in Maintenance Manual.

**1.13 DELIVERY, STORAGE AND HANDLING**

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Contract Administrator.

**1.14 WARRANTIES AND BONDS**

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30days before planned pre-warranty conference, to Contract Administrator's approval.
- .3 Warranty management plan to include required actions and documents to assure that Contract Administrator receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Contract Administrator for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
  - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
  - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
  - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within [ten]days after completion of applicable item of work.
  - .4 Verify that documents are in proper form, contain full information, and are notarized.
  - .5 Co-execute submittals when required.
  - .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with The City's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Contract Administrator.
- .9 Include information contained in warranty management plan as follows:
  - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
  - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, transformers, HVAC balancing, pumps, and motors.

- .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
  - .1 Name of item.
  - .2 Model and serial numbers.
  - .3 Location where installed.
  - .4 Name and phone numbers of manufacturers or suppliers.
  - .5 Names, addresses and telephone numbers of sources of spare parts.
  - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
  - .7 Cross-reference to warranty certificates as applicable.
  - .8 Starting point and duration of warranty period.
  - .9 Summary of maintenance procedures required to continue warranty in force.
  - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
  - .11 Organization, names and phone numbers of persons to call for warranty service.
  - .12 Typical response time and repair time expected for various warranted equipment.
- .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
- .5 Procedure and status of tagging of equipment covered by extended warranties.
- .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
  - .1 Failure to respond will be cause for the Contract Administrator to proceed with action against Contractor.

**1.15 WARRANTY TAGS**

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Contract Administrator
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
  - .1 Type of product/material.
  - .2 Model number.
  - .3 Serial number.
  - .4 Contract number.

- .5 Warranty period.
- .6 Inspector's signature.
- .7 Construction Contractor.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1    ASTM International
  - .1    ASTM A1064 / A1064M - 16b Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete"
  - .2    ASTM D1751-2013 , Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).
- .2    Canadian General Standards Board (CGSB)
  - .1    CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound.
- .3    CSA International
  - .1    CSA-A23.1/A23.2-2014 , Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2    CSA A3000-13 , Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .3    CAN/CSA-G30.18-M92(R2007) , Billet-Steel Bars for Concrete Reinforcement.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2    Shop Drawings:
  - .1    Submit placing drawings prepared in accordance with plans to clearly show size, shape, location and necessary details of reinforcing.
  - .2    Submit drawings showing formwork and falsework design to: CSA A23.1/A23.2.

**1.3                DELIVERY, STORAGE AND HANDLING**

- .1    Delivery and Acceptance Requirements:
  - .1    Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
- .2    Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

**Part 2            Products**

**2.1                DESIGN CRITERIA**

- .1    Performance : to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

## **2.2 MATERIALS**

- .1 Cement: to CSA A3001, Type GU.
- .2 Blended hydraulic cement: Type GUb to CSA A3001 .
- .3 Supplementary cementing materials: with minimum 20 % Type F fly ash replacement, by mass of total cementitious materials to CSA A3001.
- .4 Water: to CSA A23.1/A23.2 .
- .5 Reinforcing bars: to CAN/CSA-G30.18, Grade 400W .
- .6 Premoulded joint filler:
  - .1 Bituminous impregnated fibreboard: to ASTM D1751 .
- .7 Joint sealer/filler: grey to CAN/CGSB-19.24, Type 1, Class B.

## **2.3 MIXES**

- .1 Alternative 1 - Performance Method for specifying concrete: to meet performance criteria to CSA A23.1/A23.2.
  - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.
  - .2 Provide concrete mix to meet following hard state requirements:
    - .1 Durability and class of exposure: N.
    - .2 Compressive strength at 28 age: 35 MPa minimum.
  - .3 Concrete supplier's certification.
  - .4 Provide quality management plan to ensure verification of concrete quality to specified performance.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Provide the Contract Administrator 24 hours' notice before each concrete pour.
- .2 During concreting operations:
  - .1 Development of cold joints not allowed.
  - .2 Ensure concrete delivery and handling facilitates placing with minimum of rehandling, and without damage to existing structure or Work.
- .3 Protect previous Work from staining.
- .4 Clean and remove stains prior to application of concrete finishes.

### **3.2 INSTALLATION/APPLICATION**

- .1 Do cast-in-place concrete work in accordance with CSA A23.1/A23.2.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 04 05 23 – Masonry Accessories
- .2        Section 04 21 23 – Brick Masonry

**1.2                REFERENCE STANDARDS**

- .1        CSA Group
  - .1        CAN/CSA-A165 Series-04(R2009), CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).
  - .2        CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.
  - .3        CAN/CSA-A371-04(R2009), Masonry Construction for Buildings.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2        Product Data:
  - .1        Submit manufacturer's instructions, printed product literature and data sheets for masonry units and include product characteristics, performance criteria, physical size, finish and limitations.
- .3        Installer Instructions: provide manufacturer's installation instructions, including storage, handling, safety and cleaning.
- .4        Manufacturer's Reports: provide written reports prepared by manufacturer's on-site personnel to include:
  - .1        Verification of compliance of work with Contract.
  - .2        Site visit reports providing detailed review of installation of work, and installed work.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1        Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2        Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3        Storage and Handling Requirements:
  - .1        Store materials indoors, off ground, and in a dry location in accordance with manufacturer's recommendations.
  - .2        Store and protect material from nicks, scratches, and blemishes.
  - .3        Keep materials dry until use except where wetting of bricks is specified.
  - .4        Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.
  - .5        Replace defective or damaged materials with new.

## **1.5 SITE CONDITIONS**

- .1 Ambient Conditions: assemble and erect components when temperatures are above 4 degrees C.
- .2 Weather Requirements: to CAN/CSA-A371 for Cold Weather Masonry Construction.
- .3 Cold weather requirements:
  - .1 To CAN/CSA-A371 with following requirements.
    - .1 Maintain temperature of mortar between 5 degrees C and 50 degrees C until batch is used or becomes stable.
    - .2 Maintain ambient temperature of masonry work and constituent materials between 5 degrees C and 50 degrees C and protect site from wind-chill.
    - .3 Maintain temperature of masonry above 0 degrees C for minimum of 7 days, after mortar is installed.
    - .4 Preheat unheated wall sections in enclosure for minimum 72 hours above 10 degrees C, before applying mortar.
  - .2 Hot weather requirements:
    - .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.
    - .2 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until masonry work is completed and protected by flashings or other permanent construction.
  - .3 Spray mortar surface at intervals and keep moist for maximum of 3 days after installation.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Masonry materials are specified elsewhere in related Sections:
  - .1 Section 04 21 13

## **Part 3 Execution**

### **3.1 INSTALLERS**

- .1 Experienced and qualified masons to carry out erection, assembly and installation of masonry work.

### **3.2 EXAMINATION**

- .1 Examine conditions, substrates and work to receive work of this Section.



- .2 Examine openings to receive masonry units. Verify opening size, location, and that opening is square and plumb, and ready to receive work of this Section.
  - .1 Inform the Contract Administrator of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation after unacceptable conditions have been remedied and after receipt of written approval from the Contract Administrator.
- .3 Verification of Conditions:
  - .1 Verify that:
    - .1 Site conditions are acceptable and are ready to receive work.
    - .2 Built-in items are in proper location, and ready for roughing into masonry work.
  - .2 Commencing installation means acceptance of existing substrates.

### **3.3 PREPARATION**

- .1 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations.
- .2 Establish and protect lines, levels, and coursing.
- .3 Protect adjacent materials from damage and disfiguration.

### **3.4 INSTALLATION**

- .1 Do masonry work in accordance with CAN/CSA-A371 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment, respecting construction tolerances permitted by CAN/CSA-A371.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

### **3.5 CONSTRUCTION**

- .1 Exposed masonry:
  - .1 Remove chipped, cracked, and otherwise damaged units, in accordance with CAN/CSA-A165, in exposed masonry and replace with undamaged units.
- .2 Jointing:
  - .1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.
- .3 Cutting:
  - .1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.
  - .2 Make cuts straight, clean, and free from uneven edges.
- .4 Building-In:
  - .1 Build in items required to be built into masonry.

- .2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
- .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.
- .5 Wetting of bricks:
  - .1 Except in cold weather, wet bricks having initial rate of absorption exceeding 1 g/minute/1000 mm
  - .2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.
- .6 Loose steel lintels:
  - .1 Install loose steel lintels. Center over opening width.
- .7 Interface with other work:
  - .1 Cut openings in existing work as indicated.
  - .2 Openings in walls: reviewed by the Contract Administrator.
  - .3 Make good existing work. Use materials to match existing.

### **3.6 SITE TOLERANCES**

- .1 Tolerances in notes to CAN/CSA-A371 apply.

### **3.7 SITE QUALITY CONTROL**

### **3.8 CLEANING**

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

### **3.9 PROTECTION**

- .1 Temporary Bracing:
  - .1 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.
  - .2 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.
- .2 Moisture Protection:
  - .1 Keep masonry dry using waterproof, non-staining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.
  - .2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 04 05 00 – Common Work Results for Masonry
- .2        Section 04 05 23 – Masonry Accessories
- .3        Section 04 21 13 – Brick Masonry

**1.2                REFERENCE STANDARDS**

- .1        CSA Group
  - .1        CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2        CAN/CSA-A179-04(R2009), Mortar and Grout for Unit Masonry.
  - .3        CAN/CSA-A371-04(R2009), Masonry Construction for Buildings.
  - .4        CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
  - .5        .

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2        Product Data:
  - .1        Submit manufacturer's instructions, printed product literature and data sheets for masonry mortar and grout and include product characteristics, performance criteria, physical size, finish and limitations.
- .3        Manufacturers' Instructions: submit manufacturer's installation instructions.

**1.4                QUALITY ASSURANCE**

- .1        Test Reports: submit certified test reports including sand gradation tests in accordance with CAN/CSA-A179 showing compliance with specified performance characteristics and physical properties, and in accordance with Section 04 05 00- Common Work Results for Masonry.
- .2        Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.5                DELIVERY, STORAGE AND HANDLING**

- .1        Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2        Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

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

## **1.6 SITE CONDITIONS**

- .1 Ambient Conditions: maintain materials and surrounding air temperature to:
  - .1 Minimum 10 degrees C prior to, during, and 48 hours after completion of masonry work.
  - .2 Maximum 32 degrees C prior to, during, and 48 hours after completion of masonry work.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Use same brands of materials and source of aggregate for entire project.

### **2.2 MORTAR MIXES**

- .1 Pre-blended mortar for exterior masonry above grade:
  - .1 Non-Load Bearing: Type S based on proportion specifications.

### **2.3 MORTAR MIXING**

- .1 Use pre-blended, pre-coloured mortar prepackaged under controlled factory conditions. Ingredients batching limitations to be within 1% accuracy.
- .2 Mix mortar ingredients in accordance with CAN/CSA-A179 in quantities needed for immediate use.
- .3 Maintain sand uniformly damp immediately before mixing process.
- .4 Do not add air entraining admixture to mortar mix.
- .5 Use a batch type mixer in accordance with CAN/CSA-A179.
- .6 Re-temper mortar only within two hours of mixing, when water is lost by evaporation.
- .7 Use mortar within 2 hours after mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 10 degrees C.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for masonry installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of the Contract Administrator.

- .2 Inform the Contract Administrator of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Contract Administrator

### **3.2 CONSTRUCTION**

- .1 Do masonry mortar and grout work in accordance with CAN/CSA-A179 except where specified otherwise.

### **3.3 MIXING**

- .1 Clean all mixing boards and mechanical mixing machine between batches.
- .2 Mortar must be weaker than the units it is binding.
- .3 Contractor to appoint one individual to mix mortar, for duration of project. In the event that this individual must be changed, mortar mixing must cease until the new individual is trained, and mortar mix is tested.

### **3.4 MORTAR PLACEMENT**

- .1 Install premix mortar to manufacturer's instructions.
- .2 Install mortar to requirements of CAN/CSA-A179.

### **3.5 CLEANING**

- .1 Progress Cleaning: Leave Work area clean at the end of each day.
- .2 Remove droppings and splashings using clean sponge and water.
- .3 Clean masonry with low pressure clean water and soft natural bristle brush.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

### **3.6 PROTECTION**

- .1 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 04 05 00 – Common Work Results for Masonry
- .2 Section 04 21 13 – Brick Masonry

**1.2 REFERENCE STANDARDS**

- .1 CSA Group
  - .1 CAN/CSA-A371-04(R2009), Masonry Construction for Buildings.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for masonry accessories and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4 QUALITY ASSURANCE**

- .1 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .2 Manufacturer's Instructions: submit manufacturer's instructions as follows:
  - .1 Submit installation instructions for weeps

**1.5 SITE MEASUREMENTS**

- .1 Make site measurements necessary to ensure proper fit of members.

**1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with manufacturer's recommendations in a clean, dry, well-ventilated area.
  - .2 Store and protect masonry accessories from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Brick weep screens:
  - .1 Material: stainless steel (type 304)
  - .2 Provide mesh insect screen
- .2 Ties
  - .1 Adjustable Unit Ties: to CAN/CSA A-370: proprietary type ties, type, style and size to suit the application in accordance with the manufacturer's recommendations.

**Part 3 Execution**

**3.1 EXAMINATION**

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

**3.2 INSTALLATION: MOISTURE CONTROL**

- .1 Install weep hole vents in vertical joints immediately over flashings, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm on centre.
- .2 Mortar diverters: install purpose made diverters in cavities where indicated and as directed, size and shape to suit purpose and function.
- .3 Grout screens: install purpose made diverters in cavities where indicated and as directed, size and shape to suit purpose and function.

**3.3 INSTALLATION: TIES**

- .1 Tie masonry veneer to backing in accordance with the National Building Code of Canada (NBC), CSA S304.1, CAN/CSA A371, and as indicated.

**3.4 CLEANING**

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

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 04 05 00 – Common Work Results for Masonry Work
- .2        Section 04 05 23 – Masonry Accessories

**1.2                REFERENCE STANDARDS**

- .1        ASTM International
  - .1        ASTM C216-13, Standard Specification for, Facing Brick (Solid Masonry Units Made of Clay or Shale).
- .2        Brick Industry Association (BIA)
  - .1        Technical Note No. 20-2006, Cleaning Brick Work.
- .3        CSA Group
  - .1        CAN/CSA-A82-06(R2011), Fired Masonry Brick Made From Clay or Shale.
  - .2        CAN/CSA-A371-04(R2009), Masonry Construction for Buildings.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1        Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2        Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3        Storage and Handling Requirements:
  - .1        Store materials off ground, in accordance with manufacturer's recommendations.
  - .2        Store and protect brick masonry from nicks, scratches, and blemishes.
  - .3        Replace defective or damaged materials with new.

**1.5                SITE CONDITIONS**

- .1        Ambient Conditions: assemble and erect components only when temperature is above 4 degrees C.



**Part 2 Products**

**2.1 MANUFACTURED UNITS**

- .1 Face brick:
  - .1 Fired clay brick: to CAN/CSA-A82.
    - .1 Type: X.
    - .2 Grade: EG.
    - .3 Size: 102 x 203 x 68 (4" x 8" x 2-2/3")
    - .4 Colour and texture: to match existing.
    - .5 Hollow
  - .2 Connectors:
    - .1 Connectors in accordance with Section 04 05 19- Masonry Anchorage and Reinforcing.
  - .3 Mortar Mixes:
    - .1 Mortar and mortar mixes in accordance with Section 04 05 12- Masonry Mortar and Grout.
  - .4 Grout Mixes:
    - .1 Grout and grout mixes in accordance with Section 04 05 12- Masonry Mortar and Grout.
  - .5 Cleaning Compounds:
    - .1 Compatible with substrate and acceptable to masonry manufacturer for use on products.
    - .2 Cleaning compounds compatible with brick masonry units and in accordance with manufacturer's written recommendations and instructions.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for brick masonry installation in accordance with manufacturer's written instructions.
  - .1 Inform the Contract Administrator of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed the Contract Administrator.

**3.2 PREPARATION**

- .1 Protect adjacent finished materials from damage due to masonry work.

**3.3 INSTALLATION**

- .1 Construction to conform to CAN/CSA-A371.

- .2 Bond: stretcher.
- .3 Jointing: concave where exposed or where paint or similar thin finish coating is specified.
  - .1 Mixing and blending: mix units within each pallet and with other pallets to ensure uniform blend of colour and texture.
  - .2 Clean unglazed clay masonry as work progresses.
  - .3 Mortar Placement:
    - .1 Place mortar in accordance with Section 04 05 12- Masonry Mortar and Grout.
  - .4 Grout Placement:
    - .1 Place grout in accordance with Section 04 05 12- Masonry Mortar and Grout.
  - .5 Repair/Restoration:
    - .1 Upon completion of masonry, fill holes and cracks, remove loose mortar and repair defective work.
  - .6 Tolerances:
    - .1 To CAN/CSA-A371 unless noted below.

### **3.4 CLEANING**

- .1 Progress Cleaning: leave Work area clean at end of each day.
- .2 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

### **3.5 PROTECTION**

- .1 Brace and protect brick masonry in accordance with Section 04 05 00- Common Work Results for Masonry.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 ASTM International
  - .1 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A653/A653M-09a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
- .3 CSA International
  - .1 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel Structures.
  - .2 CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum.
  - .3 CSA W59-M03(R2008), Welded Steel Construction (Metal Arc Welding) Metric.
  - .4 CAN/CSA S136-07, North American Specification for the Design of Cold Formed Steel Structural Members.
- .4 Canadian Sheet Steel Building Institute (CSSBI)
  - .1 CSSBI 50M-06, Lightweight Steel Framing Manual.
  - .2 CSSBI Fact Sheet #3 June 1994, Care and Maintenance of Prefinished Sheet Steel Building Products.
  - .3 CSSBI Technical Bulletin Vol. 7, No. 2 February 2004, Changing Standard Thicknesses for Canadian Lightweight Steel Framing Applications.
  - .4 CSSBI S5-04, Guide Specification for Wind Bearing Steel Studs.
- .5 Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - current edition.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
  - .1
- .2 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.
  - .2 Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.
  - .3 Indicate locations, dimensions, openings and requirements of related work.

- .4 Indicate welds by welding symbols as defined in CSA W59.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with the manufacturer's recommendations.
  - .2 Store and protect structural metal studs from nicks, scratches, and blemishes.
  - .3 Protect steel studs during transportation, site storage and installation in accordance with CSSBI Sheet Steel Facts #3.
  - .4 Handle and protect galvanized materials from damage to zinc coating.
  - .5 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Steel: to CAN/CSA S136, fabricated from ASTM A653/A653M, Grade 340 steel.
- .2 Zinc coated steel sheet: quality to ASTM A653/A653M, with Z180 designation coating.
- .3 Welding materials: to CSAW59 and certified by Canadian Welding Bureau.
- .4 Screws: low profile head, self-drilling, self-tapping sheet metal screws, corrosion protected with minimum zinc coating thickness of 0.008 mm, with lengths as required to obtain a minimum of two flights of tap.
- .5 Anchors: concrete expansion anchors or other suitable drilled type fasteners.
- .6 Bolts, nuts, washers: hot dipped galvanized to ASTM A123/A123M, 380 600 g/m<sup>2</sup> zinc coating.
- .7 Touch up primer: zinc rich, to CAN/CGSB-1.181.

### **2.2 METAL FRAMING**

- .1 Steel studs: to CAN/CSA S136, fabricated from metallic coated steel, depth as indicated.
  - .1 Minimum steel thickness of 1.09 mm.
- .2 Stud tracks: fabricated from same material and finish as steel studs, depth to suit.
  - .1 Bottom track: single piece.
- .3 Bridging: fabricated from same material and finish as studs, 38 x 12 x 1.09 mm minimum thickness.
- .4 Angle clips: fabricated from same material and finish as studs, 38 x 38 mm x depth of steel stud, 1.37 mm minimum thickness.
- .5 Tension straps and accessories: as recommended by manufacturer.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for precast concrete installation in accordance with manufacturer's written instructions.
  - .1 Inform the Contract Administrator of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed the Contract Administrator

**3.2 GENERAL**

- .1 Weld in accordance with CSA W59.
- .2 Certification of companies: to CSA W47.1 for fusion welding, CSA W55.3 for resistance welding.
- .3 Do structural metal stud framing work to CSSBI S5.

**3.3 ERECTION**

- .1 Erect components to requirements of reviewed shop drawings.
- .2 Anchor tracks securely to structure at 400 mm on centre maximum, unless lesser spacing prescribed on shop drawings.
- .3 Erect studs plumb, aligned and welded in accordance with manufacturer's recommendations
- .4 Seat studs into bottom tracks.
- .5 Install studs at not more than 50 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.
- .6 Brace steel studs with horizontal internal bridging at 1000mm on centre.
  - .1 Fasten bridging to steel clips fastened to steel studs with screws or by welding.
- .7 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on shop drawings.
- .8 Touch up welds with coat of zinc rich primer.

**3.4 ERECTION TOLERANCES**

- .1 Plumb: not to exceed 1/500th of member length.
- .2 Camber: not to exceed 1/1000th of member length.
- .3 Spacing: not more than +/- 3 mm from design spacing.
- .4 Gap between end of stud and track web: not more than 4 mm.

**3.5 CUTOUTS**

- .1 Maximum size of cutouts for services as follows:

Member Depth	Across Member Depth	Along Member Length	Centre to Centre Spacing (mm)
92	40 max.	105 max.	600 min.

- .2 Limit distance from centerline of last unreinforced cutout to end of member to less than 300 mm.

### **3.6 CLEANING**

- .1 Progress Cleaning: Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

### **3.7 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by structural metal stud installation.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 CSA International
  - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
  - .2 CSA O121-08, Douglas Fir Plywood.
  - .3 CSA O141-05(R2009), Softwood Lumber.
  - .4 CSA O151-09, Canadian Softwood Plywood.
  - .5 CAN/CSA-O325.0-07, Construction Sheathing.
  - .6 CAN/CSA-Z809-08, Sustainable Forest Management.
- .2 Forest Stewardship Council (FSC)
  - .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .3 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber 2014.
- .4 Sustainable Forestry Initiative (SFI)
  - .1 SFI-2010-2014 Standard.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3 QUALITY ASSURANCE**

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards.
- .3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect wood.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
  - .1 CAN/CSA-O141.
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
  - .3 CAN/CSA-Z809 or FSC or SFI certified.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:
  - .1 Board sizes: "Standard" or better grade.
  - .2 Dimension sizes: "Standard" light framing or better grade.
- .3 Panel Materials:
  - .1 Douglas fir plywood (DFP): to CSA O121, standard construction.
    - .1 Urea-formaldehyde free.
  - .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
    - .1 Urea-formaldehyde free.
  - .3 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.
    - .1 Urea-formaldehyde free.

### **2.2 ACCESSORIES**

- .1 Fasteners: to CAN/CSA-G164, for interior highly humid areas, pressure- preservative, treated lumber.
- .2 Nails, spikes and staples: to CSA B111.
- .3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that existing conditions of substrates are acceptable for rough carpentry installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 PREPARATION**

- .1 Treat surfaces of material with wood preservative, before installation.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and 1 minute soak on plywood.



- .3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .4 Treat material as follows :
  - .1 Wood curbs, nailers, sleepers on roof deck.

### **3.3 INSTALLATION**

- .1 Comply with requirements of NBC, supplemented by the following paragraphs.
- .2 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, and other work as required.
- .3 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized fasteners.
- .6 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.
- .7 Install sleepers as indicated.
- .8 Use caution when working with particle board. Use dust collectors and high quality respirator masks.
- .9 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .10 Countersink bolts where necessary to provide clearance for other work.

### **3.4 CLEANING**

- .1 Progress Cleaning: Leave Work area clean at the end of each day.
  - .1
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 ASTM International
  - .1 ASTM C553-13, Standard Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
- .2 CSA Group
  - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S604-2012, Standard for Factory-Built Type A Chimneys.
  - .2 CAN/ULC-S702-2012, Standard for Mineral Fibre Insulation for Buildings.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

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

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store all materials in accordance with the manufacturer's recommendations.
  - .2 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 INSULATION**

- .1 Batt and blanket mineral fibre: to ASTM C553
  - .1 New Electrical Room Walls
    - .1 Type: 1.
    - .2 Thickness: 92 mm
  - .2 New Electrical Room Ceiling
    - .1 Type: 1.
    - .2 Thickness: 203 mm
  - .3 Existing wall patches

## **2.2 ACCESSORIES**

- .1 Insulation clips:
  - .1 Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self-locking type.
- .2 Nails: galvanized steel, length to suit insulation plus 25 mm, to CSA B111.
- .3 Tape: as recommended by manufacturer.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for blanket insulation application in accordance with manufacturer's written instructions.
  - .1 Inform the Contract Administrator of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Contract Administrator.

### **3.2 INSULATION INSTALLATION**

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C1320.
- .2 Install insulation with factory applied vapour barrier facing warm side of building spaces and vapour permeable membrane facing cold side. Lap ends and side flanges of membrane over framing members. Retain in position with staples, insulation clips installed as recommended by manufacturer. Tape seal butt ends and lapped side flanges. Do not tear or cut vapour barrier.
- .3 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .4 Do not compress insulation to fit into spaces.
- .5 Keep insulation minimum 75 mm from heat emitting devices.
- .6 Do not enclose insulation until it has been inspected and approved the Contract Administrator.

### **3.3 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A653/A653M-06a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM B749-03, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
  - .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
  - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.
  - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.
- .5 National Fire Protection Association (NFPA)
  - .1 NFPA 80-99, Standard for Fire Doors and Fire Windows.
  - .2 NFPA 252-03, Standard Methods of Fire Tests of Door Assemblies.
- .6 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .2 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
  - .3 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
  - .4 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.
  - .5 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

**1.2 SYSTEM DESCRIPTION**

- .1 Design Requirements:
  - .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.

- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Provide shop drawings: in accordance with Section 01 33 00- Submittal Procedures.
  - .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, arrangement of hardware and finishes.
  - .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing, and finishes.
  - .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with the door manufacturer's recommendations.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, and minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

### **2.2 DOOR CORE MATERIALS**

- .1 Stiffened: face sheets welded, insulated core.
  - .1 Polyurethane: to CAN/ULC-S704 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m<sup>3</sup>.

### **2.3 ADHESIVES**

- .1 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

### **2.4 PRIMER**

- .1 Touch-up primer CAN/CGSB-1.181.
  - .1 Maximum VOC limit 50 g/L to GC-03.

## **2.5 PAINT**

- .1 Field paint steel doors and frames in accordance with Section 09 91 13- Exterior Painting. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.
  - .1 Maximum VOC emission level 50 g/L .

## **2.6 ACCESSORIES**

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Top and bottom caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma steel.
- .3 Metallic paste filler: to manufacturer's standard.

## **2.7 FRAMES FABRICATION GENERAL**

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior frames: 1.6mm thermally broken type construction.
- .4 Blank, reinforce, drill and tap frames for mortised, templated hardware, using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .5 Protect mortised cutouts with steel guard boxes.
- .6 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .7 Manufacturer's nameplates on frames and screens are not permitted.
- .8 Conceal fastenings except where exposed fastenings are indicated.
- .9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .10 Insulate exterior frame components with polyurethane insulation.

## **2.8 FRAME ANCHORAGE**

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

## **2.9 FRAMES: WELDED TYPE**

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

#### **2.10 DOOR FABRICATION GENERAL**

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Exterior doors: hollow steel construction.
- .3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .4 Blank, reinforce, drill doors and tap for mortised, templated hardware.
- .5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .6 Reinforce doors where required, for surface mounted hardware. Provide flush top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .8 Manufacturer's nameplates on doors are not permitted.

#### **2.11 HOLLOW STEEL CONSTRUCTION**

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel.
- .2 Reinforce doors with vertical stiffeners, securely laminated to face sheets at 150 mm on centre maximum.
- .3 Fill voids between stiffeners of exterior doors with polyurethane core.

#### **2.12 THERMALLY BROKEN DOORS AND FRAMES**

- .1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.
- .2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
- .4 Apply insulation.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 INSTALLATION GENERAL**

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

**3.3 FRAME INSTALLATION**

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.
- .6 Maintain continuity of air barrier.

**3.4 DOOR INSTALLATION**

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00- Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
  - .1 Hinge side: 1.0 mm.
  - .2 Latchside and head: 1.5 mm.
  - .3 Finished floor, and thresholds 13 mm.
- .3 Adjust operable parts for correct function.

**3.5 FINISH REPAIRS**

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).
  - .1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-69.17, Bored and Preassembled Locks and Latches.
  - .2 CAN/CGSB-69.18/ANSI/BHMA A156.1, Butts and Hinges.
  - .3 CAN/CGSB-69.19/ANSI/BHMA A156.3, Exit Devices.
  - .4 CAN/CGSB-69.20/ANSI/BHMA A156.4, Door Controls (Closers).
  - .5 CAN/CGSB-69.22/ANSI/BHMA A156.6, Architectural Door Trim.
  - .6 CAN/CGSB-69.24/ANSI/BHMA A156.8, Door Controls - Overhead Holders.
  - .7 CAN/CGSB-69.26/ANSI/BHMA A156.10, Power-operated Pedestrian Doors.
  - .8 CAN/CGSB-69.28/ANSI/BHMA A156.12, Interconnected Locks and Latches.
  - .9 CAN/CGSB-69.29/ANSI/BHMA A156.13, Mortise Locks and Latches.
  - .10 CAN/CGSB-69.30/ANSI/BHMA A156.14, Sliding and Folding Door Hardware.
  - .11 CAN/CGSB-69.31/ANSI/BHMA A156.15, Closer/Holder Release Device.
  - .12 CAN/CGSB-69.32/ANSI/BHMA A156.16, Auxiliary Hardware.
  - .13 CAN/CGSB-69.34/ANSI/BHMA A156.18, Materials and Finishes.
  - .14 CAN/CGSB-69.36/ANSI/BHMA A156.20, Strap and Tee Hinges and Hasps.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Hardware List:
  - .1 Submit contract hardware list.
  - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .4 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .5 Manufacturer's Instructions: submit manufacturer's installation instructions.

**1.3 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Extra Stock Materials:
  - .1 Supply maintenance materials.
  - .2 Tools:
    - .1 Supply 2 sets of wrenches for locksets.

**1.4 QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with the manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
  - .1 Store and protect door hardware from nicks, scratches, and blemishes.
  - .2 Protect prefinished surfaces with wrapping.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 HARDWARE ITEMS**

- .1 Use one manufacturer's products only for similar items unless noted otherwise.

**2.2 DOOR HARDWARE**

- .1 Hardware Items

.1	Hinges	CB1960 114 x 102 NRP	630	Stanley
.2	Rim Exit Device	2100 x 217F	626	Yale
.3	Weatherstrip	W50		Crowder
.4	Sweep seals	W13S		Crowder
.5	Threshold	CT10		Crowder
.6	Door stop/holder	100H Series	630	Glynn Johnson
- .2 Provide exit device with Medeco cylinder keyed to City of Winnipeg requirements. The City will provide lock number before keying.

- .3 Butts and hinges:
  - .1 Butts and hinges: to CAN/CGSB-69.18, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
- .4 Exit devices: to CAN/CGSB-69.19.
- .5 Door Closers and Accessories:
  - .1 Door controls (closers): to CAN/CGSB-69.20, designated by letter C and numeral identifiers listed in Hardware Schedule, size in accordance with CAN/CGSB-69.20, table A1.
  - .2 Door controls - overhead holders: to CAN/CGSB-69.24, designated by letter C and numeral identifiers listed in Hardware Schedule.
  - .3 Closer/holder release devices: to CAN/CGSB-69.31, designated by letter C and numeral identifiers listed in hardware schedule.
  - .4 Power-operated pedestrian doors: to CAN/CGSB-69.26.
  - .5 Power assist and low energy power operated doors: to CAN/CGSB-69.35.
- .6 Auxiliary locks and associated products: to CAN/CGSB-69.21, designated by letter E and numeral identifiers listed in Hardware Schedule.
- .7 Architectural door trim: to CAN/CGSB-69.22, designated by letter J and numeral identifiers listed in Hardware Schedule.
  - .1 Door protection plates: kick plate, 1.27 mm thick stainless steel.

## **2.3 FASTENINGS**

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

## **2.4 KEYING**

- .1 Provide door with Medeco cylinder master keyed to City of Winnipeg requirements. The City will provide lock number before keying.
- .2 Stamp keying code numbers on keys and cylinders.
- .3 Provide construction cores.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Furnish manufacturers' instructions for proper installation of each hardware component.

**3.2 INSTALLATION**

- .1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.
- .2 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .3 Install key control cabinet.
- .4 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .5 Remove construction cores when directed by Contract Administrator; install permanent cores and check operation of locks.

**3.3 ADJUSTING**

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to provide tight fit at contact points with frames.

**3.4 CLEANING**

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
- .3 Remove protective material from hardware items where present.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 Master Painters Institute (MPI)
  - .1 Architectural Painting Specification Manual - current edition.
  - .2 Standard GPS-1-12, MPI Green Performance Standard.
  - .3 Standard GPS-2-12, MPI Green Performance Standard.
- .3 Society for Protective Coatings (SSPC)
  - .1 Systems and Specifications, SSPC Painting Manual 2011.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product Data:
  - .1 Confirm products to be used are in MPI's approved product list.
  - .2 Upon completion, provide records of products used. List products in relation to finish system and include the following:
    - .1 Product name, type and use.
    - .2 Manufacturer's product number.
    - .3 Colour number.
    - .4 MPI Environmentally Friendly classification system rating.
    - .5 Manufacturer's Material Safety Data Sheets (MSDS).

**1.3                QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Contractor: to have a minimum of 5 years proven satisfactory experience. When requested, provide list of last 3 comparable jobs including, job name and location, specifying authority, and project manager.
  - .2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work
  - .3 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.
  - .4 Conform to latest MPI requirements for exterior painting work including preparation and priming.
  - .5 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.
  - .6 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by the Contract Administrator.

- .7 Standard of Acceptance:
  - .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
  - .2 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .1 Labels: to indicate:
    - .1 Type of paint or coating.
    - .2 Compliance with applicable standard.
    - .3 Colour number in accordance with established colour schedule.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors and in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area.
  - .2 Observe manufacturer's recommendations for storage and handling.
  - .3 Store materials and supplies away from heat generating devices.
  - .4 Store materials and equipment in well ventilated area with temperature range 7degrees C to 30degrees C.
  - .5 Remove paint materials from storage only in quantities required for same day use.
  - .6 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
  - .7 Replace defective or damaged materials with new.

#### **1.5 SITE CONDITIONS**

- .1 Ambient Conditions:
  - .1 Heating, Ventilation and Lighting:
    - .1 Ventilate enclosed spaces
    - .2 Do not perform painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
    - .3 Where required, provide continuous ventilation for seven days after completion of application of paint.
    - .4 Co-ordinate use of existing ventilation system with the Contract Administrator and ensure its operation during and after application of paint as required.

- .5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.
- .6 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities to be provided by General Contractor.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
  - .1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting work when:
    - .1 Ambient air and substrate temperatures are below 10 degrees C.
    - .2 Substrate temperature is over 32 degrees C unless paint is specifically formulated for application at high temperatures.
    - .3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
    - .4 Relative humidity is above 85% or when dew point is less than 3 degrees C variance between air/surface temperatures.
    - .5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.
  - .2 Perform no painting work when maximum moisture content of substrate exceeds:
    - .1 12% for concrete and masonry (clay and concrete brick/block).
    - .2 15% for hard wood.
    - .3 17% for soft wood.
    - .4 12% for plaster and gypsum board.
  - .3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".
  - .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Application Requirements:
  - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
  - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.
  - .3 Apply paint when previous coat of paint is dry or adequately cured.
  - .4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.
  - .5 Do not apply paint when:
    - .1 Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.
    - .2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.

- .3 Surface to be painted is wet, damp or frosted.
- .6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.
- .7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.
- .8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Only paint materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Paint materials for paint systems: to be products of single manufacturer.
- .3 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, to be as follows:
  - .1 Be water clean-up.
  - .2 Be biodegradable and non-flammable.
  - .3 Be manufactured without compounds which contribute to ozone depletion in upper atmosphere.
- .4 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising there from, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).
- .5 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .6 Water-borne surface coatings and recycled water-borne surface coatings must have flash point of 61.0 degrees C or greater.
- .7 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.
  - .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
  - .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
  - .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.



## 2.2 COLOURS

- .1 Submit proposed Colour Schedule to the Contract Administrator.
- .2 Where specific products are available in restricted range of colours, selection will be based on limited range.

## 2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with the Contract Administrator's written permission.
- .2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.
- .3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or organic solvents to thin water-based paints.
- .4 Thin paint for spraying according in accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer.
- .5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.
- .6 Deep and ultra deep colors; 4 coats may be required.

## 2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss: defined as sheen rating of applied paint, in accordance with following values:

Gloss Level Category/	Units @ 60 Degrees/	Units @ 85 Degrees/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	85	

- .2 Gloss level ratings of painted surfaces as specified.

## 2.5 EXTERIOR PAINTING SYSTEMS

- .1 Concrete Horizontal Surfaces: Existing Electrical Room Concrete Floor
  - .1 EXT 3.2A - Latex floor paint low gloss finish.
- .2 Clay Masonry Units: (pressed and extruded brick)
  - .1 EXT 4.1A - Latex (over alkali-resistant primer), finish to match existing.
- .1 Galvanized Metal: not chromate passivated – Exterior Doors and Frame
  - .1 EXT 5.3D - Polyurethane, Pigmented finish (over vinyl wash and epoxy primer)

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 GENERAL**

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

**3.3 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable to be painted in accordance with manufacturer's written instructions:
  - .1 Inform the Contract Administrator of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from the Contract Administrator.

**3.4 PREPARATION**

- .1 Perform preparation and operations for exterior painting in accordance with MPI Maintenance Repainting Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.
- .3 Clean and prepare exterior surfaces to be repainted in accordance with MPI Maintenance Repainting Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:
  - .1 Remove dust, dirt, and surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
  - .2 Wash surfaces with a biodegradable degreasing detergents and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
  - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
  - .4 Allow surfaces to drain completely and allow to dry thoroughly. Allow sufficient drying time and test surfaces using electronic moisture meter before commencing work.
  - .5 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.
  - .6 Many water-based paints cannot be removed with water once dried. Minimize use of kerosene or such organic solvents to clean up water-based paints.

- .4 Clean metal surfaces to be repainted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements. Remove such contaminants from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.
- .5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .6 Do not apply paint until prepared surfaces have been accepted.
- .7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

### **3.5 PROTECTION**

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by the Contract Administrator
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Remove light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Store items and re-install after painting is completed.
- .5 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

### **3.6 APPLICATION**

- .1 Brush and Roller Application:
- .2 Spray Application:
  - .1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
  - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
  - .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
  - .4 Brush out immediately runs and sags.
  - .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
  - .6 Wood, stucco, concrete, cement masonry units CMU's and brick; if sprayed, must be back rolled.
- .3 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access.

- .4 Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .6 Sand and dust between coats to remove visible defects.
- .7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.
- .8 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

### **3.7 FIELD QUALITY CONTROL**

- .1 Standard of Acceptance:
  - .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
  - .2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
  - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.
- .2 Cooperate with inspection firm and provide access to areas of work.
- .3 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements if requested by the Contract Administrator.

### **3.8 CLEANING**

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

### **3.9 RESTORATION**

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 Master Painters Institute (MPI)
  - .1 MPI Architectural Painting Specifications Manual.
- .3 National Fire Code of Canada
- .4 Society for Protective Coatings (SSPC)
  - .1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
  - .1 Submit product data and instructions for each paint and coating product to be used.
  - .2 Submit product data for the use and application of paint thinner.
- .3 Samples:
  - .1 Submit full range colour sample chips to indicate where colour availability is restricted.
  - .2 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

**1.3                DELIVERY, STORAGE AND HANDLING**

- .1 Acceptance at Site:
  - .1 Identify products and materials with labels indicating:
    - .1 Manufacturer's name and address.
    - .2 Type of paint or coating.
    - .3 Compliance with applicable standard.
    - .4 Colour number in accordance with established colour schedule.
- .2 Remove damaged, opened and rejected materials from site.
- .3 Storage and Protection:
  - .1 Provide and maintain dry, temperature controlled, secure storage.
  - .2 Store materials and supplies away from heat generating devices.
- .4 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

## **1.4 SITE CONDITIONS**

- .1 Heating, Ventilation and Lighting:
  - .1 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.
  - .2 Provide continuous ventilation for seven days after completion of application of paint.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
  - .1 Unless pre-approved written approval by Contract Administrator and product manufacturer, perform no painting when:
    - .1 Ambient air and substrate temperatures are below 10 degrees C.
    - .2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.
    - .3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.
    - .4 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.
- .3 Surface and Environmental Conditions:
  - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
  - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
  - .3 Apply paint when previous coat of paint is dry or adequately cured.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Provide paint materials for paint systems from single manufacturer.
- .3 Conform to latest MPI requirements for interior painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
- .5 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

- .6 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

## 2.2 COLOURS

- .1 Contract Administrator will provide Colour Schedule as follows:
  - .1 Interior plywood walls and ceilings – Off White.

## 2.3 GLOSS/SHEEN RATINGS

- .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

- .2 Gloss level ratings of painted surfaces as indicated.

## 2.4 INTERIOR PAINTING SYSTEMS

- .1 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.
  - .1 INT 5.3B - Waterborne light industrial semi-gloss coating.
- .2 Wood paneling and casework: partitions, panels, shelving, millwork:
  - .1 INT 6.4B - Alkyd semi-gloss finish (over alkyd sealer).

## Part 3 Execution

### 3.1 MANUFACTURER'S INSTRUCTIONS

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

### 3.2 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

### **3.3 EXAMINATION**

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
  - .1 Stucco, plaster and gypsum board: 12%.
  - .2 Concrete: 12%.
  - .3 Clay and Concrete Block/Brick: 12%.
  - .4 Wood: 15%.

### **3.4 PREPARATION**

- .1 Protection:
  - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces.
  - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
  - .3 Protect factory finished products and equipment.
- .2 Surface Preparation:
  - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
  - .3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements.
  - .4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
  - .5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by blowing with clean dry compressed air or vacuum cleaning.
  - .6 Touch up of shop primers with primer as specified.

### **3.5 APPLICATION**

- .1 Apply paint by brush, roller, air sprayer or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.



- .2 Brush and Roller Application:
  - .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
  - .2 Work paint into cracks, crevices and corners.
  - .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
  - .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
  - .5 Remove runs, sags and brush marks from finished work and repaint.
  
- .3 Spray application:
  - .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
  - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
  - .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
  - .4 Brush out immediately all runs and sags.
  - .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.
  
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
  
- .5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
  
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
  
- .7 Sand and dust between coats to remove visible defects.
  
- .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
  
- .9 Finish inside of cupboards and cabinets as specified for outside surfaces.
  
- .10 Finish closets and alcoves as specified for adjoining rooms.
  
- .11 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

### **3.6 MECHANICAL/ELECTRICAL EQUIPMENT**

- .1 Do not paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment unless noted otherwise. Leave in original finish.

**3.7 SITE TOLERANCES**

- .1 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

**3.8 RESTORATION**

- .1 Clean and re-install hardware items removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

.1 Section Includes:

- .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

**1.2 REFERENCES**

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

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

- .1 ASTM A 480/A 480M-03c, Standard Specification for General Requirements for Flat- Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .2 ASTM A 635/A 635M-02, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
- .3 ASTM A 653/A 653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 National Fire Protection Association (NFPA).

- .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
- .2 NFPA 90B-02, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

- .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.
- .2 SMACNA HVAC Air Duct Leakage Test Manual

**1.3 SUBMITTALS**

.1 Submit Shop Drawings and product data in accordance with submittal procedures.

.2 Product Data: submit WHMIS MSDS - for the following:

- .1 Sealants
- .2 Tape
- .3 Proprietary Joints

**1.4 QUALITY ASSURANCE**

- .1 Certification of Ratings:
- .2 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Protect on Site stored or installed absorptive material from moisture damage.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling.
  - .2 Remove from Site and dispose of packaging materials at appropriate recycling facilities.
  - .3 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.

**Part 2 Products**

**2.1 SEAL CLASSIFICATION**

- .1 Classification as follows:

<u>Maximum Pressure Pa</u>	<u>SMACNA Seal Class</u>
500	C
250	C
125	C
125	Unsealed

- .2 Seal classification:
  - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
  - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.
  - .3 Class C: transverse joints and connections made air tight with gaskets sealant tape or combination thereof. Longitudinal seams unsealed.
  - .4 Unsealed seams and joints.

**2.2 SEALANT**

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of -30°C to 93°C.

**2.3 TAPE**

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

**2.4 DUCT LEAKAGE**

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

**2.5 FITTINGS**

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
  - .1 Rectangular: Centreline radius: 1.5 times width of duct.
  - .2 Round: five piece. Centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
  - .1 To 400 mm: with single thickness turning vanes.
  - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
  - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch.
  - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
  - .3 Provide volume control damper in branch duct near connection to main duct.
  - .4 Main duct branches: with splitter damper.
- .5 Transitions:
  - .1 Diverging: 20 degrees maximum included angle.
  - .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
  - .1 Full short radiused elbows as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
  - .1 Maximum included angles: as for transitions.

**2.6 FIRE STOPPING**

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 - Firestopping.
- .2 Fire stopping material and installation must not distort duct.

**2.7 GALVANIZED STEEL**

- .1 Lock forming quality: to ASTM A 653/A 653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to ASHRAE SMACNA.
- .3 Joints: to ASHRAE SMACNA.

**2.8 STAINLESS STEEL**

- .1 To ASTM A 480/A 480M, Type 304.
- .2 Finish: No. 4.
- .3 Thickness, fabrication and reinforcement: to ASHRAE SMACNA or as indicated.
- .4 Joints: to ASHRAE and SMACNA be continuous inert gas welded.

**2.9 ALUMINUM**

- .1 To ASHRAE and SMACNA. Aluminum type: 3003-H-14.
- .2 Thickness, fabrication and reinforcement: to ASHRAE SMACNA or as indicated.
- .3 Joints: to ASHRAE SMACNA be continuous weld.

**2.10 HANGERS AND SUPPORTS**

- .1 Hangers and Supports: in accordance with Hangers and Supports for HVAC Piping and Equipment.
  - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
    - .1 Maximum size duct supported by strap hanger: 500.
- .2 Hanger configuration: to ASHRAE and SMACNA.
- .3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA.

<u>Duct Size</u> (mm)	<u>Angle Size</u> (mm)	<u>Rod Size</u> (mm)
up to 750	25 x 25 x 3	6
51 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
  - .1 For concrete: manufactured concrete inserts.
  - .2 For steel joist: manufactured joist clampsteel plate washer.
  - .3 For steel beams: manufactured beam clamps:

### **Part 3 Execution**

#### **3.1 GENERAL**

- .1 Do work in accordance with NFPA 90A NFPA 90B ASHRAE SMACNA as indicated.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .3 Insulate strap hangers 100 mm beyond insulated duct. Ensure diffuser is fully seated.
- .4 Support risers in accordance with ASHRAE SMACNA as indicated.
- .5 Install breakaway joints in ductwork on sides of fire separation.
- .6 Install proprietary manufactured flanged duct joints in accordance with Manufacturer's instructions.
- .7 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

#### **3.2 HANGERS**

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with ASHRAE SMACNA.

#### **3.3 WATERTIGHT DUCT**

- .1 Form bottom of horizontal duct without longitudinal seams.
  - .1 Solder or weld joints of bottom and side sheets.
- .2 Seal other joints with duct sealer.
- .3 Slope header ducts down toward risers.

#### **3.4 SEALING AND TAPING**

- .1 Apply sealant to outside of joint to Manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one (1) coat of sealant to Manufacturer's recommendations.

**END OF SECTION**

## **Part 1           General**

### **1.1     SUMMARY**

- .1   Section Includes:
  - .1   Operating dampers for mechanical forced air ventilation and air conditioning systems.

### **1.2     REFERENCES**

- .1   American Society for Testing and Materials International (ASTM)
  - .1   ASTM A 653/A 653M-[04a], Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- .2   Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1   Material Safety Data Sheets (MSDS).

### **1.3     ACTION AND INFORMATIONAL SUBMITTALS**

- .1   Product Data:
  - .1   Submit manufacturer's printed product literature, specifications and datasheet in accordance with Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .2   Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Submittal Procedures.
- .2   Indicate the following:
  - .1   Performance data.
  - .2   Size.
  - .3   Manufacturer and Model.
- .3   Closeout Submittals
  - .1   Provide maintenance data for incorporation into manual specified in Closeout Submittals.

### **1.4     QUALITY ASSURANCE**

- .1   Health and Safety Requirements: do construction occupational health and safety in accordance with Health and Safety Requirements.



- .2 Certificates:
  - .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with Manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

## **Part 2 Products**

### **2.1 MULTI-LEAF DAMPERS**

- .1 Parallel blade type as indicated.
- .2 Frames shall be 101.6 mm (4 inch) deep x 25.4 mm (1 inch) and no less than 2.03 mm (0.080 inch) in thickness, mill finish extruded aluminum (6063-T5) with mounting flanges on both sides of frame. Frame to be assembled using plated steel mounting fasteners.
- .3 Entire frame shall be thermally broken by means of two polyurethane resin pockets, complete with thermal cuts.
- .4 Blades shall be extruded aluminum (6063-T5), mill finish air-foil profiles, internally insulated with expanded polyurethane foam and shall be thermally broken. Complete blade shall have an insulating factor of R-2.29 and a temperature index of 55.
- .5 Blade and frame seals shall be of extruded silicone and shall be secured in an integral slot within the aluminum extrusions. Blade and frame seals are to be mechanically fastened to eliminate shrinkage and movement over the life of the damper. Adhesive or clip-on type blade seals shall not be approved.
- .6 Maintenance-free bearings are to be composed of a Celcon inner bearing fixed to an 11.11 mm (7/16 inch) aluminum hexagon blade pivot pin, rotating within a polycarbonate outer bearing inserted into the frame. There shall be no metal-to-metal or metal-to-plastic contact.
- .7 Adjustable 11.11 mm (7/16 inch) hexagonal drive rod, U-bolt fastener and hexagonal retaining nuts shall be corrosion-resistant, zinc-plated steel to provide positive connection to blades and linkage.

- .8 Linkage hardware shall be installed in the frame side. All linkage crank arm and rod hardware parts shall be constructed of mill finished aluminum, complete with corrosion resistant, zinc-plated trunnions and cup-point trunnion screws for a slip-proof grip.
- .9 Dampers are to be designed for operation in temperatures ranging between -40°C (-40°F) and 100°C (212°F).
- .10 Dampers shall be rated Leakage Class 1A at 0.25 kPa (1 in. w.g). static pressure differential.
- .11 Standard air leakage data shall be certified under the AMCA Certified Ratings Program.
- .12 Dampers shall be made to size required without blanking off free area.
- .13 Flanged to Duct type.
- .14 Acceptable Material: Tamco 9000 BF

## **2.2 DAMPER MOTOR**

- .1 CSA certified, spring return open direct coupled electric motor damper actuator, 120 volt or 24 volts as required, electronic overload protected, complete with position indicator, a housing to suit the mounting location and additional features as required to suit the application and control sequence.
- .2 Acceptable material: Belimo Model NFBUP-S ACT-SPRING, 2POS, 90IN-LB,SW

## **Part 3 Execution**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 INSTALLATION**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and Manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.
- .5 Ensure dampers are observable and accessible.

### **3.3 CLEANING**

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

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1    Section Includes:
  - .1       Fans, Motors and Hardware

**1.2                REFERENCES**

- .1    ANSI/AMCA 99-10, “Standards Handbook”
- .2    ANSI/AMCA Standard 204-05, “Balance Quality and Vibration Levels for Fans”
- .3    ANSI/AMCA Standard 210-07, “Laboratory Methods of Testing Fans for Aerodynamic Performance Rating”
- .4    AMCA Publication 211-05, “Certified Ratings Program – Product Rating Manual for Fan Air Performance”
- .5    ANSI/AMCA Standard 300-08, “Reverberant Room Method for Sound Testing of Fans”
- .6    AMCA Publication 311-05, “Certified Ratings Program – Product Rating Manual for Fan Sound Performance”
- .7    AMBA - Method of Evaluating Load Ratings of Bearings ANSI-11 (r1999).
- .8    ANSI/AMCA Standard 500-D-12, “Laboratory Methods of Testing Dampers for Rating”

**1.3                SYSTEM DESCRIPTION**

- .1    Performance Requirements:
  - .1       Catalogued or published ratings for manufactured items: obtained from tests carried out by Manufacturer or those ordered by Manufacturer from independent testing agency signifying adherence to codes and standards in force.
  - .2       Capacity: flow rate, total static pressure, kW (bhp), efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
  - .3       Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
  - .4       Sound ratings: comply with AMCA 301, tested to AMCA 300.
  - .5       Performance ratings: based on tests performed in accordance with ANSI/AMCA 210.

#### **1.4 SUBMITTALS**

- .1 Product Data:
  - .1 Submit Manufacturer's printed product literature, specifications and datasheet in accordance with submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Shop Drawings:
  - .1 Submit Shop Drawings and product data in accordance with submittal Procedures.
- .3 Provide:
  - .1 Fan performance curves showing point of operation, kW (bhp) and efficiency.
  - .2 Sound rating data at point of operation.
- .4 Indicate:
  - .1 Motors, sheaves, bearings, shaft details.
  - .2 Minimum performance achievable with variable speed controllers as appropriate.
- .5 Closeout Submittals:
  - .1 Provide operation and maintenance data for incorporation into manual specified in closeout Submittals.

#### **1.5 MAINTENANCE**

- .1 Extra Materials:
  - .1 Provide maintenance materials in accordance with closeout submittals.
    - .1 Spare parts to include:
      - .1 Matched sets of belts.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with common product requirements.
  - .2 Deliver, store and handle materials in accordance with Manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

**Part 2 Products**

**2.1 FANS GENERAL**

- .1 Motors:
  - .1 In accordance with Common Motors Requirements for HVAC Equipment supplemented as specified herein.
  - .2 Sizes as indicated specified.
- .2 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and or outlet safety screens as indicated and as specified in common Motor Requirements for HVAC Equipment inlet outlet dampers and vanes and as indicated.
- .3 Factory primed before assembly in colour standard to manufacturer.
- .4 Scroll casing drains: as indicated.
- .5 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .6 Vibration isolation: Vibration and Seismic Controls for HVAC Piping and Equipment.
- .7 Flexible connections: To Air Duct Accessories.
- .8 Fan capacity
  - .1 2000 CFM @ 1.5 inches ESP.

**2.2 CENTRIFUGAL FANS**

- .1 Fan wheels:
  - .1 Welded steel or aluminum construction.
  - .2 Maximum operating speed of centrifugal fans not more than 50% of first critical speed.
  - .3 Air foil forward curved backward inclined blades, as indicated.
- .2 Bearings: heavy duty split pillow-block flange mounted grease lubricated ball or roller self-aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000 hours.
- .3 Housings:
  - .1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, steel, or aluminum, for smaller wheels, braced, and with welded supports.
  - .2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.
  - .3 Provide bolted latched airtight access doors with handles.

### **2.3 CABINET FANS – GENERAL PURPOSE**

- .1 Fan characteristics and construction: as centrifugal fans.
- .2 Cabinet hung single or multiple wheel with SWSI or DWDI centrifugal fans in factory fabricated casing complete with vibration isolators, motor, variable speed or V-belt drive and guard inside casing.
- .3 Fabricate casing of zinc coated or phosphate treated steel, reinforced and braced for rigidity. Provide removable panels for access to interior. Paint uncoated, steel parts with corrosion resistant paint to CAN/CGSB 1.181. Finish inside and out, over prime coat, with rust resistant enamel.

### **2.4 IN-LINE CENTRIFUGAL FANS**

- .1 Characteristics and construction: as for centrifugal fan wheels, with axial flow construction and belt drive.
- .2 Provide AMCA arrangements 1 or 9 as indicated with stiffened flanges, smooth rounded inlets, and stationary guide vanes.
- .3 Acceptable Product: Greenheck Model TBI-CA-5H18-15, Tube Axial Inline Fans or approved equal.

## **Part 3 EXECUTION**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 FAN INSTALLATION**

- .1 Install fans as indicated, complete with resilient mountings specified in vibration and Seismic Controls for HVAC Piping and Equipment, flexible electrical leads and flexible connections in accordance with air duct Accessories.
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

### **3.3 ANCHOR BOLTS AND TEMPLATES**

- .1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified.

**3.4 CLEANING**

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

**END OF SECTION**



**Part 1        General**

**1.1            RELATED SECTIONS**

- .1        This Section covers items common to Sections Division 26, Electrical.

**1.2            REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA C22.1-06, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
  - .2        CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .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 SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

**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 SP1122.

**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 and labels for control items in English.

**1.5            SUBMITTALS**

- .1        Submit for review single line electrical diagrams and locate under plexiglass in electrical rooms.
- .2        Shop drawings:
  - .1        Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
  - .2        Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

- .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
  - .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
  - .5 Submit copies of 600 x 600 mm minimum size drawings and product data to inspection authorities.
  - .6 If changes are required, notify Contract Administrator of these changes before they are made.
- .3 Quality Control:
- .1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.
  - .2 Submit test results of installed electrical systems and instrumentation.
  - .3 Permits and fees: in accordance with General Conditions of contract.
  - .4 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
  - .5 Submit certificate of acceptance from inspection authority upon completion of Work to Contract Administrator.
- .4 Manufacturer's Field Reports: submit to Contract Administrator manufacturer's written report, within 3 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 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license 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.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Material Delivery Schedule: provide Contract Administrator with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

## **1.8 SYSTEM STARTUP**

- .1 Instruct Contract Administrator 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.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

## **Part 2 Products**

### **2.1 MATERIALS AND EQUIPMENT**

- .1 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .2 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 Control wiring and conduit: in accordance with Section 26 29 03 - Control Devices except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

### **2.3 WARNING SIGNS**

- .1 Warning Signs: in accordance with requirements of inspection authorities and Contract Administrator.
- .2 Decal 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 and controls equipment and instrumentation with nameplates and labels as follows:

- .1 Nameplates: lamicoid 3 mm melamine, black face, white core, 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
Size 8	50 x 100 mm	2 lines	12 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 Contract Administrator prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved as directed by Contract Administrator. Eg. "P600"
- .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, 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.
- .5 Identify each wire at termination points with unique wire tag, generally as shown on the drawings. Markers shall consist of machine printed sleeves.

**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, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

**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 outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.
  - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

**2.9 SCOPE OF WORK**

- .1 The scope of the electrical work includes all items identified on the drawings and the specifications. The following list of major work items has been provided to provide a high level overview.
- .2 Partial demolition of the existing electrical vault in the flood pumping station to facilitate new electrical transformers and motor control center within the electrical room.
- .3 Partial demolition of the electrical equipment within the existing floor room in the flood pumping station to facilitate new electrical connections within the electrical room.
- .4 Partial demolition of the existing 4" South and East wall.
- .5 Installation of new 750kVA electrical distribution, and all associated components.
- .6 Installation of new pumping station electrical distribution equipment including: service entrance switchgear, electrical panels, circuit breakers, motor starters, motor control center, and all associated components.
- .7 Installation of housekeeping pads for all electrical equipment installed on floor.
- .8 Installation of a new electrical panel, including relocation of automation and controls.
- .9 Installation of new 12" wall and insulation of wall and ceiling within the electrical room.
- .10 Installation of heating and ventilation HVAC system in the electrical room to maintain safe temperature and humidity levels within the electrical room.
- .11 Miscellaneous Site works, including realignment of the sidewalk access.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 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 Install conduit and sleeves prior to pouring of concrete.
  - .1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

**3.4 LOCATION OF OUTLETS**

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
  - .1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

**3.5 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation. Install electrical equipment at following heights unless indicated otherwise.
  - .1 Local switches: 1400 mm.
  - .2 Wall receptacles:
    - .1 General: 300 mm.
    - .2 Above top of continuous baseboard heater: 200 mm.
    - .3 Above top of counters or counter splash backs: 175 mm.

- .4 In mechanical rooms: 1400 mm.
- .3 Panelboards: as required by Code or as indicated.
- .4 Telephone and interphone outlets: 300 mm.
- .5 Wall mounted telephone and interphone outlets: 1500 mm.
- .6 Fire alarm stations: 1500 mm.
- .7 Fire alarm bells: 2100 mm.
- .8 Television outlets: 300 mm.
- .9 Wall mounted speakers: 2100 mm.
- .10 Clocks: 2100 mm.
- .11 Door bell pushbuttons: 1500 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 Load Balance:
  - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
  - .3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests:
  - .1 Power 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 system and communications.
  - .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.
- .3 Carry out tests in presence of Contract Administrator.

- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 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 26 05 01 – Common Works Results – For Electrical

**1.2               REFERENCES**

- .1       Canadian Standards Association (CSA International)
  - .1       CAN/CSA-C22.2 No.18.1-13 (R2018), Metallic outlet boxes (Tri-national standard, with UL 514A and ANCE NMX-J-023/1)
  - .2       CSA C22.2 No.65-18, Wire Connectors.

**1.3               WASTE MANAGEMENT AND DISPOSAL**

- .1       Separate and recycle waste materials.
- .2       Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3       Collect and separate for disposal paper, plastic, polystyrene and 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 Contract Administrator.

**Part 2           Products**

**2.1               MATERIALS**

- .1       Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2       Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3       Clamps or connectors for armoured cable 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 CSA C22.2 No.65.
  - .3       Install fixture type connectors and tighten. Replace insulating cap.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 26 05 01 – Common Works Results – For Electrical
- .2        Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.
- .3        Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

**1.2                REFERENCES**

- .1        CSA C22.2 No .0.3-09 (R2014), Test Methods for Electrical Wires and Cables.
- .2        CAN/CSA-C22.2 No. 131-17, Type TECK 90 Cable.
- .3        City of Winnipeg
  - .1        Identification Standard – 510276-0000-40ER-0002.
  - .2        Tag Naming Standard – 612620-0014-40ER-0001.

**1.3                SHOP DRAWING**

- .1        Include detail construction, dimension, capacities, weights of equipment or material.

**Part 2            Products**

**2.1                BUILDING WIRES**

- .1        Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2        Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

**2.2                1 KV TECK90 POWER CABLE**

- .1        Cable: to CAN/CSA-C22.2 No. 131.
- .2        Conductors:
  - .1        Grounding conductor: copper.
  - .2        Circuit conductors: copper, size as indicated. (12 AWG minimum where not indicated)
- .3        Insulation:
  - .1        Type: ethylene propylene rubber.
  - .2        Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.
- .4        Inner jacket: polyvinyl chloride material.
- .5        Armour: interlocking aluminum.
- .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 300 mm centers.
  - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
  - .1 Watertight, explosion-proof approved for TECK cable.

### **2.3 600 V TECK90 CONTROL CABLE**

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
  - .1 Grounding conductor: copper.
  - .2 Circuit conductors: copper, size as indicated. (14 AWG minimum where not indicated)
- .3 Insulation:
  - .1 Type: ethylene propylene rubber.
  - .2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .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 300 mm centers.
  - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
  - .1 Watertight, explosion-proof approved for TECK cable.

### **2.4 300 V INSTRUMENT CABLE**

- .1 Conductors: 16 AWG, 7 strand concentric lay, Class B tinned copper, twisted pairs/triads.
- .2 Insulation: PVC TW75, 75 °C Wet, 105 °C Dry (-40 °C), 300 Volt.
- .3 Twisted pairs/triads cabled with staggered lays.
- .4 Shielding: Individual twisted pair(s)/triads Aluminum/mylar shield with ST drain wire, 100 % shield. Overall aluminum/mylar shield with ST drain wire. Individual drain wires one size smaller than conductor AWG. Overall drain wire the same AWG as conductors.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride material (90 °C, -40 °C).

- .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 300 mm centers. .
- .8 Connectors:
  - .1 Watertight, explosion proof approved for armoured cable.

## **2.5 TYPE RW90 CONDCUTOR**

- .1 In accordance with CSA C22.2 No.38
- .2 Circuit conductors shall be concentric stranded soft copper, size as indicated (12 AWG minimum where not indicated).
- .3 Insulation to be chemically cross-linked thermosetting polyethylene rated type RW90 XLPE, 600V
- .4 Suitable for installation in temperatures down to -40 °C.
- .5 90 °C conductor operating temperature.

## **2.6 WIRING IDENTIFICATION**

- .1 Provide wiring identification in accordance with Section 26 05 01 – Common Work Results – For Electrical

## **Part 3 Execution**

### **3.1 INSTALLATION OF BUILDING WIRES**

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

### **3.2 INSTALLATION OF TECK CABLE 0 -1000 V**

- .1 Install cables.
  - .1 Group cables wherever possible on channels.
  - .2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors - 0 -1000 V.

### **3.3 INSTALLATION OF ARMOURED CABLES**

- .1 Group cables wherever possible.
- .2 Terminate cables in accordance with Section 26 05 20 – Wire and Box Connectors - 0 -1000 V.

**3.4           INSTALLATION OF CONTROL CABLES**

- .1       Install control cables in conduit.
- .2       Ground control cable shield.

**END OF SECTION**

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**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1 ANSI/IEEE 837-2014, Qualifying Permanent Connections Used in Substation Grounding.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3 DELIVERY, STORAGE AND HANDLING**

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

**Part 2 Products**

**2.1 MATERIALS**

- .1 Rod electrodes: copper clad steel, 19mm diameter by 3m long.
- .2 Conductors: bare, stranded, soft annealed copper wire, size No. 4/0 AWG and 2/0 AWG for ground bus, electrode interconnections, metal structures, gradient control mats, transformers, switchgear, motors, ground connections.
- .3 Conductors: bare, stranded soft annealed copper wire, size No. 4 AWG for grounding cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers.
- .4 Conductors: pvc insulated coloured green, stranded soft annealed copper wire No. 10 AWG for grounding metre and relay cases.
- .5 Conductors: No. 3/0 AWG extra flexible (425 strands) copper conductor for connection of switch mechanism operating rod to gradient control mat, fence gates, vault doors.
- .6 Bolted removable test links.
- .7 Accessories: non-corroding, necessary for complete grounding system, type, size material as indicated, including:
  - .1 Grounding and bonding bushings.
  - .2 Protective type clamps.
  - .3 Bolted type conductor connectors.
  - .4 Thermit welded type conductor connectors.

- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.
- .8 Wire connectors and terminations: as indicated.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Install continuous grounding system including, electrodes, conductors, connectors and accessories as indicated and to requirements of local authority having jurisdiction.
- .2 Install connectors and cadweld in accordance with manufacturer's instructions.
- .3 Install bare ground conductors around the service transformer at a depth of 500mm.
- .4 Protect exposed grounding conductors during and after construction.
- .5 Make buried connections, and connections to electrodes, structural steel work, using copper welding by thermit process.
- .6 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .7 Use No. 4/0 AWG bare copper cable for main ground bus of substation and No. 2/0 AWG bare copper cable for taps on risers from main ground bus to equipment.
- .8 Use tinned copper conductors for aluminum structures.
- .9 Do not use bare copper conductors near un-jacketed lead sheath cables.

#### **3.2 ELECTRODE INSTALLATION**

- .1 Install ground rod electrodes at transformer and switchgear locations.
- .2 Make special provision for installing electrodes that will give acceptable resistance to ground value, where rock or sand terrain prevails.

#### **3.3 EQUIPMENT GROUNDING**

- .1 Install grounding connections as indicated to typical station equipment including: metallic water main, line sky wire, neutral, gradient control mats. Non current carrying parts of: transformers, generators, motors, circuit breakers, reclosers, current transformers, frames of gang-operated switches and fuse cutout bases. Cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers. Meter and relay cases. Any exposed building metal, within or forming part of station enclosure. Sub-station fences, pothead bodies. Outdoor lighting.

#### **3.4 NEUTRAL GROUNDING**

- .1 Connect transformer neutral and distribution neutral together using 1000 V insulated conductor to one side of ground test link, the other side of the test link being connected directly to main station ground. Ensure distribution neutral and neutrals of potential transformers and service banks are bonded directly to transformer neutral and not to main station ground.
- .2 Interconnect electrodes and neutrals at each grounding installation.

- .3 Connect neutral of station service transformer to main neutral bus with tap of same size as secondary neutral.
- .4 Ground transformer tank with continuous conductor from tank ground lug through connector on ground bus to primary neutral. Connect neutral bushing at transformer to primary neutral in same manner.

**3.5 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Engage an independent testing agent to inspect grounding and perform ground resistance test before backfill.
- .3 Perform earth loop test and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction.
- .4 Perform test before energizing electrical system.
- .5 Provide step-and-touch potential calculations using measured station ground resistance measurements. Submit test result and inspection certificate before energizing electrical system.

**END OF SECTION**



**Part 1           General**

**1.1               RELATED SECTIONS**

- .1       Section 26 05 01 – Common Works Results – For Electrical

**1.2               REFERENCES**

- .1       American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
  - .1       ANSI/IEEE 837-2014, Qualifying Permanent Connections Used in Substation Grounding.
- .2       Canadian Standards Association, (CSA International)

**1.3               WASTE MANAGEMENT AND DISPOSAL**

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

**Part 2           Products**

**2.1               EQUIPMENT**

- .1       Clamps for grounding of conductor: size as required.
- .2       Grounding conductors: stranded copper, tinned, soft annealed, size as indicated.
- .3       Insulated grounding conductors: green, type RW90.
- .4       Ground bus: copper, size 2/0 AWG, complete with insulated supports, fastenings, connectors.
- .5       Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1       Grounding and bonding bushings.
  - .2       Protective type clamps.
  - .3       Bolted type conductor connectors.

- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

### **Part 3 Execution**

#### **3.1 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .8 Connect building structural steel and metal siding to ground by welding copper to steel.
- .9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .10 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.
- .11 Ground secondary service pedestals.

#### **3.2 SYSTEM AND CIRCUIT GROUNDING**

- .1 Install system and circuit grounding connections to neutral of primary 600 V system and secondary 120 V system.

#### **3.3 EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

#### **3.4 GROUNDING BUS**

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.

- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 2/0 AWG.

### **3.5 COMMUNICATION SYSTEMS**

- .1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:
  - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
  - .2 Sound, fire alarm, intercommunication systems as indicated.

### **3.6 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Contract Administrator and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

**END OF SECTION**

**Part 1           General**

**1.1               RELATED SECTIONS**

- .1       Section 26 05 01 – Common Works Results – For Electrical

**1.2               WASTE MANAGEMENT AND DISPOSAL**

- .1       Separate and recycle waste materials.
- .2       Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3       Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.
- .4       Divert unused metal materials from landfill to metal recycling facility as approved by Contract Administrator.
- .5       Fold up metal banding, flatten and place in designated area for recycling.

**Part 2           Products**

**2.1               SUPPORT CHANNELS**

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

**Part 3           Execution**

**3.1               INSTALLATION**

- .1       Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2       Secure equipment to poured concrete with expandable inserts.
- .3       Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4       Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5       Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6       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.
- .7 Suspended support systems.
  - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
  - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

**END OF SECTION**

**Part 1           General**

**1.1               RELATED SECTIONS**

- .1       Section 26 05 01 – Common Works Results – For Electrical

**1.2               SHOP DRAWINGS AND PRODUCT DATA**

- .1       Include detail construction, dimension, capacities, weights of equipment or material.

**1.3               WASTE MANAGEMENT AND DISPOSAL**

- .1       Separate and recycle waste materials.
- .2       Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.
- .3       Fold up metal banding, flatten and place in designated area for recycling.

**Part 2           Products**

**2.1               SPLITTERS**

- .1       Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2       Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3       At least three spare terminals on each set of lugs in splitters less than 400 A.

**2.2               JUNCTION AND PULL BOXES**

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

**2.3               CABINETS**

- .1       Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2       Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing sheet steel backboard for surface mounting.

**Part 3 Execution**

**3.1 SPLITTER INSTALLATION**

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

**3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

**3.3 IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name, voltage and phase.

**END OF SECTION**

**Part 1           General**

**1.1               RELATED SECTIONS**

- .1       Section 26 05 01 – Common Works Results – For Electrical

**1.2               REFERENCES**

- .1       CSA C22.1-2006, Canadian Electrical Code, Part 1.

**1.3               WASTE MANAGEMENT AND DISPOSAL**

- .1       Separate and recycle waste materials.
- .2       Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

**Part 2           Products**

**2.1               OUTLET AND CONDUIT BOXES GENERAL**

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

**2.2               SHEET STEEL OUTLET BOXES**

- .1       Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2       102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .3       102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

**2.3               MASONRY BOXES**

- .1       Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.



**2.4 CONCRETE BOXES**

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

**2.5 FLOOR BOXES**

- .1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.
- .2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 12 mm and 19 mm conduit. Minimum size: 73 mm deep.

**2.6 CONDUIT BOXES**

- .1 Cast FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

**2.7 FITTINGS - GENERAL**

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

**2.8 SERVICE FITTINGS**

- .1 'High tension' receptacle fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish for 1 duplex receptacles. Bottom plate with two knockouts for centered or offset installation. 12 x 102 mm extension piece as indicated.
- .2 Pedestal type 'low tension' fitting made of 2 piece die-cast aluminum with brushed aluminum housing finish to accommodate two amphenol jack connectors.

**Part 3 Execution**

**3.1 INSTALLATION**

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

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

**END OF SECTION**

**Part 1           General**

**1.1               RELATED SECTIONS**

- .1       Section 26 05 01 – Common Works Results – For Electrical

**1.2               REFERENCES**

- .1       Canadian Standards Association (CSA)
  - .1       CAN/CSA C22.2 No. 18.1-13 (R2018), Metallic outlet boxes (Tri-national standar, with UL 514A and ANCE NMX-J-023/1).
  - .2       CSA C22.2 No. 45-M1981(R2008), Rigid Metal Conduit.

**1.3               WASTE MANAGEMENT AND DISPOSAL**

- .1       Separate and recycle waste materials.
- .2       Place materials defined as hazardous or toxic waste in designated containers.
- .3       Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4       Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

**Part 2           Products**

**2.1               CONDUITS**

- .1       Rigid metal conduit: to CSA C22.2 No. 45, aluminum threaded.

**2.2               CONDUIT FASTENINGS**

- .1       One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2       Beam clamps to secure conduits to exposed steel work.
- .3       Channel type supports for two or more conduits at 1.5 m oc.
- .4       Threaded rods, 6 mm dia., to support suspended channels.

**2.3               CONDUIT FITTINGS**

- .1       Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2       Factory "ells" where 90° bends are required for 25 mm and larger conduits.
- .3       Watertight connectors and couplings for EMT. Set-screws are not 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.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

**2.5 FISH CORD**

- .1 Polypropylene.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits in finished areas.
- .3 Surface mount conduits except in mechanical and electrical service rooms and in unfinished areas.
- .4 Use rigid aluminum threaded conduit except where specified otherwise.
- .5 Use explosion proof flexible connection for connection to explosion proof motors.
- .6 Install conduit sealing fittings in hazardous areas. Fill with compound.
- .7 Minimum conduit size for lighting and power circuits: 19 mm.
- .8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 19 mm dia.
- .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .11 Install fish cord in empty conduits.
- .12 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
- .13 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .14 Dry conduits out before installing wire.

**3.2 SURFACE CONDUITS**

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

**3.3 CONCEALED CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

**3.4 CONDUITS IN CAST-IN-PLACE CONCRETE**

- .1 Locate to suit reinforcing steel. Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.
- .5 Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

**3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE**

- .1 Run conduits 25 mm and larger below slab and encased in 75 mm concrete envelope. Provide 50 mm of sand over concrete envelope below floor slab.

**3.6 CONDUITS UNDERGROUND**

- .1 Slope conduits to provide drainage.

- .2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1 Canadian Standards Association (CSA International)
  - .1 CAN/CSA C22.1 No.126.1-17, Metal Cable Tray Systems.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.
- .3 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.
- .4 Identify types of cabletroughs used.
- .5 Show actual cabletrough installation details and suspension system.

**1.3                WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials.
- .2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

**Part 2            Products**

**2.1                CABLETROUGH**

- .1 Cabletroughs and fittings: to CAN/CSA C22.1 No.126.1.
- .2 Ladder type, Class E to CAN/CSA C22.2 No. 126.1.
- .3 Trays: Rigid Galvanized Steel, width as indicated on drawings.
- .4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cabletrough supplied.
  - .1 Radii on fittings: 600mm minimum.
- .5 Solid covers for complete cabletrough system including fittings.
- .6 Barriers where different voltage systems are in same cabletrough.
- .7 Ground cable trays with #2 AWG bare copper conductor attached to each tray section in accordance with CEC requirements.
- .8 Provide fire stop material at firewall penetrations.

**2.2                SUPPORTS**

- .1 Provide splices, supports for a continuously grounded system as required.

- .2 Use stainless steel SS316 bolting and fixing hardware.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install complete cabletrough system.
- .2 Support cabletrough on both sides.
- .3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

**3.2 CABLES IN CABLETROUGH**

- .1 Install cables individually.
- .2 Lay cables into cabletrough. Use rollers when necessary to pull cables.
- .3 Secure cables in cabletrough at 2m centres, with nylon ties.
- .4 Identify cables every 8m with size 2 nameplates.

**END OF SECTION**



**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1    CSA International
  - .1    CAN/CSA-C22.2 No.47-13 (R2018), Air-Cooled Transformers (Dry Type).
  - .2    CSA C9-17, Dry-Type Transformers.
  - .3    CAN/CSA-C802.2-18, Minimum Efficiency Values for Dry Type Transformers.
- .2    National Electrical Manufacturers Association (NEMA)
- .3    Canada's Energy Efficiency Act and Energy Efficiency Regulations

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2    Product Data:
  - .1    Submit manufacturer's instructions, printed product literature and data sheets for dry type transformers and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3                CLOSEOUT SUBMITTALS**

- .1    Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2    Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1    Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2    Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3    Storage and Handling Requirements:
  - .1    Store and protect dry type transformers from nicks, scratches, and blemishes.
  - .2    Replace defective or damaged materials with new.

**Part 2            Products**

**2.1                DESIGN DESCRIPTION**

- .1    XFMR-F71.
  - .1    Type: ANN.
  - .2    1 phase, 37.5kVA
  - .3    Voltage taps: Minimum two taps above and two taps below at 2.5% increments, full capacity.

- .4 Insulation: 150°C Rise
- .5 Basic Impulse Level (BIL): standard.
- .6 Hipot: standard.
- .7 Average sound level: standard.
- .8 Impedance at 17 degrees C: standard.
- .9 Enclosure: NEMA 1.
- .10 Mounting: floor.
- .11 Finish: in accordance with Section 26 05 00- Common Work Results for Electrical.
- .12 Copper windings.
- .13 Lifting hooks for lifting complete transformer assembly.

## **2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Label size: 7.

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

### **3.2 INSTALLATION**

- .1 Mount dry type transformers up to 75 kVA as indicated on drawings.
- .2 Mount dry type transformers above 75 kVA on floor.
- .3 Ensure adequate clearance around transformer for ventilation.
- .4 Install transformers in level upright position.
- .5 Remove shipping supports only after transformer is installed and just before putting into service.
- .6 Loosen isolation pad bolts until no compression is visible.
- .7 Make primary and secondary connections in accordance with wiring diagram.
- .8 Energize transformers after installation is complete.
- .9 Make conduit entry into bottom 1/3 of transformer enclosure.

**3.3 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

**3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by dry type transformers installation.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCE STANDARDS**

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers, Inc. (IEEE)
  - .1 ANSI/IEEE C57.12.28, Pad-Mounted Equipment-Enclosure Integrity.
  - .2 ANSI/IEEE 386-2016, IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Rated 2.5 kV through 35 kV.
  - .3 ANSI/IEEE C62.11-2012 – IEEE Standard for Metal-Oxide Surge Arresters for AC Power Circuits (>1 kV).
  - .4 ANSI/IEEE C57.12.00-2015 – IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
- .2 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-C2.1-06, Single-Phase and Three Phase Liquid-Filled Distribution Transformers.
  - .2 CSAC227.4-06(R2017), Three-Phase, Pad-Mounted Distribution Transformers with Seperable Insulated High-Voltage Connectors.
  - .3 CSA C22.2 NO. 0.15-15, Adhesive Labels.
  - .4 CAN/CSA-C802.1-13 (R2018), Minimum efficiency values for liquid-filled distribution transformers.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, and limitations.
- .3 Submit shop drawings and indicate:
  - .1 Anchoring method and dimensioned foundation template.
  - .2 Dimensioned cable entry locations.
  - .3 Dimensioned cable termination and pothead height.
- .4 Identified internal and external component layout on assembly drawing.
- .5 Insulating liquid capacity.
- .6 Submit primary fuse and secondary breaker time-current characteristics.
- .7 Quality Assurance Submittals: submit following in accordance with Section 01 45 00- Quality Control.
  - .1 Certificates: submit production certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

- .2 Instructions: submit manufacturer's installation instructions.
- .8 Closeout Submittals:
  - .1 Provide operation and maintenance data for pad mounted distribution transformers for incorporation into manual specified in Section 01 78 00- Closeout Submittals.
  - .2 Include insulating liquid maintenance data.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Separate and recycle waste materials.
- .2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

### **1.4 MAINTENANCE**

- .1 Provide maintenance materials in accordance with Section 01 78 00- Closeout Submittals.

## **Part 2 Products**

### **2.1 EQUIPMENT**

- .1 Three phase dead front pad mounted distribution transformers: to CSA C227.4.
- .2 Separable insulated connectors for power distribution systems above 600 V: to ANSI/IEEE 386.
- .3 Oil filled pad mounted distribution transformer complete with primary and secondary cable compartments, and accessories to form complete factory assembled, self contained, steel fabricated unit for mounting on concrete pad.
- .4 High voltage bushings or high voltage bushing wells for connection to distribution system through separable insulated connectors for dead front operation.
- .5 Separable insulated connectors.
- .6 Primary terminal bushings shall be suitable for cable connections.
- .7 Secondary terminals shall be tinned copper bus bars for connecting secondary cables.
- .8 Secondary neutral terminal bushing is required. The neutral must be fully rated for all neutral grounding resistor applications.
- .9 Connectors for primary and secondary cables.
- .10 Mechanical interlock to Section 26 18 41- Interlock Systems to prevent access to primary compartment unless primary supply is isolated at source.
- .11 Transformer shall be equipped with heavy duty under-oil MOV surge arresters compliant with IEEE Std C62.11 suitable for the high-voltage specified. Under oil arresters shall be disconnect-able via an externally clamped arrester disconnect complete with locking provision and designed to withstand various surge currents as specified in IEEE Std

C62.11 as well as high potential and impulse requirements specified in IEEE Std C57.12.00.

- .12 Load break inserts for elbow connectors.
- .13 Stays to hold compartment doors in 110 degrees open position.
- .14 Windings shall be disc type and not layer type.
- .15 Transformer core shall be cold rolled grain oriented steel laminations.
- .16 Oil shall be PCB free suitable for Arctic conditions (extreme cold climate).
- .17 Exterior finish shall conform to ANSI C57.12.28.
- .18 The color shall be Seafoam Green, Munsell 4.82 G 4.07/3.35.

## **2.2 TRANSFORMER CHARACTERISTICS**

- .1 Primary voltage: 4160 V connected, delta. 3 phase.
- .2 Secondary voltage: 600 V connected, wye, 3 phase. 4 wire.
- .3 Capacity: 750 kVA
- .4 Basic impulse level: 60 kV
- .5 Maximum rms short-circuit: 18.04 kA for 2 seconds.
- .6 Impedance: Standard.

## **2.3 VOLTAGE TAPS**

- .1 Four-2.5% taps, 2-FCAN, 2-FCBN.

## **2.4 TAP CHANGER**

- .1 Internally operated off-load tap changer, with provision for padlocking on 3 phase units. Tap changer should be functional to -40°C ambient temperature operation.

## **2.5 ACCESSORIES**

- .1 Transformers shall be equipped with all standard metering, pressure relief, and CTs as required by CSA.
- .2 Transformers shall be equipped with oil filling, drain and sampling valves.
- .3 Voltage selector Tap switch.

## **2.6 GROUNDING**

- .1 Provide stainless steel grounding pads at two diagonally opposite ends and connect to ground grid in two locations as indicated.

## **2.7 FINISH**

- .1 Finish exterior of unit in accordance with Section 26 05 00- Common Work Results for Electrical.

**2.8 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Nameplate showing information in accordance with CSA C2.

**2.9 WARNING SIGNS**

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

**2.10 SOURCE QUALITY CONTROL**

- .1 Submit to Departmental Representative standard factory test certificates of each transformer and type test of each transformer with high voltage accessories in accordance with CSA C2.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 INSPECTION**

- .1 Check factory made connections of transformer unit for mechanical security and electrical continuity.
- .2 Check transformer insulating liquid for correct quantity and specification according to manufacturer's instructions.

**3.3 INSTALLATION**

- .1 Ensure concrete pad is fully cured before transformer is installed.
- .2 Set and secure transformer unit in place, rigid, plumb and square.
- .3 Make connections.
- .4 Connect transformer unit ground bus to system ground.
- .5 Wire one set of contacts on liquid temperature thermometer, liquid level gauge, to sound alarm when unsafe condition reached. Wire trip contacts to transformer circuit interrupter.
- .6 Ensure care is taken to prevent contamination of liquid and components when field filling transformer.
- .7 Use only metal hose when field-filling transformer with oil: do not use rubber hose.
- .8 Set taps to produce rated secondary voltage at no-load.

**3.4 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Carry out following insulation tests using megger with 20,000 megohm scale and resulting insulation resistance corrected to base of 20 degrees C.
  - .1 High voltage to ground with secondary grounded for duration of test.
  - .2 Low voltage to ground with primary grounded for duration of test.
  - .3 High to low voltage.
- .3 Inspect primary and secondary connections for tightness and for signs of overheating.
- .4 Inspect and clean bushings and insulators.
- .5 Check oil level and temperature indicators.
- .6 Set transformer taps to rated voltage as specified.
- .7 Inspect for oil leaks and excessive rusting.
- .8 Inspect oil level.
- .9 Check fuses for correctness of type and size.
- .10 Check for grounding and neutral continuity between primary and secondary circuits of transformer.

**3.5 CLEANING**

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

**END OF SECTION**



**Part 1           General**

**1.1               REFERENCE STANDARDS**

- .1    American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1       ANSI/IEEE C37.30.1-2011, IEEE Standard Requirements for AC High-Voltage Air Switches Rated Above 1000 V.
  - .2       ANSI/IEEE C37.30.1a-2017, IEEE Standard Requirements for AC High-Voltage Air Switches Rated Above 1000 V – Amendment 1: Criteria for acceptance.
  - .3       ANSI/IEEE 141-1993, IEEE Recommended Practice for Electric Power Distribution for Industrial Plants.
- .2    CSA International
  - .1       CSA C22.2 No.31-10, Switchgear Assemblies.

**1.2               ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2    Product Data:
  - .1       Submit manufacturer's instructions, printed product literature and data sheets for interlock systems and include product characteristics, performance criteria, physical size, finish and limitations.

**1.3               DELIVERY, STORAGE AND HANDLING**

- .1    Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2    Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

**Part 2           Products**

**2.1               INTERLOCK SYSTEMS**

- .1    Kirk key interlocks, Type F for fused main disconnect and Type D for gate in transformer vault to prevent:
  - .1       Opening of vault gate while fused disconnect is closed.
  - .2       Closing of fused disconnect while gate is open.

**Part 3 Execution**

**3.1 EXAMINATION**

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

**3.2 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 This Section covers items common to Sections Division 26, Electrical.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for service equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
  - .1 Recycled Content:
    - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer, post-industrial content, and total cost of materials for project.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00- Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect service equipment from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Fused disconnect switch: in accordance with Section 26 28 23- Disconnect Switches - Fused and Non-Fused, rating as indicated.
- .2 Circuit breaker: in accordance with Section 26 28 16.02- Moulded Case Circuit Breakers, rating as indicated.
- .3 Junction box: in accordance with Section 26 05 31- Splitters, Junction, Pull Boxes and Cabinets, size as indicated.

**2.2 5kV SWITCHGEAR C/W FUSIBLE DISCONNECT SWITCH COMPARTMENT  
& UTILITY METERING COMPARTMENT (SGR-F70)**

- .1 Requirements:
  - .1 Rating: 5kV (or higher), 200A (or higher), 3ph, 4 wire.
  - .2 Service entrance rated.
  - .3 Load break / load make rated to meet CSA C22.1-2018 Rule 36-204(1)(b)
  - .4 Interrupting Rating: 3kA minimum.
  - .5 Fuses: Type and ampere rating as shown on the drawings.
    - .1 Provide three (3) spare fuses of equal type and rating.
  - .6 Manually operated switch.
  - .7 Integrated 5kV utility metering compartment.
    - .1 Metering components (meter, CTs, and PTs) supplied by Manitoba Hydro.
    - .2 Meter socket supplied with switchgear or separately by the installation Contractor.
  - .8 Dead front construction.
  - .9 Outer and inner door on main switch compartment. Outer door will be locked by City. Inner door will be locked by electric utility. Out door to cover disconnect switch handle.
  - .10 All compartments and sections to be barriered from adjoining sections.
  - .11 Copper bus.
  - .12 Cabling: 5/8kV rated, EPR or EPDM, copper conductors, with 133% insulation when applied to a 5kV system.
  - .13 Switch Kirk-Key Interlock: Interlocked with XFMR-F70 HV compartment door. Removal of the key from SGR-F70 only allowed when 5kV switch is in the OFF position. Removal of the key from SGR-F70 and insertion into HV compartment door of XFMR-F70 will allow opening of XFMR-F70 HV compartment door. Switching ON of SGR-F70 5kV switch only permitted with key inserted into SGR-F70.
  - .14 Enclosure Rating: NEMA Type 3R.
  - .15 Enclosure Size:
    - .1 Two (2) sections wide.
    - .2 Each section shall not exceed 36" width x 48" depth x 96" height.
- .2 Manufacturer:
  - .1 JRS MFG.,
  - .2 Strong Electric,
  - .3 S&C Electric,
  - .4 ABB,
  - .5 Or approved equal in accordance with B7.

**2.3 5kV MEDIUM VOLTAGE SERVICE TRANSFORMER (XFMR-F70)**

- .1 Requirements:

- .1 4160:600V, 750 kVA, in accordance with Section 26 12 19 – Pad Mounted, Liquid Filled, Medium Voltage Transformers.

## **2.4 600V CUSTOMER SERVICE TERMINATION ENCLOSURE (CSTE-F70)**

- .1 Requirements:
  - .1 Rating: 600V, 600A, 3 phase, 4 wire
  - .2 Short Circuit Current Rating: 25kA minimum
  - .3 Service Entrance Rated.
  - .4 Meter socket: 7-jaw with insulated neutral.
  - .5 Provision for utility metering PTs (potential transformers).
  - .6 Provision for utility metering CTs (current transformers).
    - .1 Metering CTs not included in contract.
    - .2 Provide copper bus bars to jumper across CT openings.
  - .7 Compartments and sections:
    - .1 Metering Section
    - .2 Distribution Section
  - .8 All compartments and sections to be barriered from adjoining sections.
  - .9 Copper bus.
  - .10 Insulated neutral.
  - .11 Provision for factory-installed neutral-ground link.
  - .12 Enclosure Rating: NEMA Type 3R.
  - .13 Doors: stays to hold compartment doors in 110 degrees open position.
- .2 Manufacturer:
  - .1 JRS MFG.,
  - .2 Strong Electric,
  - .3 Or approved equal in accordance with B7.

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

### **3.2 INSTALLATION**

- .1 Install conduit sleeves, conduits, cable sleeves, ground cabling, and transformer pad.

- .2 Install service equipment.
- .3 Connect to incoming service.
- .4 Connect to outgoing load circuits.
- .5 Make primary grounding connections in accordance with Section 26 05 27 – Grounding – Primary.
- .6 Make secondary grounding connections in accordance with Section 26 05 28 – Grounding – Secondary.
- .7 Make provision for power supply authority's metering.
- .8 Set transformer taps.
- .9 Ensure care is taken to prevent contamination of liquid and components when field filling transformer.
- .10 Use only metal hose when field filling transformer with oil: do not use rubber hose.
- .11 Provide spare components as indicated in the specifications and drawings.

### **3.3 CLEANING**

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1            CSA International
  - .1            CSA C22.2 No.29-15, Panelboards and Enclosed Panelboards.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2            Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Shop Drawings:
  - .1            Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.
  - .2            Include on drawings:
    - .1            Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

**1.3                CLOSEOUT SUBMITTALS**

- .1            Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2            Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3            Storage and Handling Requirements:
  - .1            Store and protect panelboards from nicks, scratches, and blemishes.
  - .2            Replace defective or damaged materials with new.

**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 built to withstand.
- .2 240 V panelboards: bus and breakers rated for 10 kA.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Minimum of 2 flush locks for each panel board.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus with neutral of equal ampere rating of mains.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked enamel.
- .11 Isolated ground bus.
- .12 Include grounding busbar with minimum 3 terminals for bonding conductor equal to breaker capacity of the panel board.

## **2.2 BREAKERS**

- .1 Breakers: to Section 26 28 16.02- Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

## **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 typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.



- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed Departmental Representative.

### **3.2 INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00- Common Work Results for Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.

### **3.3 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

### **3.4 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by panelboards installation.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            This Section covers items common to Sections Division 26, Electrical.

**1.2                REFERENCE STANDARDS**

- .1            Electrical Equipment Manufacturers Association of Canada (EEMAC)

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2            Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets for motor control centres and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Shop Drawings:
  - .1            Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.
  - .2            Indicate on drawings:
    - .1            Outline dimensions.
    - .2            Configuration of identified compartments.
    - .3            Floor anchoring method and dimensioned foundation template.
    - .4            Cable entry and exit locations.
    - .5            Dimensioned position and size of busbars and details of provision for future extension.
    - .6            Schematic and wiring diagrams.
- .4            Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, and cleaning procedures.

**1.4                CLOSEOUT SUBMITTALS**

- .1            Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2            Operation and Maintenance Data: submit operation and maintenance data for motor control centre for incorporation into manual.
  - .1            Include data for each type and style of starter.

**1.5                EXTRA STOCK MATERIALS**

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

**1.6                DELIVERY, STORAGE AND HANDLING**

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

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect motor control centres from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 SUPPLY CHARACTERISTICS**

- .1 Wye connected, 3 phase.

### **2.2 GENERAL DESCRIPTION**

- .1 Compartmentalized vertical sections with common power busbars.
- .2 Floor mounting, free standing, enclosed dead front.
- .3 Indoor CSA gasketed enclosure.

### **2.3 VERTICAL SECTION CONSTRUCTION**

- .1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.
- .2 Each vertical section divided into compartment units, height as indicated.
- .3 Each unit to have complete top and bottom steel plate for isolation between units.
- .4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.
- .5 Vertical wireways c/w doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.
- .6 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.
- .7 Incoming cables to enter at top.
- .8 Provision for outgoing cables to exit via top or bottom with terminals.
- .9 Removable lifting means.
- .10 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.
- .11 Divide assembly for shipment to site, as indicated complete with hardware and instructions for re-assembly.

## **2.4 BUSBARS**

- .1 Main horizontal and branch vertical, three phase and neutral high conductivity plated aluminum busbars in separate compartment bare self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:
  - .1 Main horizontal busbars: as indicated.
  - .2 Branch vertical busbars: as indicated.
- .2 Branch vertical busbars for distribution of power to units in vertical sections.
- .3 No other cables, wires, equipment in main and branch busbar compartments.
- .4 Brace buswork to withstand effects of short-circuit current of 100kA rms symmetrical.
- .5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

## **2.5 GROUND BUS**

- .1 Copper ground bus extending entire width of motor control centre.
- .2 Vertical ground bus strap, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

## **2.6 STARTER UNIT COMPARTMENTS**

- .1 Units EEMAC size 5 and smaller, circuit breaker units 225A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.
- .2 Unit mounting:
  - .1 Engaged position - unit stabbed into vertical bus.
  - .2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.
  - .3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.
  - .4 Stab-on connectors free floating tin plated clips, self-aligning, backed up with steel springs.
- .3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3padlocks to lock operating handle in "off" position and lock door closed.
- .4 Hinge unit doors on same side.
- .5 Overload relays manually reset from front with door closed.
- .6 Pushbuttons and indicating lights mounted on door front.
- .7 Devices and components by one manufacturer to facilitate maintenance.
- .8 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

**2.7 WIRING IDENTIFICATION**

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

**2.8 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.
  - .1 Motor control centre main nameplate: size No. 7, engraved as indicated.
  - .2 Individual compartment nameplates: size No. 5, engraved as indicated.

**2.9 FINISHES**

- .1 Apply finishes in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Paint motor control centre exterior light grey and interiors white.

**2.10 SOURCE QUALITY CONTROL**

- .1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.
- .2 Contract Administrator to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters and controls.

**Part 3 Execution**

**3.1 EXAMINATION**

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

**3.2 INSTALLATION**

- .1 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.
- .2 Make field power and control connections as indicated.
- .3 Ensure correct overload heater elements are installed.

**3.3 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Ensure moving and working parts are lubricated where required.

- .3 Operate starters in sequence to prove satisfactory performance of motor control centre during 8 hours period.

**3.4 CLEANING**

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 26 05 01 – Common Works Results – For Electrical

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1            Indicate detail construction, dimension, capacities, weights and electrical performance characteristics of equipment or material.

**Part 2            Products**

**2.1                MATERIALS**

- .1            NEMA 4X rated enclosure for all locations except within electrical rooms and control rooms.
- .2            NEMA 12 rated enclosures for devices within electrical rooms or control rooms unless otherwise specified.
- .3            Door: minimum 1 m wide, hinged, minimum 3 point latching, with padlocking means.
- .4            Door interlocks

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Assemble enclosure in accordance with manufacturer's instructions and mount on concrete pad.
- .2            Mount equipment in enclosure.

**END OF SECTION**

**Part 1           General**

**1.1               SECTION INCLUDES**

- .1       Switches, receptacles, wiring devices, cover plates and their installation.

**1.2               RELATED SECTIONS**

- .1       Section 26 05 01 – Common Works Results – For Electrical

**1.3               REFERENCES**

- .1       Canadian Standards Association (CSA International)
  - .1       CSA-C22.2 No.42-10 (R2015), General Use Receptacles, Attachment Plugs and Similar Devices.
  - .2       CSA-C22.2 No.42.1-13 (R2017), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
  - .3       CSA-C22.2 No.55-15, Special Use Switches.
  - .4       CSA-C22.2 No.111-18, General-Use Snap Switches (Trinational standard with UL 20 and NMX-J-005-ANCE)

**Part 2           Products**

**2.1               SWITCHES**

- .1       15 A, 120 V, single pole, double pole, three-way, four-way industrial grade switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111 as required.
- .2       Manually-operated general purpose ac switches with following features:
  - .1       Terminal holes approved for No. 10 AWG wire.
  - .2       Silver cadmium oxide contacts.
  - .3       Fully enclosed with 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.
- .5       Acceptable materials: Hubbell 1200 Series or equivalent.

**2.2               RECEPTACLES**

- .1       Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:



- .1 Ivory or Brown urea moulded housing.
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Break-off links for use as split receptacles.
  - .4 Eight back wired entrances, four side wiring screws.
  - .5 Triple wipe contacts and rivetted grounding contacts.
- .2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
- .1 Brown urea moulded housing.
  - .2 Suitable for No. 10 AWG for back and side wiring.
  - .3 Four back wired entrances, 2 side wiring screws.
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles of one manufacturer throughout project.
- .5 Acceptable materials: Hubbell 5252 or equivalent.

### **2.3 COVER PLATES**

- .1 Stainless steel or pvc cover plates for wiring devices.
- .2 Cover plates from one manufacturer throughout project.
- .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.
- .5 Weatherproof double lift spring-loaded stainless steel or pvc cover plates, complete with gaskets for duplex receptacles as indicated on the drawings.
- .6 Weatherproof spring-loaded stainless steel or pvc cover plates complete with gaskets for single receptacles or switches as indicated on the drawings.

## **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 01 - Common Work Results - Electrical.

- .2 Receptacles:
  - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
  - .2 Mount receptacles at height in accordance with Section 26 05 01 - Common Work Results - Electrical.
  - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
  - .4 Mount lighting fixture receptacles local to fixtures.
- .3 Cover plates:
  - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
  - .2 Install suitable common cover plates where wiring devices are grouped.
  - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCE STANDARDS**

- .1    CSA International
  - .1    CSA C22.2 No. 5-16, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2016).

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2    Product Data:
  - .1    Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.
- .3    Include time-current characteristic curves for breakers with ampacity of 100 A and over.
- .4    Certificates:
  - .1    Prior to installation of circuit breakers in either new or existing installation, Contractor must submit 2 copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.
    - .1    Production certificate of origin must be submitted to Departmental Representative for approval.
  - .2    Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.
  - .3    Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.
  - .4    Production certificate of origin must contain:
    - .1    Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
    - .2    Licensed dealer's name and address and person of distributor responsible for Contractor's account.
    - .3    Contractor's name and address and person responsible for project.
    - .4    Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
    - .5    Name and address of building where circuit breakers will be installed.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store and protect circuit breakers from nicks, scratches, and blemishes.
  - .2 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 BREAKERS GENERAL**

- .1 Ground-fault circuit-interrupters, Circuit breakers, and Moulded-case circuit breakers: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
- .5 Circuit breakers with interchangeable trips as indicated.

**2.2 THERMAL MAGNETIC BREAKERS**

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

**2.3 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, and instantaneous, short time, and long-time tripping for phase fault short circuit protection.

**2.4 OPTIONAL FEATURES**

- .1 As indicated.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 INSTALLATION**

- .1 Install circuit breakers as indicated.

**3.3 CLEANING**

- .1 Progress Cleaning:
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Materials and installation for fused and non-fused disconnect switches.

**1.2                RELATED SECTIONS**

- .1            Section 26 05 01 – Common Works Results – For Electrical
- .2            Section 26 28 14 - Fuses - Low Voltage.

**1.3                REFERENCES**

- .1            Canadian Standards Association (CSA International).
  - .1            CAN/CSA C22.2 No.4-16, Enclosed and Dead-front Switches.
  - .2            CSA C22.2 No.39-13 (R2017), Fuseholder Assemblies.

**1.4                SHOP DRAWINGS AND PRODUCT DATA**

- .1            Indicate:
  - .1            Mounting method and dimensions.
  - .2            Enclosure types.

**Part 2            Products**

**2.1                DISCONNECT SWITCHES**

- .1            Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 sized as per drawings.
- .2            Provision for padlocking in off switch position by three locks.
- .3            Mechanically interlocked door to prevent opening when handle in ON position.
- .4            Fuses: size as indicated on drawings, in accordance with Section 26 28 14 - Fuses - Low Voltage.
- .5            Fuseholders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.
- .6            Quick-make, quick-break action.
- .7            ON-OFF switch position indication on switch enclosure cover.

**2.2 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - 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 REQUIREMENTS**

- .1            This Section covers items common to Sections Division 26, Electrical.

**1.2                REFERENCE STANDARDS**

- .1            CSA International
  - .1            CSA C22.2 No.14-18, Industrial Control Equipment.
- .2            National Electrical Manufacturers Association (NEMA)
  - .1            NEMA ICS 2-2000 (R2005), Controllers, Contactors and Overload Relays Rated 600 V.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2            Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets for contactors and include product characteristics, performance criteria, physical size, finish and limitations.

**1.4                CLOSEOUT SUBMITTALS**

- .1            Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2            Operation and Maintenance Data: submit operation and maintenance data for contactors for incorporation into manual.
- .3            Include operating information required for start-up, synchronizing and shut-down of generating units.

**1.5                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials with manufacturer's written instructions.
- .2            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3            Storage and Handling Requirements:
  - .1            Store materials in dry location, off ground, indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2            Store and protect contactors from nicks, scratches, and blemishes.
  - .3            Replace defective or damaged materials with new.



**Part 2 Products**

**2.1 CONTACTORS**

- .1 Contactors: to CSA C22.2 No.14.
- .2 Electrically held and controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.
- .3 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.
- .4 Mount in NEMA 4 Enclosure
- .5 Include following options in cover:
  - .1 Red or Green indicating lamp, as indicated.
  - .2 Stop-Start pushbutton, as indicated.
  - .3 Hand-Off-Auto selector switch, as indicated.
  - .4 On-Off selector switch, as indicated.
- .6 Control transformer: in accordance with Section 26 29 03- Control Devices, factory wired and installed in contactor enclosure.

**2.2 EQUIPMENT IDENTIFICATION**

- .1 Identify equipment in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Size 4 nameplate as indicated.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install contactors and connect power wires and auxiliary control devices.
- .2 Identify contactors with nameplates or labels indicating panel and circuit number.
- .3 Test contactors in accordance with 26 05 00- Common Work Results for Electrical.

**3.2 CLEANING**

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**3.3 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by contactor installation.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            This Section covers items common to Sections Division 26, Electrical.

**1.2                REFERENCE STANDARDS**

- .1            CSA International
  - .1            CSA C22.2 No.14-18, Industrial Control Equipment.
- .2            National Electrical Manufacturers Association (NEMA)
  - .1            NEMA ICS 1-2000(R2008), Industrial Control and Systems: General Requirements.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2            Product Data:
  - .1            Submit manufacturer's instructions, printed product literature and data sheets for control devices and include product characteristics, performance criteria, physical size, finish and limitations.
- .3            Shop Drawings:
  - .1            Submit drawings stamped and signed by professional engineer registered or licensed in Manitoba, Canada.
  - .2            Include schematic, wiring, interconnection diagrams.

**1.4                QUALITY ASSURANCE**

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

**1.5                CLOSEOUT SUBMITTALS**

- .1            Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2            Operation and Maintenance Data: submit operation and maintenance data for control devices for incorporation into manual.

**1.6                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2            Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3            Storage and Handling Requirements:
  - .1            Store materials indoors, off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect control devices from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

**Part 2 Products**

**2.1 AC CONTROL RELAYS**

- .1 Control Relays: to NEMA ICS 1 CSA C22.2 No.14.
- .2 Convertible contact type: contacts field convertible from NO to NC, permanent magnet latched electrically held, double-voltage type with sliding barrier to permit access to contacts only or coil only, with pneumatic, solid state timer. Coil rating: overlap type.

**2.2 RELAY ACCESSORIES**

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

**2.3 PUSHBUTTONS**

- .1 Operator mushroom type. Black, with 1-NO and 1-NC, labels as indicated. Stop pushbuttons coloured red, labelled "Stop".

**2.4 SELECTOR SWITCHES**

- .1 Standard 2 position labelled as indicated.

**2.5 INDICATING LIGHTS**

- .1 Standard, full voltage, type, lens colour: as indicated, supply voltage: as indicated, lamp voltage:, labels as indicated.

**2.6 CONTROL AND RELAY PANELS**

- .1 CSA Type 4 sheet steel enclosure with hinged padlockable access door, accommodating relays timers, labels, as indicated, factory installed and wired to identified terminals.

**2.7 CONTROL CIRCUIT TRANSFORMERS**

- .1 Single phase, dry type.
- .2 Primary: 600V, 60 Hz ac.
- .3 Secondary: 120 V, AC.
- .4 Rating: 50VA.
- .5 Secondary fuse: 3A.
- .6 Close voltage regulation as required by magnet coils and solenoid valves.

**2.8 THERMOSTAT (LINE VOLTAGE)**

- .1 Wall mounted, for exhaust fan and unit heater control.
- .2 Full load rating: 8A at 120V AC.
- .3 Temperature setting range: 5 degrees Celsius – 25 degrees Celsius.

- .4 Thermometer Range: 0-30 degrees Celsius.
- .5 Markings in 5 degrees increments.

**Part 3 Execution**

**3.1 EXAMINATION**

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

**3.2 INSTALLATION**

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

**3.3 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.

**3.4 CLEANING**

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 26 05 01 – Common Works Results – For Electrical

**1.2                REFERENCES**

- .1            National Electrical Manufacturer’s Association (NEMA)
  - .1            NEMA Standards Publication ICS 2-2000: Industrial Control and Systems  
                  Controllers, Contactors and Overload Relays Rated 600 Volts.

**1.3                SHOP DRAWINGS AND PRODUCT DATA**

- .1            Indicate:
  - .1            Mounting method and dimensions.
  - .2            Starter size and type.
  - .3            Layout of identified internal and front panel components.
  - .4            Enclosure types.
  - .5            Wiring diagram for each type of starter.
  - .6            Interconnection diagrams.

**1.4                EXTRA MATERIALS**

- .1            Provide listed spare parts for each different size and type of starter:
  - .1            3 contacts, stationary.
  - .2            3 contacts, movable.
  - .3            1 contacts, auxiliary.
  - .4            1 control transformer.
  - .5            1 operating coil.
  - .6            2 fuses.
  - .7            10% indicating lamp bulbs used.

**1.5                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate and recycle waste materials.
- .2            Place materials defined as hazardous or toxic waste in designated containers.
- .3            Ensure emptied containers are sealed and stored safely for disposal away from children.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Starters: to NEMA ICS 2-2000

**2.2 FULL VOLTAGE REVERSING STARTERS**

- .1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
  - .1 Contactor solenoid operated, rapid action type.
  - .2 Intelligent electronic motor overload protective relay complete with a Modbus/TCP communication interface to connect to the control system PLC.
    - .1 Acceptable Product: Schneider Electric Tesys T
  - .3 Wiring and schematic diagram inside starter enclosure in visible location.
  - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include motor circuit interrupter.
- .3 Accessories:
  - .1 Pushbuttons and selector switches: heavy duty oil tight labelled as indicated.
  - .2 Indicating lights: heavy duty oil tight type and color as indicated.
  - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

**2.3 CONTROL TRANSFORMER**

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

**2.4 FINISHES**

- .1 Apply finishes to enclosure in accordance with Section 26 05 01 - Common Work Results - Electrical.

**2.5 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Magnetic starter designation label, white plate, black letters, size 4 engraved as indicated.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload devices elements installed.

**3.2 FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.
- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 26 05 01 – Common Works Results – For Electrical

**1.2 REFERENCES**

- .1 National Electrical Manufacturer’s Association (NEMA)
  - .1 NEMA 250-2003, Enclosures for Electrical Equipment (1000 Volts Maximum).
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-C22.1-2015, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

**1.3 SUBMITTALS**

- .1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Manufacturer's Instructions:
  - .1 Include manufacturer's installation instructions for specified equipment and devices in O&M Manuals.

**Part 2 Products**

**2.1 GENERAL**

- .1 Control devices of each category to be of same type and manufacturer.
- .2 External trim materials to be corrosion resistant.
- .3 Operating conditions: 0 - 35°C with 5 - 95% RH (non-condensing) unless otherwise specified.
- .4 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

**2.2 ROOM TEMPERATURE SWITCHES – DOUBLE POLE**

- .1 Requirements:
  - .1 Functionality: Field adjustable with reference dials for each pole
  - .2 Outputs: Qty 2, SPDT dry contacts, independently adjustable
  - .3 Operating Temperature: -10°C to 40°C minimum
  - .4 Sensor: Local
  - .5 Mounting: Wall
  - .6 Enclosure Rating: NEMA 4X

- .7 Approvals: CSA or equivalent
- .2 Acceptable Products:
  - .1 United Electric B402-120,
  - .2 Or approved equal in accordance with B7.

### **2.3 ROOM THERMOSTAT**

- .1 Requirements:
  - .1 Functionality: Dual setpoint for heating and cooling
  - .2 Outputs: Qty 2, SPDT dry contacts, independently adjustable
  - .3 Operating Temperature: -10°C to 40°C minimum
  - .4 Sensor: Local
  - .5 Mounting: Wall
  - .6 Enclosure Rating: NEMA 4X
- .2 Acceptable Products:
  - .1 Johnson Controls T701DFN-4,
  - .2 Or approved equal in accordance with B7.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
- .2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.
- .3 Install in a manner to allow easy removal of the transducer and cable assembly for maintenance purposes.
- .4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.
- .5 Electrical:
  - .1 Complete installation in accordance with Section 26 05 01 - Common Work Results – Electrical.
  - .2 Provide complete conduit/cable system to link instrumentation and the control panel(s).
  - .3 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.
  - .4 Maximum conduit fill not to exceed 40%.
  - .5 Design drawings do not show conduit layout.

**3.2 TEMPERATURE SWITCHES AND SENSORS**

- .1 Stabilize to ensure minimum field adjustments or calibrations.
- .2 Mount in readily accessible location to allow for quick easy replacement and servicing without special tools or skills.
- .3 Field adjust setpoint on temperature switches as per the drawings.
- .4 Make adjustments as directed by the Contract Administrator.

**3.3 INSPECTION AND INSTRUCTION**

- .1 Provide for a factory-trained representative who shall give instructions regarding the installation of the equipment.
- .2 The factory-trained representative shall visit the site as required to ensure that the installation work is being performed in a proper and workmanlike manner. Allow for a minimum of one (1) full working day.
- .3 The factory-trained representative shall be present to supervise the commissioning, initial operation, and functional testing of the equipment.

**3.4 IDENTIFICATION**

- .1 Identify field devices with lamacoids. Install in a conspicuous location.

**3.5 TESTING AND COMMISSIONING**

- .1 Calibrate and test field devices for accuracy and performance.

**END OF SECTION**