

1.0 GENERAL REQUIREMENTS

1.1 Codes and Standards

- .1 Execute Work in accordance with the latest editions and supplements of the applicable regulations and standards listed below and as stated in the specifications:
 - .1 Manitoba Building Code
 - .2 Manitoba Fire Code
 - .3 Federal, Provincial and Municipal government laws, rules, ordinances and codes, where applicable.
Refer to General Conditions for Construction Contracts.
 - .2 Where specified standards are not dated, conform to the latest issue of specified standard, amended and revised as of the date for receipt of bids.
 - .3 Work shall meet or exceed requirements of specified standards, codes and referenced documents. Even if permitted by preceding regulations and standards, grade of Work shall in no case be lower than specified in project specifications.
 - .4 Electrical and mechanical components and equipment which are not CSA approved shall be approved by the Manitoba Department of Labour and Manpower prior to installation. Pay for all costs associated with obtaining the necessary approval.
 - .5 Contractor shall, at his own expense, obtain all required permits and certificated of inspection and approval from proper authorities.

1.2 Materials and Equipment

- .1 Products, materials, and equipment incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
- .2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .3 Contractor shall be responsible for all transportation, handling, protection and storage of materials and equipment.
- .4 Touch-up damaged factory finished surfaces to Contract Administrator's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

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

1.4 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 his or her 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.

1.5 Concealment

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

1.6 Building Envelope

- .1 Comply with the National Building Code (NBC), 2005, Section 5 "Wind, Water and Vapour Protection". Building Envelope shall resist air leakage, vapour diffusion, rain penetration, moisture and groundwater infiltration, and flame spread.
- .2 Avoid penetrating through building envelope air barrier. Where penetrations are necessary, maintain integrity of air barrier by patching and making good to the approval of the Contract Administrator with approved material and methods.
- .3 Patch and make good building envelope at all locations where envelope has been penetrated as a result of removal and/or relocation of existing equipment, piping, ductwork, conduit, cable, wiring, etc. Use only approved materials and methods.

1.7 Site Conditions

- .1 Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

1.8 Construction Safety

- .1 Observe and enforce all construction safety measures required by the Manitoba Building Code, Worker's Compensation Board, Municipal Statute or By-Laws.
- .2 In the event of conflict between any provisions of above authorities, the most restrictive provision shall apply.
- .3 The Contractor shall be registered with the Workers Compensation Board of Manitoba and shall provide and maintain workers compensation coverage throughout the term of the Contract, and shall provide the Contract Administrator with evidence thereof upon request.

1.9 Use of Site and Premises

- .1 The Contractors are to allow for continued access throughout the construction period and ensuring the facility's entering and exiting is maintained to the approval of the Local Authorities having Jurisdiction, local by-laws, and Work Place Safety and Health Policies. This will also be applicable for parking lot accesses and other such requirements to assist the City in maintaining normal operations.
- .2 Where Work must occur in public areas, all scheduling shall be arranged with the Contract Administrator prior to commencement of such Work and the Contractor shall submit a Safety Access Plan.
- .3 The Contractor shall provide a Construction Schedule for the Work indicating commencement and completion dates. The Contractor shall be aware that Substantial Performance under the Lien Act applies to the Total Contract and not to the completion and occupancy of individual items of Work.
- .4 The Contractor's use of premises, Site access and construction activities are limited to those areas as defined on drawings.
- .5 Construction personnel must use only designated entrances for access to Work areas, delivery of materials and/or equipment and removal of construction debris.
- .6 Restrict equipment, Work and workers to designated areas and established routes to and from Work areas.
- .7 Storage of construction materials, tools, equipment, etc. in areas outside designated Work areas is not permitted.
- .8 Keep all fire lanes, egress, and access routes clear at all times.
- .9 Parking restrictions may be applied and on Site parking will only be allowed at the City's discretion.

1.10 Cleanup and Final Cleaning of the Work

- .1 The Contractor shall maintain the Site and the Work in a tidy condition and free from the accumulation of waste products and debris. Upon attaining Substantial Performance of the Work, the Contractor shall remove any products, tools, construction machinery and equipment not required for the performance of the remaining Work. He shall also remove

waste products and debris, and clean the construction area for suitable occupancy

.2 Total Performance of the Work shall not be attained until the Contractor has cleaned up the Site and has removed all plant and surplus products, tools, construction materials and equipment. The Contractor shall also have removed waste products and debris.

2.0 SUBMITTALS

2.1 Shop Drawings

- .1 Provide seven (7) copies of shop drawings for review. Allow five (5) business days for Contract Administrator's review of each submission.
- .2 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.
- .3 Delete information not applicable to project.
- .4 Supplement standard information to provide details applicable to project.

2.2 Close-Out Documents - General

- .1 To satisfy Total Performance, Contractor shall provide four (4) copies of Operating and Maintenance Manuals in binders (see details below), four (4) sets of paper "as-built" record drawings and one (1) electronic AutoCAD copy of the record drawings on CD.
 - .1 Organize data into 2" D-ring vinyl hard covered binders
 - .2 Cover: Identify each binder (typed or printed) with: date, title of the Project, Project address
 - .2 Arrange content by tabbed systems identified in a Table of Contents.
- .2 The Contractor shall affix his company name and sign and date each drawing. The accuracy of these drawings shall be the responsibility of the Contractor.
- .3 If requested, furnish evidence as to type, source and quality of products provided.
- .4 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .5 Pay costs of transportation.

2.5 Close-Out Documents - Contents

- .1 Table of Contents
- .2 Product Data: for each product or system:
 - .1 List full names, addresses and telephone numbers of applicable sub-trades and suppliers, including local source of supplies and replacement parts.
 - .2 Include close-out documents listed in sections of this specification.
- .3 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .4 Occupancy Permit and Inspection Certificate(s) from the Authority Having Jurisdiction.
- .5 Warranties: file under separate tabs. Include information per Section 01-1.8 (below).
- .6 Equipment and Systems:
 - .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. 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. Include regulation, control stopping, shut-down, and emergency instructions. 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 coordination 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 14.0 Testing, Adjusting and Balancing.
 - .15 Additional requirements: As specified in individual specification sections.
- 7 Materials and Finishes:**
- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. 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.
- 8 Warranties and Bonds**
- .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 the applicable item of Work.
 - .4 Per D23 of the Contract Documents, the warranty period shall begin on the date of Substantial Performance.
 - .5 Verify that documents are in proper form, contain full information, and are notarized where applicable.

3.0 STRUCTURAL STEEL

3.1 Reference

- .1 See drawing BE-1.0 R-3 for specification.

3.2 Qualifications of Contractor

- .1 Structural steel fabricator shall have not less than five (5) years experience in the fabrication of structural steel.
- .2 Erector shall have not less than five (5) years experience in erection of structural steel.
- .3 The steel fabricators and erectors must be certified under the requirements of CAN/CSA W47.1 as required by CAN/CSA-S16-01.
- .4 Welding procedures, welders and welding operations shall be qualified in accordance with Canadian Welding Bureau Standards.

3.3 Submittals

- .1 Submit detailed erection and shop drawings prepared under the supervision of a Registered Professional Engineer in accordance with the General Conditions. Where pre-engineered or fabricator designed elements are part of the shop drawings, the shop drawings shall be stamped by a professional engineer licensed to practice in the

applicable province.

.2 The shop drawings shall clearly show all shop and erection details, including cuts, copes, connections, holes, threaded fasteners, splices and welds.

.3 Provide setting drawings, templates and directions for the installation of anchor bolts plates and other devices.

.4 Prior to starting erection work, submit a description of the methods, sequence of erection and type of equipment proposed for in erecting structural steel.

3.4 Finishes

.1 Steel shall be painted with shop primer meeting the requirements of CSA Standard CAN/CSA-S16.1 unless noted otherwise.

.1 Primers for interior exposure not to receive a shop or field paint finish shall be CISC/CPMA Standard 1-73a Primer or other pre-approved.

.2 Primers for exterior exposure not to receive a shop or field paint finish shall be zinc chromate Type - 1, conforming to CGSB 1-GP-40d.

.2 Primers used in a multi-coat system where a final shop or field paint finish is to be applied shall be selected and pre-approved based on surface preparation, exposure conditions and compatibility with subsequent coatings.

3.5 Erection

.1 Verify all dimensions and take necessary field measurements before fabrication.

.2 The erector is fully responsible for erection methods, equipment, workmanship and safety precautions.

.3 Erect structural steel plumb, true and with all necessary precautions against damage of any kind to the material and to the structure. Report every failure of members to come properly together and any measures taken for correction shall be submitted to the Contract Administrator for review.

.4 Confirm the setting of anchor bolts and bearing plates and make an instrument survey to verify the setting prior to erection of steel members.

.5 Cutting or burning of base plates to accommodate misplaced anchor bolts is not permitted.

.6 Provide and install temporary bracing as required to keep the structure plumb and in true alignment during construction. Assume complete responsibility for the extent and timing of the removal of such bracing. The bracing members indicated on the drawings are required for the finished structure and shall not be considered as adequate for temporary bracing. Any failure to make proper and adequate provision for stresses occurring during the erection from any causes whatsoever shall be entirely the responsibility of the Contractor.

.7 Structural steel frames shall be accurately assembled to the lines and elevations indicated within the specified tolerances.

.8 The various members forming parts of complete frame structure after being assembled shall be aligned and adjusted accurately before being fastened.

.9 Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled.

.10 Temporary bolts, clips and angles etc., used to facilitate erection shall be removed unless noted otherwise on the drawings.

3.6 Completion

.1 The Registered Professional Engineer responsible for the sealed shop drawings, or his representative shall visit the site to review in place connections and components designed by that Registered Professional Engineer as required to substantiate compliance with his sealed shop drawings. He shall then submit a letter of compliance provide a sealed and signed letter to the Contract Administrator.

4.0 VAPOUR AND AIR BARRIERS

4.1 References

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.13M-M87, Sealing Compound, One Component, Elastomeric Chemical Curing.
 - .2 CAN/CGSB-19.18M-M87, Sealing Compound, One Component, Silicone Base Solvent Curing.
 - .3 CAN/CGSB-19.24M-M90, Multi-Component, Chemical Curing Sealing Compound.
 - .4 CGSB 19-GP-14M-76, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.
- .2 NBCC 1995; Part 5 – Environmental Separation.
- .3 Sealant and Waterproofer's Institute – Sealant and Caulking Guide Specification.
- .4 National Air Barrier Association (NABA).

4.2 Quality Assurance

- .1 Perform work in accordance with Sealant and Waterproofer's Institute – Sealant and Caulking Guide Specification requirements for materials and installation, National Air Barrier Association – Professional Contractor Quality Assurance Program and requirements for materials and installation, manufacturer's instructions, and drawings and specifications.

4.3 Warranty

- .1 Warranty coverage to include installed sealant and sheet materials which fail to achieve air tight and watertight, seal, exhibit loss of adhesion or cohesion, or do not cure.

4.4 Materials

- 4.4.1 Thermo-fusible vapour barrier on concrete or masonry substrate. Acceptable material: Blueskin TG, Bakor, Soprseal, Soprema or approved equal in accordance with B6.
- 4.4.2 Flat roof vapour barrier. Acceptable material: Orange Label Fibrene, Permastop, Fibreglass Canada, or approved equal in accordance with B6.

5.0 SHEET METAL FLASHING AND TRIM

5.1 Products

- .1 Pre-coated Galvanized Steel: ASTM A525, Z275 zinc coating; 0.6 mm (24 ga.) core steel in all installed locations higher than 2 meters, 1.23 mm (18 ga.) core steel in all installed locations at or lower than 2 meters, shop pre-coated galvalume.
- .2 Galvalume sheet steel: commercial quality to ASTM A 653 with Z275 designation zinc coating, 24 ga. thickness.
- .3 Fascia: Pre-coated Galvalume Steel: ASTM A525, Z275 zinc coating; 0.6 mm (24 ga.) core steel in all installed shop pre-galvanized.
- .4 Fastener: Galvanized steel with fiberglass reinforced nylon head and soft neoprene washer at exposed locations. Finish exposed fasteners same as flashing metal.
- .5 Sealant: Silicone; colour-grey where not exposed to site and to match adjacent materials where exposed.
- .6 Tape: isobutyl, colour grey-3x25.
- .7 Fasteners: same material as sheet metal to CSA B111, flat head roofing nails.
- .8 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .9 Isolation coating: to CAN/CGSB-1.108.
- .10 Isolate dissimilar metals from reacting.

5.2 Installation

- .1 The Work included under this section shall conform to the industry standard and be accepted by the local construction and trade associations.
- .2 Hem exposed edges on underside 13 mm; miter and seam corners.
- .3 Form material with flat lock seam.

- .4 Seal all joints with silicone
- .5 Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
- .6 Verify membrane termination and base flashings are in place, sealed and secure.
- .7 Beginning of installation means acceptance of existing conditions.
- .8 Apply plastic cement compound between metal flashings and felt flashings.

6.0 FIRE STOPPING

6.1 References

- .1 See drawing BE-1.0 R-3 for specification.

6.2 Product Data

- .1 Submit product data in accordance with Section 2.0 Submittals.
- .2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

6.3 Installation

- .1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
- .2 Firestop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Top of fire-resistance rated masonry and gypsum board partitions.
 - .3 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .4 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .5 Openings and sleeves installed for future use through fire separations.
 - .6 Around mechanical and electrical assemblies penetrating fire separations.
 - .7 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

7.0 ALUMINUM DOORS AND FRAMES

7.1 References

- .1 See drawing BE-1.0 R-3 for specification and Door Schedule.

7.2 Submittals

- .1 Shop Drawings: Submit for each type of door and frame, including hardware and finish details.
- .2 Close-Out: Provide maintenance data for cleaning and maintenance of aluminum finishes.

7.3 Warranty

- .1 Manufacturer's Product Warranty to be two (2) years from date of Substantial Completion of the project. In addition, welded door corner construction shall be supported with a limited lifetime warranty for the life of the door under normal use.

7.4 Aluminum Doors

- .1 Aluminum Doors - Standard of Acceptance: Kawneer Aluminum Entrances 190 Swing Door; Narrow stile, 2-1/8" (54mm) vertical face dimension, 1-3/4" (44.5mm) depth
- .2 Glass: Factory sealed single glazed unit; 25 mm overall thickness, comprised of laminated film 0.030 inches thick, clear, glass each side of air space to CAN/CGSB-12.8-M.
- .3 Material Standard: ASTM B 221; 6063-T6 alloy and temper.
 - .1 Glazing stops: tamperproof type.

- .4 Door stile and face rail dimensions to be as follows:
 - .1 Vertical Stile: 2-1/8" (54mm)
 - .2 Top Rail: 2-1/4" (58mm)
 - .3 Bottom Rail: 3-7/8" (99mm)
- .5 Factory Finishing: Kawneer Permanodic® AA-M12C22A31, AAMA 611, Architectural Class II Clear Anodic Coating (Color #17 Clear).
- .6 Hardware: see Door and Hardware Schedule, drawing BE-1.0 R-3 and Door Hardware specification in Section 8.0 Door Hardware.
- .7 Glazing gaskets shall be either EPDM elastomeric extrusions or a thermoplastic elastomer.
- .8 Provide adjustable glass jacks to help center the glass in the door opening.

7.5 Aluminum Frames

- .1 Construct insulated frames of Aluminum extrusions with minimum wall thickness of 3 mm.
- .2 Frame members 114 x 44.5 mm nominal size not thermally broken, for flush glazing.
- .3 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry.

8.0 DOOR HARDWARE

8.1 References

- .1 See drawings BE-1.0 R-3 for specification and Hardware Schedule.

8.2 Submittals

- .1 Close-Out: Provide operation, maintenance and cleaning data for door closers, locksets, door holders and fire exit hardware.

8.3 Mounting Heights

- .1 Maintain the following mounting heights above finished floor for door from finished floor to centre line of hardware item:
 - .1 Push/Pulls: mount at 1050mm
 - .2 Handicap Door Operators: mount two (2) operators on each side of door. One (1) to be mounted at 850-950mm, and one (1) to be mounted at 225mm.

9.0 GLAZING

9.1 References

- .1 See drawing BE-1.0 R-3 for specification.

9.2 Submittals

- .1 Close-Out: Provide maintenance data including cleaning instructions.

10.0 GYPSUM WALL BOARD

10.1 References

- .1 See drawing BE-1.0 R-3 for specification.

10.2 Materials

- .1 Standard board: to ASTM C36/C36M regular, Type X, 12 mm thick x 1200 mm wide x maximum practical length, ends square cut, edges bevelled.
- .2 Water-resistant board (indicated on drawing BE-1.0 R-3 as "AQUA BOARD"): to ASTM C630 regular, Type X, 12 mm thick x 1200 mm wide x maximum practical length.

11.1 PAINTING

11.1 References

- .1 See drawing BE-1.0 R-3 for specification.

11.2 Samples

- .1 Submit samples in accordance with Section 2.0 Submittals
- .2 Submit samples in duplicate of each colour selected in 300 mm x 300 mm sizes.

11.3 Materials

- .1 Paint materials: only materials listed in the latest edition of the MPI Approved Product List (APL) are acceptable for use on this project. All such material shall be a single manufacturer for each system used.
- .2 Acceptable products: Benjamin Moore- Cloverdale, ICI Delux Lifemaster.- Low VOC, low odour. Choice of full range of colours.
- .3 Other material such as linseed oil, shellac, thinners, solvents, etc. shall be the highest quality product of an MPI listed manufacturer and shall be compatible with paint materials being used as required.
- .4 All materials used shall be lead and mercury free and shall have low VOC content where possible.
- .5 Where required, paints and coatings shall meet flame spread and smoke development ratings designated by local Code requirements and/or authorities having jurisdiction.
- .6 Unless otherwise specified herein, all painting work shall be in accordance with MPI Premium Grade finish requirements.
- .7 Colours shall be as selected by the Contract Administrator from a manufacturer's full range of colour. Colour and gloss level to match existing unless directed otherwise by Contract Administrator.

11.4 Execution

- .1 Apply paint in accordance with MPI Painting Manual Premium Grade finish requirements.
- .2 Do not paint unless substrates are acceptable and/or until all environmental conditions (heating, ventilation, lighting and completion of other sub trade work) are acceptable for applications of products.

11.5 Mechanical/Electrical Equipment and Related Sections

- .1 Unless otherwise specified or noted, paint all "unfinished" conduits, piping, hangers, ductwork, and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in the following areas:
 - .1 Where exposed-to-view in all exterior (includes roof-top units) and interior areas.
 - .2 In all interior high humidity interior areas.
 - .3 In all boiler room, mechanical and electrical rooms.
- .2 In unfinished areas, leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .3 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .4 Do not paint over nameplates.
- .5 Paint the inside of all ductwork where visible behind louvers, grilles and diffusers for a minimum of 460 mm (18") or beyond sight line, whichever is greater, with primer and one coat of matt black (non-reflecting) paint.
- .6 Paint disconnected switches for fire alarm system and exit light systems in red enamel.
- .7 Paint red or band on all fire protection piping and sprinkler lines in accordance with mechanical specification requirements. Keep sprinkler heads free of paint.
- .8 Paint yellow or band on all natural gas piping in accordance with mechanical specification requirements.

11.6 Protection

- .1 Protect all interior and exterior surfaces and areas from painting operations and damage
 - .1 Areas include landscaping, walks, drives, all adjacent building surfaces (including glass, aluminum surfaces, etc.) equipment, labels and signage

- .2 Protect using drop cloths, shields, masking, templates, or other suitable protective means and make good any damage
- .2 Erect barriers or screens and post signs to warn of or limit or direct traffic away or around Work area as required.

12.0 PLUMBING – NATURAL GAS SYSTEMS

12.1 References

- .1 See drawing M-2.0 R-3 for Mechanical specification.

12.2 Materials

- .1 See drawing M-2.0 R-3 for Plumbing specification.
- .3 Valve parts must be of material recommended by manufacturer for service specified. Valves must be installed with stems upright or horizontal, not inverted. Valves not specifically covered herein shall be of comparable quality to those specified.
 - .1 Valves up to 50mm (2") size – Toyo 5044A and Kitz Code No. 58 ball valve or Newman Hattersley 1969F. Newman-Milliken 200M, lubricated screwed plug valve.
 - .2 Valves 64mm (2 ½") and larger: Newman-Milliken 201M flanged plug valve. Newman-Milliken 200M, lubricated screwed plug valve.

12.3 Installation

- .1 Remove valve working parts during installation to prevent damage from heat where brazing, soldering, or welding is used.
- .2 Comply with latest CSA Standard W117.2 "Code for Safety in Welding and Cutting".
- .3 Provide a shutoff valve on supply connections at each piece of equipment.
- .4 Make arrangements with gas utility company to bring in service and install meter and regulator. Pay all service and installation charges.
- .5 Run piping as shown to serve equipment. Take out permits and connect equipment ready for use. Provide gas regulators as required. Run vent piping from relief valves to atmosphere. Install gas piping in accordance with Provincial Department of Labour regulations. Provide gas cock at each piece of equipment. Provide drip pockets at each piece of equipment and at low points. Grade horizontal piping 1:500 (1" in 40') to drain through risers.
- .6 All natural gas piping concealed above lay-in tile ceilings, in walls or other inaccessible locations shall have all welded joints and shall be stamped by the welder with his number.
- .7 Where gas piping is welded, welding to be performed by welder holding current welder's certificate from Provincial Department of Labour. Arrange with Provincial authorities to inspect and provide written approval to Contract Administrator prior to system use.

12.4 Expansion and Contraction of Piping

- .1 Make provision for expansion and contraction of all piping. Use swing connections where shown or necessary.

13.0 MECHANICAL

13.1 References

- .1 See drawing M-2.0 R-3 for Mechanical specification.

13.2 Submittals

- .1 Shop Drawings: Submit shop drawings and/or product data for review by the Contract Administrator.
- .2 Provide for Close-Out Documents:

- .1 Maintenance data, including control and layout diagrams, specification sheets and maintenance and repair instructions
- .2 Operating instructions

13.3 Equipment

- .1 Provide one indirect fired gas heating unit (outdoor):
 - .1 Rooftop gas heating unit
 - .2 Standard temperature rise furnace 20-60 F (-7 – 16 C) per furnace, right hand
 - .3 700 MBH input
 - .4 Gravity venting
 - .5 208/60/3 main power supply
 - .6 Electronic modulating gas control with duct thermostat
 - .7 Natural gas with 100% lockout
 - .8 409 stainless steel heat exchanger (first furnace only)
 - .9 Rooftop arrangement C – Standard blower with downflow supply plenum
 - .10 3 HP supply fan motor with magnetic starter
 - .11 Single speed high efficiency totally enclosed fan cooled motor
 - .12 100% outside air opening with outside air hood
 - .13 2-position outside air damper/spring return
 - .14 Air flow proving switch
 - .15 Status indicator lamps (electrical cabinet)
 - .16 Manual reset high limit switch
 - .17 2" (51mm) pleated media filter with carbon, including 2 spare filters
 - .18 Convenience service package
 - .19 7 day timeclock
 - .10 Remote control station
 - .11 Stainless steel duct thermostat
 - .12 Insulated roof curb
 - .13 Interlock relay 24/115V coil SPDT 10A
- .2 Standard of Acceptance: Trane model GRBA70GHDF0
- .3 In accordance with B6, any substitutes or alternates the Contractor considers equal to that specified must not exceed available space or weight limitations. All additional costs for mechanical, electrical, structural and/or architectural revisions required to incorporate materials substituted by Contractor shall be responsibility of Contractor.
- .4 Equipment listed as 'equal' in specifications or submitted in accordance with B6 shall meet all space requirements, specified capacities and must have equipment characteristics of specified equipment as interpreted by Contract Administrator. Install equipment in strict accordance with manufacturer's published recommendations.

13.3 Installation

- .1 Follow manufacturer's recommendations for safety, adequate access for inspection, maintenance and repairs of individual equipment installed.
- .2 Permit equipment maintenance and disassembly with minimum disturbance to connecting piping and duct systems and without interference with building structure or other equipment.
- .3 Provide accessible lubricating means for bearings, including permanent lubricated 'Lifetime' bearings.
- .4 Air inlet for MUA to be turned away from the tire factory at the south.

13.4 Hanger and Supports

- .1 Piping, ductwork and equipment shall be securely supported from building structure. Perforated strap or wire hangers are not permitted.
- .2 Support components shall conform to Manufacturers Standardization Society Specification.

13.5 Supports, Bases, Pits

- .1 Supply and erect all special structural Work required for installation of tanks, pumps, fans, motors and other apparatus.

13.6 Flashing

- .1 Where pipes or ducts go through a roof or wall, they should be boxed-in and flashed as per Section 5.0 Sheet Metal Flashing and Trim. Allow for expansion and contraction of pipe. Flashing shall be waterproof.

13.7 Access Doors

- .1 Contractor to provide access doors where valves, dampers and/or any other mechanical equipment requiring access are built-in.
- .2 Access door to be 2.5mm (12 ga.) steel, 300mm x 450mm (12" x 18") or as specified elsewhere, finished prime coat only, with concealed hinges, anchor straps, plaster lock and without screws, all equal to Milcor manufacture. Where it is necessary for persons to enter through door, doors to be at least 450mm x 600mm (18" x 24") or as required.
- .3 Supply access doors for concealed valves or groups of valves, dampers, fire dampers, flush valves, shock arrestors, trap seal primers, etc.
- .4 Access doors located in fire rated ceilings and walls shall be an approved ULC stamped, fire rated door.

13.8 Identification

.1 Valves:

- .1 Provide engraved lamacoid colour coded tags secured to items with non-ferrous chains or "S" hooks. Use for valves and operating controllers of all systems. Consecutively number valves in each piping system i.e. domestic water, steam, etc.
- .2 For each building, provide tag schedule, designating number, service, function, colour code, and location of each tagged item. Provide one plastic laminated copy of tag schedule and secure to mechanical room wall where instructed. Place one additional copy in each maintenance instruction manual.
- .3 Identify controls and gauges by labels of 3mm (1/8") plastic engraving stock with white lettering on black background. Size approximately 62mm x 25mm (2½" x 1") high.

.2 Equipment:

- .1 Provide manufacturer's nameplate on each piece of equipment.
- .2 In addition Mechanical Subcontractor shall provide equipment I.D. tag minimum size 87mm x 32mm x 2.3mm (3 ½" x 1 ½" x 3/32") nominal thickness laminated phenolic plastic with black face and white centre. Engraved 6mm (1/4") high lettering. For motors and controls and for larger equipment such as chillers, tanks, 25mm (1") high lettering; for hot equipment such as boilers and convertors, provide engraved brass or bronze plates with black paint filled identification.
- .3 Identify as follows: equipment type and number (e.g. pump no. 2), service or areas or zone building served (e.g. south zone chilled water primary).
- .4 Provide manufacturer's registration plates (e.g. pressure vessel, Underwriters' Laboratories and CSA approval plates) as required by respective agency and as specified.

.3 Piping:

- .1 For building additions and alterations, use existing coding system.

.4 Ductwork:

- .1 Use black 50mm (2") high stencilled letters (e.g. "Cold", "Hot", "Return", "Sanitary Exhaust", "Kitchen Exhaust") with arrow indicating air flow direction.
- .2 Distance between markings 15m (50') maximum.
- .3 Identify ducts on each side of dividing walls or partitions and beside each access door.
- .4 Stencil only over final finish.
- .5 Prior to installation, review general application of identification with Contract Administrator.

13.9 Mechanical Equipment Guards

- .1 Meet safety requirement of Provincial Department of Labour and local authorities having jurisdiction.

13.10 Screws, Bolts and Fasteners

- .1 Use standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hex heads, semi-finished unless otherwise specified. Use non-ferrous material throughout for plumbing services. Use type 304 stainless steel for exterior areas.
- .3 Bolts used on fan equipment for access to motors, bearings, filters and the like shall be heavy-duty.
- .4 Bolts shall not project more than one diameter beyond nuts.
- .5 Washers:
 - .1 Use plain-type washers on equipment, sheet metal and soft gaskets
 - .2 Use lock-type washers where vibration occurs
 - .3 Use resilient washers with stainless steel.

13.11 Openings in Fire Separations

- .1 Per Section 6.0 Fire Stopping, provide firestopping for all openings in fire separations for passage of pipes, ducts, etc. to maintain integrity of fire separations.

14.0 TESTING, ADJUSTING AND BALANCING

14.1 References

- .1 See drawing M-2.0 R-3 for Testing and Balancing specification.
- .2 See General Note 2 on drawing M-1.0 R-3.
- .3 AABC – National Standards for Total System Balance.
- .4 ADC – Test Code for Grilles, Registers, and Diffusers.
- .5 ASHRAE 111 – Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- .6 NEBB – Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.
- .7 SMACNA – HVAC Systems Testing, Adjusting and Balancing.

14.2 Scope of Work

- .1 Provide complete testing, adjustment and final balancing of all building air systems.
- .2 Provide inspection, verification and testing of all fire dampers, fire/smoke dampers, smoke control dampers and ceiling fire stops after installation.

14.3 Balancing Reports

- .1 Provide sufficient number of copies of final balancing report for inclusion in Close-Out Documents.

14.4 Identification of Fire Dampers and Ceiling Fire Stops

- .1 At all fire dampers, fire/smoke dampers, smoke control dampers and ceiling fire stops, supply and install identification tags. Tags c/w envelopes shall be of type approved by Contract Administrator.
- .2 Envelopes shall be mechanically fastened to adjacent duct access door, or onto structure near dampers or ceiling fire stop where there is no connecting ductwork.
- .3 After each device has been verified, Contractor shall label tag with permanent ink identifying device, location (room number), inspection date, inspector's signature and TAB Agency name.

15.0 INSULATION

15.1 References

- .1 See drawing M-2.0 R-3 for Mechanical specification.
- .2 NAIMA National Insulation Standards

.3 SMACNA – HVAC Duct Construction Standards – Metal and Flexible

15.2 Materials

- .1 All new supply air duct main, and exhaust or relief ductwork shall be externally insulated with Fibreglas RFFRK reinforced foilfaced vapour seal duct insulation PF335, 340 g. (3/4 lb./cu. ft.) density.
- .2 Insulation thickness to be 25mm (1").

15.3 Refrigerant Pipe Insulation

- .1 Insulate all refrigerant piping lines with 12mm (1/2") Armstrong Armaflex AP sealed with Armstrong 520 adhesive. Refinish exposed and exterior insulation with Armstrong WB Armaflex finish.
- .2 Cover outdoor insulation with aluminum jacket CSA HA Series-M1980.
 - .1 Crimped or embossed alloy jacketing 0.4mm thick with longitudinal slip joints and 50mm end laps with factory attached protective liner on interior surface. Aluminum alloy butt straps with mechanical fastener.
 - .2 Jackets on fittings, 0.4mm thick, die shaped components of alloy with factory attached protective liner on interior surface.
- .3 Seal joints and seams with adhesive, and refinish exposed fittings with specified finish. Refinish all exposed piping with two additional coats.
- .4 Where insulation comes in close contact with adjacent equipment or piping having surface temperatures above 100 deg. C, provide additional protection to ensure against deterioration of insulation by heat.
- .5 Allow adhesive joints of Pipe Insulation to dry 24 hours to 36 hours before applying finish. Apply finish directly to clean, dry insulation in two coats.
- .6 Finish insulation located outdoor with Armstrong WB black Armaflex finish. Do not apply over joints freshly cemented with 520 adhesive. Allow adhesive joints of Armaflex pipe insulation to dry 24 to 36 hours before applying finish.

15.4 Workmanship

- .1 Work shall be performed by licensed journeymen.
- .2 Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations.
- .3 Do not apply coverings until hydrostatic tests have been completed, surfaces are free of grease, scale, moisture, and heat tracing, where required, has been installed. Insulation shall be clean and dry when installed and during application of any finish.
- .4 Apply insulation and coverings to equipment and piping which will operate with hot or warm liquid vapour, while surface is hot. Provide any required temporary heat to accomplish this.
- .5 Cold surfaces to be dry and ferrous surfaces to be coated with rust penetrating protective paint before applying insulation and vapour barriers.
- .6 Vapour barriers and insulation to be complete over full length of pipe or surface, without penetration for hangers, duct or seams, and without interruption at sleeves, pipe and fittings.
- .7 Pack solid around all pipes where they pass through sleeves in walls, floor slabs, etc. for full thickness of floor with fibreglass or rockwool. Refer to firestopping clause where piping passes through fire separations. On all services, carry full insulation thickness through walls, floor, etc. protect insulation of exposed pipes passing through floors with 1.2mm (18 ga.) galv. Iron 150mm (6") from finished floor.
- .8 Duct insulation with vapour barrier shall be continuous, except at fire dampers.
- .9 Existing duct and pipe covering damaged or cut back during installation Work to be made good with same insulation as specified for new Work.
- .10 Protect insulation against elements during all stages of application.
- .11 Do not cover manufacturer's nameplates. Cut insulation on 45 deg. angle to nameplate edge and seal.

16.0 HVAC SYSTEMS

16.1 References

- .1 See drawing M-2.0 R-3 for Mechanical specification.
- .2 ANSI/NFPA (Latest Edition)- Installation of Air Conditioning and Ventilating Systems
- .3 ANSI/NFPA (Latest Edition)- Installation of Warm Air Heating and Air Conditioning Systems
- .4 NFPA 54 (AGA Z223.1) – National Gas Code
- .5 Ashrae 90A – Energy Conservation in New Building Design
- .6 Ashrae 62 (latest edition) – Ventilation for Acceptable Indoor Air Quality
- .7 SMACNA 006- 2006- HVAC Duct Construction Standards Metal and Flexible

16.2 Submittals

- .1 Close-Out Documents: provide documents showing wiring diagram, system equipment, operation descriptions and maintenance procedures. Identify all dampers clearly and accurately on the as-built drawings.

16.3 Installation

- .1 All duct and plenum dimensions as indicated on the drawings refer to clear inside duct dimensions.
- .2 Provide U.L. listed fire damper or fire stop flap for wall, floor, attic and ceiling as indicated on plans. These are life safety items and shall be carefully done. If they are not indicated, the Contractor to provide fire damper at fire separation as requested by the Authority having jurisdiction without additional cost to the City. Installation shall conform to manufacturer's instructions with retaining angles and breakaway joints, Contractor shall provide airtight duct access at convenient location, to access fusible links to facilitate testing and maintenance, at all fire damper locations.
- .3 Brace all ducts properly, so as not to interfere with the free flow of air, make air tight and free from buckling and sagging. All flat surfaces to be cross broken.
- .4 Provide "Shaftloc" damper locking quadrant with damper position indicator (close-open) for all manual balancing dampers.
- .5 All laps shall be in the direction of air flow. Rivets and bolts shall be used throughout. All edges and slips to be hammered down to leave a smooth interior duct.
- .6 Connect ductwork to furnace with 75mm Duro-Dyne flexible connection or as specified elsewhere, secure in place with rigid strapping and make airtight.
- .7 Seal all transverse joints and connections air tight with gaskets, sealant or combination thereof. Longitudinal seams unsealed. Use an approved duct dealer on all joints and seams. No duct tape allowed.
- .8 All horizontal ductwork shall be supported by non-perforated, galvanized steel hanger strap or rod. Hanger strap to be next sheet metal thickness heavier than duct at a maximum of 2400mm on centre. Maximum size duct supported by strap hanger, 500mm. Hanger rod size 6mm c/w 40 x 40 steel support angle. Wire hangers or perforated straps will not be accepted. Hangers and supports shall not damage or pierce insulation.
- .9 Duct hangers, supports, bolts, rods and sleeves, etc. shall be of galvanized (non-rust) or stainless steel type.
- .10 No cutting of beams, columns or slabs will be allowed without the approval of the Contract Administrator for the installation of ductwork, etc. Protect all Work from damage, any Work defaced must be repaired by the Contractor.
- .11 Seal all duct openings made in the building structure properly to provide a weather tight, water proof seal.
- .12 System schematics shown on plans are of minimum requirements. Equipment installation including all controls, fittings, and accessories shall be in strict accordance with manufacturer's instructions, and Contractor shall include and bear all cost for such installations.

17.0 CONTROLS

17.1 References

- .1 See drawing M-2.0 R-3 for Mechanical specification.
- .2 See drawing E-2.0 R-3 for Motor/Equipment Schedule.

17.2 Submittals

- .1 Submit shop drawings for the following:
 - .1 Control panel.
 - .2 Control diagrams.
 - .3 Equipment.
 - .4 Dampers.
 - .5 Thermostats.
- .2 Provide for Close-Out Documents:
 - .1 Maintenance data, including control and layout diagrams, specification sheets and maintenance and repair instructions
 - .2 Operating instructions
- .3 Supply control diagrams mounted permanently on hard board and plasticized. Install adjacent to the equipment in each Mechanical Room.

17.3 Execution

- .1 All temperature control wiring 50 volts or more shall be a minimum of #14 gauge wire. All temperature control wiring less than 50 volts shall be minimum #18 gauge wire. All wiring shall be run in conduit including low voltage control wiring.

17.4 Control Dampers

- .1 Provide all control dampers of the sizes and type indicated on the plans.
- .2 Leakage shall not exceed 1% with an approach velocity of 7.6 m/s when the damper is closed against 1000 Pa.

17.5 Damper Operators

- .1 Damper operators as indicated on plans.
- .2 Operators shall be direct mount type.
- .3 Valve operators shall be of type to withstand temperatures likely to be encountered in application.

17.6 Sequence of Operation

- .1 MUA CONTROL
 - .1 The new remote control panel shall control the AHU on an occupied/unoccupied schedule. AHU to run continuously, but maintain occupied and unoccupied temperature set points from a duct thermostat. Contractor to install and wire all necessary controls. MUA to be interlocked to existing shower room exhaust fan
- .2 RTU CONTROL
 - .1 RTU shall be controlled by a new thermostat shall control the AHU on an occupied/unoccupied schedule. During the occupied mode the RTU will operate to maintain the space temperature set point. During the unoccupied mode, the RTU will be cycled by a space thermostat to maintain the space temperature at the night set back set point. Contractor to install and wire all necessary controls.

18.0 ELECTRICAL**18.1 References**

- .1 See drawing E-3.0 R-3 for Electrical specification.
- .2 CSA C22.1-02 – Canadian Electrical Code, Part 1 (Latest Edition), Safety Standard for Electrical Installations.
- .3 CSA Electrical Bulletins (Latest Editions)
- .4 Electrical Supply Authority and Local Inspection Authority

18.2 Submittals

- .1 Shop Drawings: Submit shop drawings and/or product data for review by the Contract Administrator.
- .2 Close-Out Documents: Provide operation and maintenance data, including names and addresses of local suppliers for items included in the manuals.
 - .1 Include details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
 - .2 Include technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
 - .3 Include wiring and schematic diagrams and performance curves.
 - .4 Furnish a Certificate of Acceptance from the Inspection Authorities on completion of the Work. Copies of certificate shall be included in Close-Out Document binders. Certificate shall be submitted before final payment may be considered to be due.

18.3 Care, Operation and Start-Up

- .1 Instruct the City's operating personnel in the operation, care and maintenance of equipment. Arrangement of such instructional sessions shall be done at a time convenient to the City, and ensure that operating personnel are conversant with all aspects of its care and operation.
- .2 Arrange and pay for services of Manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.

18.4 Equipment Identification

- .1 Identify electrical equipment with lamacoid nameplates, 3mm ($\frac{1}{8}$ ") thick plastic engraving sheet, black or red face, white core, mechanically attached (screwed or riveted) unless specified otherwise. Sizes as follows:
 - Size 0 10 x 38mm ($\frac{3}{8}$ " x 1- $\frac{1}{2}$ ") 1 line 3mm ($\frac{1}{8}$ ") high letters
 - Size 1 10 x 100mm ($\frac{3}{8}$ " x 4") 1 line 3mm ($\frac{1}{8}$ ") high letters
 - Size 2 13 x 75mm ($\frac{1}{2}$ " x 3") 1 line 5mm ($\frac{3}{16}$ ") high letters
 - Size 3 13 x 75mm ($\frac{1}{2}$ " x 3") 2 lines 3mm ($\frac{1}{8}$ ") high letters
 - Size 4 19 x 75mm ($\frac{3}{4}$ " x 3") 1 line 10mm ($\frac{3}{8}$ ") high letters
 - Size 5 19 x 100mm ($\frac{3}{4}$ " x 4") 2 lines 5mm ($\frac{3}{16}$ ") high letters
 - Size 6 25 x 100mm (1" x 4") 1 line 13mm ($\frac{1}{2}$ ") high letters
 - Size 7 25 x 100mm (1" x 4") 2 lines 6mm ($\frac{1}{4}$ ") high letters
- .2 Wording on nameplates shall be approved prior to manufacture. Submit schedule of nameplates and wording.
- .3 Allow for average of twenty-five (25) letters per nameplate.
- .4 Nameplates for terminal cabinets and junction boxes shall indicate system and/or voltage characteristics.
- .5 Use black nameplates with white lettering for normal power and communications equipment. Use red nameplates with white lettering for emergency power and fire alarm equipment.

18.5 Labels and Warning Signs

- .1 Manufacturer's nameplates and CSA labels shall be visible and legible after equipment is installed.
- .2 Provide warning signs on equipment, as required, to meet the requirements of the Inspection Authorities, including indication of multiple power sources.

18.6 Mounting Heights

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicate otherwise (if mounting height of equipment is not indicated, verify with Contract Administrator before proceeding with installation):

- .1 General receptacles: 400mm (16").
- .2 Receptacles in mechanical areas: 1m (40").
- .3 Switches, dimmers, push buttons: 916mm (36").
- .4 Fire alarm pullstations, thermostats: 1200mm (46").
- .5 Fire alarm bells, horns, speakers: 2.2m (88").

18.7 Protection

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts "LIVE () VOLTS", with appropriate voltage in English.
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision.

18.8 Load Balance

- .1 Measure phase current to panelboards with normal loads operating at time of measurement. Add new equipment and circuit breakers with the aim of obtaining the best balance of current between phases, record changes and add to record drawings.

18.9 Insulation Resistance Testing

- .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
- .2 Megger 350-600V circuits, feeders and equipment with a 1000V instrument.
- .3 Check resistance to ground before energizing.

18.10 Final Cleaning

- .1 At time of final cleaning, clean lighting reflectors, lenses, and other lighting surfaces in and around the area of the Work that have been exposed to construction dust and dirt.

19.0 WIRES AND CABLES

19.1 References

- .1 See drawing E-3.0 R-3 for Electrical specification.
- .2 CSA C22.1-02 – Canadian Electrical Code, Part 1 (Latest Edition), Safety Standard for Electrical Installations.
- .3 CSA C22.2 No. 0.3 – Test Methods for Electrical Wires and Cables.
- .4 CSA C22.2 No. 48-M90 (R2000) – Non-metallic Sheathed Cable.
- .5 CSA C22.2 No. 51 Armoured Cables.
- .6 CSA C22.2 No. 52-96 (R2000) – Underground Service-Entrance Cables.
- .7 CAN/CSA C22.2 No. 65-03 (CSA/UL/ANCE) – Wire Connectors.
- .8 CSA C22.2 No. 75-03 (CSA/UL/ANCE) – Thermoplastic-Insulated Wires and Cables.
- .9 CSA C22.2 No. 123 Aluminum Sheathed Cables.
- .10 CSA C22.2 No. 131 Type TECK 90 Cable.
- .11 NECA (National Electrical Contractors Association) – Standard of Installation.

19.2 Materials

- .1 Conductors in Conduit:
 - .1 Type: RW90
- .2 Conductors:
 - .1 Solid Copper #10 AWG and smaller.
 - .2 Stranded Copper #8 AWG and larger.
 - .3 Sized as indicated (Minimum #12 AWG).
- .3 Insulation: Cross link polyethylene (RW90), (RWU90), 90 deg. C.
- .4 Configuration: Single conductor.
- .5 Voltage Rating: Minimum 600V.
- .6 Certification: CSA C22.22 No. 38 or latest revision.
- .2 Armored Cable (BX):
 - .1 Type: AC90.
- .2 Conductors:

- .1 Solid Copper #10 AWG and smaller.
- .2 Stranded Copper #8 AWG and larger.
- .3 Sized as indicated (Minimum #12 AWG).
- .3 Insulation: Cross link polyethylene (RW90), (RWU90), 90 deg. C.
- .4 Configuration: Multi-conductor, as required, c/w a separate bare CU ground wire.
- .5 Voltage Rating: Minimum 600V.
- .6 Certification: CSA C22.22 No. 51 or latest revision.
- .3 Armored Cable (TECK)
 - .1 Type: TECK
 - .2 Conductors:
 - .1 Solid Copper #10 AWG and smaller.
 - .2 Stranded Copper #8 AWG and larger.
 - .3 Sized as indicated (Minimum #12 AWG).
 - .3 Insulation: Cross link polyethylene (RW90), 90 deg. C.
 - .4 Configuration: Multi-conductor, as required, c/w a separate bare CU ground wire.
 - .5 Voltage Rating: 1KV, 5 KV, or 15KV as indicated.
 - .6 Inner Jacket:
 - .1 Black polyvinyl chloride (PVC).
 - .2 Low Flame Spread (LFS).
 - .3 Low Gas Emission (LGE).
 - .7 Armor: Inter-locked aluminum
 - .8 Outer Jacket:
 - .1 Black polyvinyl chloride (PVC), -40 deg. C.
 - .2 Low Flame Spread (LFS).
 - .3 Low Gas Emission (LGE).
 - .9 Flame Rating: FT4
 - .10 Certification: CSA C22.22 No. 131 or latest revision.
- .4 Low Voltage Control Cables
 - .1 Type: LVT.
 - .2 Conductor: Solid Copper #18 AWG.
 - .3 Insulation: Thermoplastic, colour coded.
 - .4 Configuration: single, two conductor – parallel, three or more conductors twisted.
 - .5 Voltage Rating: 30V.
 - .6 Outer Jacket: thermoplastic.
 - .7 Certification: CSA C22.22 No. 35
 - .8 Flame Rating: FT4.
- .5 Pressure type connectors, fixture type splicing connectors, cable clamps and lugs as required.
- .6 RA90 Cables
 - .1 Single conductor RW90 insulation, minimum 600V, -40C.
 - .2 Stranded copper, size as indicated.
 - .3 Liquid and vapour tight corrugated aluminum sheath.
 - .4 Overall PVC jacket rated FT-4.

19.3 Installation

- .1 All branch circuit wiring and conduit shall be installed to minimize voltage drop. Install additional conduit runs as required to take the most direct and shortest route to outlets, light fixtures, etc.
- .2 Branch circuits exceeding 21 metres shall be #10 AWG, branch circuits exceeding 35 metres shall be #8 AWG.
- .3 Group and lace-in neatly wire and cable installed in switchboards, panelboards, cabinets, wireways and other such enclosures.
- .4 Identify control conductors in motor control equipment, contactors, fire alarm panels, etc. with mylar/cloth wire markers.

20.0 CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

20.1 References

- .1 See drawing E-3.0 R-3 for Electrical specification.
- .2 CSA C22.1 – Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.
- .3 CAN/CSA-C22.2 No. 18 – Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
- .4 CSA C22.2 No. 45 – Rigid Metal Conduit.
- .5 CSA C22.2 No. 45.1 – Rigid Metal Conduit – Steel
- .6 CSA C22.2 No. 56 – Flexible Metal Conduit and Liquid – Tight Flexible Metal Conduit
- .7 CSA C22.2 No. 83.1 (CSA/UL) – Electrical Metallic Tubing – Steel.
- .8 CSA C22.2 No. 211.1 – Rigid Types EB1 and DB2/ES2 PVC Conduit.
- .9 CSA C22.2 No. 211.2 – Rigid PVC (Unplasticized) Conduit.
- .10 CSA C22.2 No. 211.3 (CSA/UL) – Reinforced Thermosetting Resin Conduit (RTRC) on Fittings.
- .11 CSA C22.2 No. 227.1 (CSA/UL) – Electrical Nonmetallic Tubing.
- .12 CSA C22.2 No. 227.2.1 (CSA/UL) Liquid-Tight Flexible Nonmetallic Conduit.
- .13 NFPA 70 – National Electrical Code.

20.2 Conduits

- .1 Rigid galvanized steel threaded conduit.
- .2 Epoxy coated conduit: with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): with couplings. Minimum size shall be 13mm.
- .4 Rigid pvc conduit.
- .5 Flexible metal conduit and liquid-tight flexible metal conduit.

20.3 Conduit Fastenings and Fittings

- .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 U channel type supports for two or more conduits at 1500 mm oc. (Surface mounted or suspended).
- .4 Six mm diameter galvanized threaded rods to support suspended channels.
- .5 Fittings for raceways: to CSA C22.2 No. 18.
- .6 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .7 Factory “ells” where 90 deg. bends are required for 25 mm and larger conduits.
- .8 Steel set screw connectors and couplings. Insulated throat liners on connectors.
- .9 Raintight connectors and fittings complete with O-rings for use on weatherproof or sprinklerproof enclosures. Raintight couplings to be used for surface conduit installations exposed to moisture or sprinkler heads.
- .10 Explosion proof in hazardous areas to meet requirements of authorities having jurisdiction.

20.4 Installation

- .1 Use electrical metallic tubing (EMT) except where specified otherwise.
- .2 Use rigid PVC conduit for underground installations.
- .3 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures, transformers and equipment subject to vibration or movement. Provide a separate insulated grounding conductor within flexible conduit.
- .4 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .5 Install conduit sealing fittings in hazardous areas, Fill with compound.
- .6 Conduit stubs from floor slabs where exposed to damage to be rigid galvanized steel.
- .7 Dry conduits out before installing wire.

- .8 No circuits fed from emergency or essential power sources shall be run in the same conduit as other systems.
- .9 Provide separate conduit system for emergency distribution.
- .10 All conduit runs passing across expansion joints of the building shall be installed utilizing approved expansion fittings, and bonding devices.
- .11 All conduit systems in hazardous areas to be rigid galvanized steel to meet the requirements of the authorities having jurisdiction.

20.5 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 150 mm parallel to steam or hot water lines with minimum of 75 mm at crossovers.
- .7 No power driven pins (Ramset) shall be utilized to secure any portion of the conduit.

21.0 WIRING DEVICES

21.1 References

- .1 See drawing E-3.0 R-3 for Electrical specification.
- .2 CSA C22.1 – Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.
- .3 CSA C22.2 No. 42 – General Use Receptacles, Attachment Plugs and Similar Devices.
- .4 CSA C22.2 No. 42.1 – Cover Plates for Flush-Mounted Wiring Devices (Bi-National standard, with UL 5154D).
- .5 CSA C22.2 No. 55 – Special Use Switches.
- .6 CSA C22.2 No. 111 – General-Use Snap Switches (Bi-National standard, with UL 20, twelfth edition).
- .7 C22.2 No. 184 – Solid State Lighting Controls.
- .8 C22.2 No. 184.1 – Solid-State Dimming Controls (Bi-National standard with UL 1472).

21.2 Switches

- .1 Toggle operated general purpose AC Switches 15A and 20A 120Vac and 240Vac single pole, double pole, three-way and four-way switches as indicated, with the following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea molding.
 - .4 Suitable for back and side wiring.
 - .5 Fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .2 Switches of one manufacturer throughout project.
- .3 Switches to be premium specification grade.
- .4 Acceptable manufacturers (120 volt): Hubbell 1200 Series, Bryant 4800 Series, Leviton 1200 Series, Pass & Seymour AG-1 Series, Smith & Stone 4-4800 Series, Slater 710 Series.

21.3 Receptacles

- .1 Duplex receptacles, CSA type 5-15 R, 125 Vac, 15 A, U ground, with following features:
 - .1 Suitable for No. 10 AWG for back and side wiring.
 - .2 Break-off links for use as split receptacles.
 - .3 Double wipe contacts and rivetted grounding contacts.
- .2 Single receptacles CSA type 5-15 R, 125 VAC, 15 A, U ground with following features:
 - .1 Suitable for No. 10 AWG for back and side wiring.
- .3 Receptacles to be orange face isolated ground type where indicated. Provide a separate

- insulated ground wire and a separate neutral for each isolated ground circuit.
- .4 Receptacles of one manufacturer throughout project.
 - .5 Acceptable manufacturers: Hubbell, Arrow Hart, Bryant, Pass & Seymour, Slater. Catalogue No. 5262 for all manufacturers.
 - .6 Acceptable manufacturers for ground fault receptacles shall be: Arrow Hart - GF 5242, Bryant - GFR 52FT, Hubbell - GF 5252, Pass & Seymour - 1591-R.
 - .7 Duplex safety receptacles in public waiting areas and public lounges shall be Hubbell #SG-62.

21.4 Special Wiring Devices

- .1 Special wiring devices: as indicated on drawings.
- .2 Pushbutton stations to be flush or surface mounted as required. Units to be complete with up/down or start/stop buttons, as required, and green pilot light.
- .3 Range outlets to be NEMA #14-50, 125/250V, 50 Amp., black, c/w cordset.

21.5 Identification

- .1 Identify receptacles with size 1 (per Section 18.4) lamacoid nameplate indicating panel and circuit number.
- .2 Nameplates to be mechanically fastened.

22.0 CIRCUIT BREAKERS

22.1 References

- .1 See drawing E-3.0 R-3 for Electrical specification.
- .2 See drawing E-2.0 R-3 for Single Line Diagram and Motor/Equipment Schedule.

22.2 Submittals

- .1 Shop Drawings: Submit shop drawings and/or product data for review by the Contract Administrator.

22.3 Breakers - General

- .1 Bolt-on or snap in molded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C (104°F) ambient.
- .2 Common-trip breakers with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-10 times current rating.
- .4 Acceptable manufacturers: CGE, Cutler-Hammer, Schneider Canada, Seimens.

22.4 Breakers - Thermal Magnetic

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

22.5 Ground Fault Circuit Interrupters

- .1 Molded case circuit breakers as above with integral Class A Group 1 ground fault interrupter.

23.0 MOTOR AND CIRCUIT DISCONNECTS

23.1 References

- .1 See drawing E-3.0 R-3 for Electrical specification.
- .2 See drawing E-2.0 R-3 for Single Line Diagram and Motor/Equipment Schedule.

23.2 Submittals

- .1 Shop Drawings: Submit shop drawings and/or product data for review by the Contract Administrator.

23.3 Equipment

- .1 Fusible and non-fusible disconnect switches in EEMAC '1' enclosure for interior applications, and EEMAC '3' enclosure for exterior applications, unless otherwise indicated.
- .2 Provision for padlocking in "ON-OFF" position.
- .3 Mechanically interlocked door to prevent opening when handle in "ON" position.
- .4 Fuse holders in each switch suitable without adaptors, for type of fuse, as indicated.
- .5 Quick-make, quick-break action.
- .6 "ON-OFF" switch position indication on switch enclosure cover.
- .7 Single-phase motor disconnect switches shall be one or two-pole toggle-type, 20 amp, 120/227V AC, brown handle with side and back wiring complete with pilot light.
- .1 Acceptable manufacturers: CGE, Cutler-Hammer, Square D, Siemens.

23.4 Equipment Identification

- .1 Provide size 4 lamacoid nameplate (per Section 18.4), indicating name of load controlled.

24.0 EXIT LIGHTING

24.1 References

- .1 See drawing E-3.0 R-3 for Electrical specification.

24.2 Submittals

- .1 Shop Drawings: Submit shop drawings and/or product data for review by the Contract Administrator. Data to indicate system components, mounting method, source of power and special attachments.
- .2 Close-Out Documents: Provide the following data:
 - .1 Operation and maintenance instructions for complete battery system to permit effective operation and maintenance.
 - .2 Technical data - illustrated parts lists with parts catalogue numbers.
 - .3 Copy of approved shop drawings.

24.3 Products

- .1 Exit lighting to match existing style where possible.
- .2 Housing: Slim-Line 2.0 mm thick, heavy-duty extruded aluminum, white powder coat finish c/w snap-out directional arrows and universal canopy mount. Entire fixtures to meet CSA-C860.
- .3 Extruded aluminum 2.00 mm thick stencil face, white powder coat finish.
- .4 Lamps: LED light bar type c/w internally mounted transformers as required.
- .5 Designed for 10 years of continuous operation without relamping.
- .6 Letters: 153 mm high x 20 mm wide, white faceplate on red glass reading EXIT.
- .7 No external holes or slots to eliminate light leaks.
- .8 Built-in switch-over relays for 12 Volt DC operation.
- .9 Face plate to remain captive for relamping.
- .10 Units c/w punch-out directional arrows as required.
- .11 Units c/w universal mounting canopies as required.
- .12 Shall comply with CSA-860, and Manitoba Hydro "Power Smart" rebate program.

25.0 EMERGENCY LIGHTING

25.1 References

- .1 See drawing E-3.0 R-3 for Electrical specification.

25.2 Submittals

- .1 Shop Drawings: Submit shop drawings and/or product data for review by the Contract Administrator. Data to indicate system components, mounting method, source of power and special attachments.
- .2 Close-Out Documents: Provide the following data:
 - .1 Operation and maintenance instructions for complete battery system to permit effective operation and maintenance.
 - .2 Technical data - illustrated parts lists with parts catalogue numbers.
 - .3 Copy of approved shop drawings.

25.3 Warranty

- .1 Provide a written guarantee, stating that the new batteries for emergency lighting are guaranteed against defects in material and workmanship for a period of 10 years, with a no-charge replacement during the first lustrum and a pro-rate charge on the second lustrum, from the date of the Substantial Performance from the Contract Administrator.

25.4 Products

- .1 Supply voltage: 120 V.
- .2 Output voltage: 12 V dc.
- .3 Operating time: 60 min..
- .4 Battery: sealed, long life, lead acid or lead calcium maintenance free.
- .5 Charger: solid state, multi-rate, pulse type, voltage/current regulated, inverse temperature compensated, short circuit protected, modular construction.
- .6 Solid state transfer.
- .7 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage c/w 2-fused DC output circuits.
- .8 Signal lights: solid state, life expectancy 100,000 h minimum, for 'AC Power ON' and 'High Charge'.
- .9 Lamp heads: integral on unit 360 deg. horizontal and 180 deg vertical adjustment. Lamp type: tungsten-halogen, 12 W, glare free, (mini style).
- .10 Cabinet: minimum 20 gauge steel cabinet c/w white polyester paint finish c/w knockouts for conduit.
- .11 Auxiliary equipment:
 - .1 Low voltage disconnect switch.
 - .2 Lamp disconnect switch.
 - .3 Test switch.
 - .4 Time delay relay.
 - .5 Battery disconnect device.
 - .6 ac input and dc output terminal blocks inside cabinet.
 - .7 Shelf where required.
 - .8 Cord and 3-prong straight blade NEMA 5-15P plug connection for ac.
- .12 Wall mounted battery banks to be direct wall mounted or with wall mounting shelf. Provide removable or hinged front panel for easy access to the batteries. LED diagnostics display and test switch mounted by side of enclosure.
- .13 Acceptable Manufacturers: Dual-Lite, Emergi-lite, Lithonia, Lumacell, Luxnet, Uniglo.

3.1 Installation

- .1 Charge the batteries and test the system for proper operation (minimum of 35 or 65 minutes discharge time).

26.0 AUDIBLE AND VISUAL EMERGENCY DEVICES

26.1 References

- .1 See drawing E-3.0 R-3 for Electrical specification.
- .2 See drawing E-1.0 R-3 for Layout and Drawing Notes
- .3 CSA C22.1 – Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.

- .4 CAN/ULC-S524 - Standard for the Installation of Fire Alarm Systems.
- .5 CAN/ULC-S525 – Audible Signal Appliances for Fire Alarm Systems
- .6 CAN/ULC-S526 – Standard for Visual Signal Appliances for Fire Alarm Systems
- .7 CAN/ULC-S536 – Standard for the Inspection and Testing of Fire Alarm Systems.

26.2 Submittals

- .1 Shop Drawings: Submit shop drawings and/or product data for review by the Contract Administrator. Data to indicate system components, mounting method, source of power and special attachments.
- .2 Close-Out Documents: Provide the following data:
 - .1 Operation and maintenance instructions to permit effective operation and maintenance.
 - .2 Technical data - illustrated parts lists with parts catalogue numbers.
 - .3 Copy of approved shop drawings.

26.3 Equipment

- .1 All audible and signal appliances in a building shall be of the same general type.

26.4 Inspection and Testing

- .1 The fire alarm system shall be tested for correct operation according to the National Fire Code of Canada.
- .2 Provide one copy of Fire Alarm Verification Report with Operating and Maintenance Manuals.