Part 2 Products

2.1 MATERIALS

.1 Sheet steel: to ASTM A653/A653M with ZF001 designation zinc coating.

.2 Stainless steel sheet metal: to ASTM A167, Type 302, with satin finish.

.3 Stainless steel tubing: Type 302, commercial grade, seamless welded, 1.2 mm wall thickness.

.4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 COMPONENTS

.1 All washroom components shall be supplied by the same manufacturer, from the same design series wherever possible.

.2 Police Building:

.1 Toilet tissue dispenser (TPD2): double roll type, surface mounted, heavy-duty cast aluminum with satin finish, capacity of two standard-core toilet tissue rolls up to 152mm diameter (2000 sheets). Theft-resistant spindles shall be molded high-impact ABS with retractable pins and concealed locking mechanism.

.1 Bobrick B-2740

.2 Approved alternate.

.2 Soap dispenser (HSD): liquid push-in valve spout, self-contained, 340 mL translucent polyethylene, tamper proof filler lock, surface mounted.

.3 Paper Towel Dispenser (TD): for roll paper towels, stainless steel cabinet, hinged front panel with full length piano hinge, lock and key, surface mounted, touch free pull dispensing mechanism dispenses one 305mm (12”) towel per pull (pull force 1.8 pounds (8.0N), minimum capacity 205mm (8”) wide x 205mm (8”) diameter non-perforated paper towel rolls.

.1 Acceptable material: Bobrick B-2860

.2 Approved alternate.

.4 Waste receptacle (TC): 320mm x 320 mm x 560 mm high, stainless steel, open top, no cover.

.1 Acceptable material: Bobrick B-2260 or approved alternate.

.5 Mirror (MI): Frame: heavy-gauge, one piece, roll-formed stainless steel with bright polished stainless steel finish. Channel shall be a minimum 13mm x13mm x 9.5mm with 90 degree mitred corners. Continuous integral stiffeners on all sides. Back of unit to be galvanized steel.

.1 Mirror: 6 mm tempered glass set on neoprene tubing in frame.

.2 Attachment clips: Vandal resistant stainless steel clips with concealed fasteners. Mirror support brackets sized to suit mirror size.

.3 Size: 450mm x 900mm, or equivalent, in configurations shown on drawings.

.4 Acceptable material: Bobrick B-165 Series or approved alternate.

.6 Grab bars (GB1 & GB2): 32 mm dia x 1.6 mm wall tubing of stainless steel, 76 mm diameter wall flanges, concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Peened surface at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN.

.7 Clothes Hook (CH & BFCH)

.1 Type 304, 2.8mm stainless steel, all welded construction with no sharp corners. Satin finish.

.2 Acceptable material: Bobrick B-6827 or equivalent.

.8 Mop/Broom Holder (MBH):

.1 Stainless steel, spring-loaded rubber cams with anti-slip coating, plated steel retainers. Length 610mm with three holders.

.2 Acceptable material: Bobrick B-223 or approved alternate.

.9 Shower Rod and Curtain (SR)

.1 Heavy duty, 20 ga., stainless steel shower curtain rod complete with 1200 x 1830 heavy duty white vinyl shower curtain and hooks.

.10 Stainless Steel Shelf (SLF): Surface Mounted Shelf is 18-8 stainless steel, type 304. All exposed surfaces are N^{o}4 satin finish. Exposed finishes to be protected during shipment by PVC film which is easily removed after installation. Shelf and brackets to be welded construction.

.1 Shelf: 18 gauge. 13mm lip on all four (4) sides, with front lip hemmed under.

.2 Brackets: 16 gauge. Three (3) brackets used with 381mm spacing.

.3 Attachment: N^{o}10 (M5) self-tapping screws through holes provided in support brackets. Adequate blocking in wall required so as to meet intended load weight (times 3) and to support shelf.

.4 Size: Shelf is 305mm deep by 914mm long with 152mm high brackets.

.5 Acceptable material: ASi Model N^{o} 0692-1236 or approved equivalent.

.3 Housing Units (H Series Rooms):

.1 Toilet tissue dispenser (HTPD): single roll type, surface mounted, concealed fastener, brushed nickel plated steel frame, spring-loaded roller' lifetime limited warranty.

.1 Acceptable manufacturers:

.1 Moen EVA Series

.2 Approved alternate.

.2 Mirror (HMI): Frameless.

.1 Mirror: 6 mm tempered glass.

.2 Attachment: Stainless steel clips with concealed fasteners. Mirror support brackets sized to suit mirror size. Supplemental adhesive as recommended by manufacturer.

.3 Size: Configurations shown on drawings.

.3 Towel bars (HTB1): Brushed nickel plated steel, concealed screw attachment, lifetime limited warranty.

.1 Acceptable manufacturers:

.1 Moen EVA Series

.2 Approved alternate.

.4 Towel ring (HTR): brushed nickel plated steel, concealed screw attachment, lifetime limited warranty..

.1 Acceptable manufacturers:

.1 Moen EVA Series

.2 Approved alternate.

.5 Shower rod and curtain (HSR): 20 ga., brushed nickel, curved, fits standard 1.5m x 1.8m (60" x 72") shower complete with heavy duty white vinyl shower curtain and hooks.

.1 Acceptable manufacturers:

.1 To match Moen EVA Series

.2 Approved alternate.

2.3 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

.1 Chrome and nickel plating: to ASTM B456, satin finish.

.2 Manufacturer's or brand names on face of units not acceptable.

Part 3 Execution

3.1 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:

.1 Stud walls: install steel back-plate to stud prior to plaster, drywall or plywood finish. Provide plate with threaded studs or plugs.

.2 Toilet/shower compartments: use male/female through bolts.

.2 Install grab bars on built-in anchors provided by bar manufacturer.

.3 Use tamper proof screws/bolts for fasteners.

.4 Fill units with necessary supplies shortly before final acceptance of building.

.5 Install mirrors in accordance with Section 08 80 50 - Glazing.

3.2 SCHEDULE

.1 Locate accessories where indicated. Exact locations determined by Departmental Representative.

.2 Room 102

.1 1 mirror at sink
.2 1 toilet tissue dispenser
.3 1 soap dispenser
.4 1 paper towel dispenser
.5 1 waste disposal
.6 1 clothes hook
.7 1 grab bar 610 long
.8 1 grab bar 915 long

.3 Room 154

.1 1 paper towel dispenser

.4 Room 110

.1 1 mirror at sink
.2 1 toilet tissue dispenser
.3 1 soap dispenser
.4 1 paper towel dispenser
.5 1 waste disposal
.6 1 clothes hook
.7 1 grab bar 610 long
.8 1 grab bar 915 long

.5 Rooms 113

.1 1 Mop/Broom Holder
.2 1 Stainless Steel Shelf

.6 Room 116

.1 1 mirror at each sink
.2 1 toilet tissue dispenser in each stall
.3 1 soap dispenser
.4 1 paper towel dispenser
.5 1 waste disposal

.7 Room 117

.1 4 clothes hooks
.2 1 shower rod with hooks and curtain

.8 Room 119

.1 1 mirror at each sink
.2 1 toilet tissue dispenser in each stall
.3 1 soap dispenser
.4 1 paper towel dispenser
.5 1 waste disposal

.9 Room 120

.1 4 clothes hooks
.2 1 shower rod with hooks and curtain

.10 Room 130

.1 1 mirror at sink
.2 1 toilet tissue dispenser
.3 1 soap dispenser
.4 1 paper towel dispenser
.5 1 waste disposal

.11 Room 133

.1 1 Mop/Broom Holder

.12 Rooms 132,146.2,147

.1 1 paper towel dispenser each room
.2 1 waste disposal each room

.13 Room H105

.1 1 toilet tissue dispenser
.2 1 towel ring
.3 1 – 900mm long towel bar
.4 1- soap dish integrated into tub surround (see Section 22 42 20)
.5 1 mirror
.6 1 shower rod with hooks and curtain

.14 Room H110

.1 1 toilet tissue dispenser
.2 1 towel ring
.3 1 – 900mm long towel bar
.4 1- soap dish integrated into shower surround (see Section 22 42 20)
.5 1 mirror
.6 1 shower rod with hooks and curtain

END OF SECTION

1 General

1.1 REFERENCES

.1 Canada Green Building Council (CaGBC)
  .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

.3 National Fire Protection Association (NFPA)
  .1 NFPA 10-2006, Standard for Portable Fire Extinguishers.

1.2 SUBMITTALS

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

.2 Product Data:
  .1 Submit manufacturer's printed product literature and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with specifications.

.3 Provide shop drawings.

.4 Quality control submittals: submit following in accordance with Section 01 45 00 - Quality Control.
  .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.

.5 Closeout Submittals:
  .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

.1 Cartridge operated type with hose and shut-off nozzle, ULC labelled for A, B and C class protection.
  .1 Sizes: Refer to equipment schedule.

2.2 CARBON DIOXIDE

.1 Extinguishers Frost free handle, hose and horn discharge assembly, self-closing lever or squeeze-grip operation, fully charged, ULC labelled for B and C class protection.
  .1 Sizes: Refer to equipment schedule.

2.3 EXTINGUISHER BRACKETS

.1 Type recommended by extinguisher manufacturer.

2.4 CABINETS

.1 Semi-recessed, as indicated, constructed of 1.6 mm thick steel, 180 degrees opening door of 2.5 mm thick steel with latching device.

.2 Cabinet to maintain fire resistive rating of construction in which they occur.

.3 Cabinet door: with 5 mm full glass panel.

.4 Finish:
- .1 Tub: prime coated.
- .2 Door and frame: No.4 satin finish stainless steel.

2.5 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of ANSI/NFPA 10.

.2 Attach bilingual label to extinguishers, indicating month and year of installation. Provide space for service dates.

3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install or mount extinguishers in cabinets or on brackets as indicated on drawings and/or required by authority having jurisdiction.

.2 Install fire safety blankets as indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Section includes clothing lockers, change room bench, evidence lockers and weapon storage lockers.

1.2 REFERENCES

.1 CAN/CGSB-44.40-2001, Steel Clothing Locker.

1.3 SHOP DRAWINGS

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

.2 Indicate type and class of locker, thicknesses of metal, fabricating and assembly methods, assembled banks of lockers, tops, hooks, shelves, bases, trim, numbering, filler panels, end/back panels, doors, handles, locking method, ventilation method, and finishes.

1.4 SAMPLES

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

.2 Submit duplicate 50 x 50 mm samples of colour and finish on actual base metal.

Part 2 Products

2.1 SINGLE TIER CLOTHING LOCKERS (LK1) – ROOMS 115 AND 121

.1 Lockers: to CAN/CGSB-44.40.

.2 Steel: cold rolled to ASTM #A653.

.3 Acceptable product:

- .1 Shanahan's – "Police and Crew Series, Double Door"
- .2 Approved equivalent.

.4 Single tier locker.

- .1 Size: 610 mm wide x 610 mm deep x 1829 mm high, minimum 1.5 mm steel thickness.
- .2 Side and back panels: .56 mm (24 Ga) cold rolled steel.
- .3 Vent holes: vent openings in top and bottom of doors plus additional vent holes in body top of locker. Vent holes in body top to be equal in area to vent holes in top of doors.
- .4 Assembly: factory assembled welded construction.
- .5 Doors:
  - .1 Double doors.

.2 Double pan construction. Outer panel shall be no less than .90mm (20 Ga) cold rolled steel to ASTM A366. Inner panel .56 mm (24 Ga) cold rolled steel. Sandwich panel construction welded and complete with honeycomb core. Vent slots in top and bottom of door.

.3 Full length astragal welded to active door (right hand).

.4 Rubber bumpers.

.6 Door hinges: Frame to be equipped with 3 – 64mm long, 5 knuckle hinges, 2 mm (14 Ga).

.7 Door handle: recessed handle stainless steel box and pull.

.8 Shelves and centre divider

.1 Notched into frame, thickness .90mm (20 Ga).

.1 Top shelf, full width of locker; bottom shelf, half width of locker; vertical divider to underside of top shelf; and pull out drawer (full extension), half width of locker complete with keyed cylinder cam lock.

.9 Accessories

.1 Coat rod – 19 mm diameter.

.2 Coat hooks – 6 mm diameter zinc plated steel, 5 per locker.

.10 Locking system: padlocks provided by Departmental Representative.

.11 Options: to CAN/CGSB-44.40,

.1 Base: 100 high steel base, colour to match locker frames.

.2 Finished end panels: minimum 0.9 mm steel thickness, colour to match locker frames.

.3 Steel trim including corner angles and jamb trim: minimum 0.9 mm steel thickness, colour to match locker frames.

.4 Corner and Filler Panels: minimum 0.9 mm steel thickness, colour to match locker frames. See drawings for locations.

.5 Number plates: to manufacturer's recommendations.

.12 Finish

.1 Metal finish: Steel surfaces shall be thoroughly cleaned and undercoated with an iron phosphate treatment utilizing a wash and etching process. The paint finish shall be 2 coats of high quality alkyd baking enamel to 40% - 45% gloss, electro-statically applied to a minimum thickness of 1mm.

.2 Color to be selected from manufacturers standard color selector.

2.2 BENCH – ROOMS 115 AND 121

.1 Acceptable product:

.1 Shanahan's – "Moveable Pedestal Locker Room Benches"

.2 Approved equivalent.

.2 Movable Pedestal:

.1 Free standing, A-Frame leg design from stainless steel. Frame is 280 mm at base of legs sloping inward to seat. PVC cap fitted to bottom of legs.

.2 Height: 380 mm to 405 mm high.

.3 Tubing: 25 mm x 25 mm 16 gauge, type 304-4 stainless steel.

.3 Seat

.1 End grain hard Maple, 32 mm thick by 254 wide, edges rounded, all surfaces sanded.

.2 Quantity and Length:

.1 2 benches each 1220 mm (4') long

.3 Finish: one coat sealer and one top coat clear lacquer.

2.3 RIFLE LOCKERS – ROOMS 122 AND 148 (STG4 and STG10)

.1 Acceptable product:

.1 Dasco Storage Solutions, "Weapon Storage Components".

.2 Approved equivalent.

.2 Lockers: to CAN/CGSB-44.40, freestanding.

.1 Steel thickness: No. 16 ga

.2 Assembly: welded construction.

.3 Top: flat

.4 Doors: bi-fold. One-piece double-wall envelope construction, steel thickness 16 ga MSG, door swings as indicated in drawings.

.5 STG4: 42" side x 15" deep x 72" high. 16 rifle rack with 2 plain adjustable shelves per unit. Two adjustable removable stock saddles per unit.

.6 STG10: 42" side x 15" deep x 84" high. 32 rifle rack with 1 plain adjustable shelf. Two adjustable removable stock saddles per unit.

.7 Hinges: hinges concealed behind door when door is closed.

.8 Door handle: recessed handle steel with nickel-plated finish.

.9 Quantity: refer to drawings.

.3 Accessories

.1 Adjustable rifle stock saddles with rubber matting on shelf, barrel saddle.

.2 Extruded rubber edging on all saddles to prevent direct contact between weapon and metal.

.3 Adjustable shelving: steel construction, 16 ga. Adjustable in minimum 50mm increments.

.4 Mounting: provide holes in back of cabinet for mechanical fastening of cabinet to wall.

.4 Locking

.1 Locking system: cylinder lock keyed to building keying system.

2.4 RECESSED HANDGUN LOCKERS – ROOMS 151 AND 112

.1 Acceptable product:

.1 Model Number EDHGF06 Flush. Wall mounted handgun lockers by Spacesaver Corporation, a division of KI, 1450 Janesville Ave., Fort Atkinson, WI 53538-

2798. 1-800-492-3434. www.spacesaver.com. Distributed by HBI Office Plus Inc., Saskatoon, SK.

.2 Approved equivalent.

.2 Acceptable manufacturers:

.1 DSM Law Enforcement Products by Spacesaver Corporation

.2 Approved equivalent.

.3 Lockers: to CAN/CGSB-44.40, recessed.

.1 Door and hinge steel thickness: minimum 16 ga.

.2 Cabinet steel thickness: minimum 16 ga.

.3 Assembly: welded construction.

.4 Finish: Textured powder coated steel.

.5 Color: Selected by consultant from manufacturer's standard range.

.6 Doors: Each 132 mm high x 264 mm wide (5-3/16" high x 10-3/8" wide). 6 doors/compartments.

.7 Shelves: 1/8" neoprene shelf lining.

.8 Cabinet Size: 25" wide x 6.5" deep x 20-1/8" high. 1-1/2" trim frame.

.9 Hinges: piano hinges concealed behind door when door is closed.

.10 Door handle: none.

.11 Number tags: located on each door.

.12 Quantity: refer to drawings.

.4 Accessories

.1 Mounting: holes in back of cabinet for mechanical fastening of cabinet to wall. Provide wood blocking in wall to suit.

.5 Keying and Locking

.1 Keying and Locking system: Master keyed and all locks keyed differently. Keys removable only in locked position.

2.5 SURFACE MOUNTED HANDGUN LOCKERS – ROOM 122

.1 Acceptable product:

.1 Model Number EDHGS08 Surface. Wall mounted handgun lockers by Spacesaver Corporation, a division of KI, 1450 Janesville Ave., Fort Atkinson, WI 53538-2798. 1-800-492-3434. www.spacesaver.com. Distributed by HBI Office Plus Inc., Saskatoon, SK.

.2 Approved equivalent.

.2 Acceptable manufacturers:

.1 DSM Law Enforcement Products by Spacesaver Corporation

.2 Approved equivalent.

.3 Lockers: to CAN/CGSB-44.40, surface mounted.

.1 Door and hinge steel thickness: minimum 16 ga.

.2 Cabinet steel thickness: minimum 16 ga.

.3 Assembly: welded construction.

.4 Finish: Textured powder coated steel.

.5 Color: Selected by consultant from manufacturer's standard range.

.6 Doors: Each 132 mm high x 264 mm wide (5-3/16" high x 10-3/8" wide). 8 doors/compartments.

.7 Shelves: 1/8" neoprene shelf lining.

.8 Cabinet Size: 25" wide x 6.5" deep x 26-1/8" high.

.9 Hinges: piano hinges concealed behind door when door is closed.

.10 Door handle: none.

.11 Number tags: located on each door.

.12 Quantity: refer to drawings.

.4 Accessories

.1 Mounting: holes in back of cabinet for mechanical fastening of cabinet to wall. Provide wood blocking in wall to suit.

.5 Keying and Locking

.1 Keying and Locking system: Master keyed and all locks keyed differently. Keys removable only in locked position.

2.6 EVIDENCE LOCKERS – ROOM 147 (STG11, STG12, STG13)

.1 Acceptable manufacturer:

.1 Group Lincora Inc. 6255 Notre Dame Street East, Montreal, PQ, HIN 2E9.

.2 Approved Equivalent

.2 Acceptable product:

.1 GRC series by Lincora.

.2 Approved equivalent.

.3 Lockers: to CAN/CGSB-44.40, freestanding.

.1 Style: Non-pass through.

.2 Steel thickness: No. 18 ga

.3 Assembly: welded construction.

.4 Top: flat

.5 Doors: One piece welded. Formed from two pieces of minimum 18-gauge cold rolled steel box formed and welded together. Inner and outer door skins shall have a combined steel thickness of no less than 0.096 inches (2.4MM) thick. Provide neoprene silencers and anti-pry tabs. Provide surface mounted door numbers in sequence with other lockers in the same room.

.6 Hinges: Stainless steel spring loaded to keep door closed. Hinges to be welded to prevent pin removal.

.7 Shelves: Welded to frame. No. 18 ga. cold rolled steel. Sides to be turned up 90 degrees for cleaning.

.8 STG11: 36” wide x 24” deep x 82” high. 14 door unit – refer to drawings for door arrangement.

.1 Acceptable product: Lincora GRC series

.2 Approved equivalent.

.9 STG12: 36” wide x 24” deep x 82” high. 6 door unit – refer to drawings for door arrangement.

.1 Acceptable product: Lincora GRC series

.2 Approved equivalent.

.10 STG13: 24” wide x 24” deep x 82” high. 4 door unit – refer to drawings for door arrangement.

.1 Acceptable product: Lincora GRC series

.2 Approved equivalent.

.11 Door handle: recessed handle steel with nickel-plated finish.

.12 Bases: Welded. Complete with floor levelers and removable access panel for access to mounting holes and leveling points.

.13 Lock housing: structural, full height and depth of locker.

.14 Locking System: Padlocks provided by Departmental Representative. Hasps must accept padlocks with shackle height of 25mm (measurement from padlock body to inside loop of shackle) and shackle diameter of 8mm.

.15 Finish: Electrostatically applied powder coat. Color to be selected by Departmental Representative from manufacturer’s standard range.

.16 Quantity: refer to drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Lockers

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to floor assembly and blocking in walls.

.3 Install locker bases and level as required.

.4 Install filler panels (false fronts) where indicated and where obstructions occur.

.5 Install finished end panels to exposed ends of locker banks.

.6 Install sloped false tops and gable ends.

.7 Install locker numbers.

.2 Benches

.1 Assemble benches in accordance with manufacturer's written instructions.

.2 Place as per locations in drawings. Do not secure to floor.

.3 Rifle Lockers and Evidence Lockers

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to floor assembly and blocking in walls.

.3 Level as required.

.4 Recessed Handgun Lockers

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Ensure rough opening for recess is as per manufacturer’s instructions.

.3 Securely fasten lockers to wood blocking in walls.

.4 Adjust to provide smoothly operating, visually acceptable installation.

.5 See drawings for details.

.5 Surface Mounted Handgun Lockers

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to wood blocking in walls.

.3 Adjust to provide smoothly operating, visually acceptable installation.

3.2 CLEANING

.1 Immediately upon completion of installation, clean components and surfaces. Remove surplus materials, rubbish and debris resulting from installation upon completion of work and leave areas of installation in neat, clean condition.

3.3 SCHEDULE

.1 Quantities and configuration as indicated on drawings.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Section includes metal shelving, and steel storage cabinets.

1.2 RELATED REQUIREMENTS

.1 Section 06 10 00 – Rough Carpentry.

1.3 REFERENCES

.1 CAN/CGSB-44.40-2001, Steel Clothing Locker.

.2 American Society for Testing and Materials (ASTM): ASTM A1008 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

.3 ASTM A1011 - Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

.4 ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

1.4 DESIGN REQUIREMENTS

.1 Layout: Refer to Drawings for configuration and quantities.

1.5 SHOP DRAWINGS

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

.2 Schedule of shelving units indicating configuration, types, materials, quantities, sizes, and finishes.

.3 Design data to determining loads, gear ratio, and anti-tip restraints.

.4 Shop drawings showing layout plans, elevations, dimensions, required tolerances, clearances, and details for fabrication, installation, connections, anchors, accessories, and interface with other elements and systems.

1.6 SAMPLES

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

.2 Minimum 75 mm square sample of each colour and texture to be exposed after installation.

.3 Finish color samples for selection by Departmental Representative.

1.7 QUALITY ASSURANCE

.1 Installer qualifications: Experienced in installation of storage systems and employee of manufacturer or certified by manufacturer for installation of specified system.

1.8 WARRANTY

.1 Provide under provisions of Section 01780 - Closeout Submittals the following warranties:

.1 5 years warranty to cover parts and materials against defects.

.2 2 years warranty to cover workmanship.

Part 2 Products

2.1 MATERIALS

.1 Steel sheet:

.1 Cold rolled steel sheet complying with ASTM A1008.

.2 Hot rolled, pickled steel sheet complying with ASTM A1011.

.2 Steel rail: SAE 1045.

.3 Extruded aluminum: ASTM B221, alloy 6063 Temper T-5.

2.2 GENERAL STORAGE CABINETS (STG3, STG6)

.1 All steel construction.

.1 Steel: cold rolled to ASTM #A1008.

.2 Galvanneal conforming to ASTM #653 zf 120 (A40).

.2 Shelf:

.1 Cold-rolled furniture-grade steel,1.27 mm (18 ga.) . Double formed on all four sides. Corners are closed with double thickness steel forming a no-slip notch for the shelf clip.

.2 Clip: 12-gauge compression type; cadmium plated.

.3 Reinforcement: 25 mm x 12 GA. bent angle of steel, installed in the front and rear flange of the shelf to provide additional shelf capacity.

.4 Number of shelves per unit as indicated in drawings.

.3 Frame:

.1 Horizontal components 1.27 mm (18 ga.)

.2 Vertical components 1.59 mm (16 ga.)

.4 Body:

.1 Side and back panels 0.63 mm (24 ga.)

.2 Top, shelf and bottom 1.59 mm (16 ga.)

.3 Shelves are adjustable with standards riveted to locker sides.

.5 Door:

.1 Outer and inner panels 0.95 mm (20 ga.), 30 mm thick honeycomb core.

.2 Hinge 64mm long, 5 knuckle, 14 gauge.

.3 Stainless steel handle box and pull

.4 Locking plate welded to one door.

.6 Pull and locking:

.5 Stainless steel handle, box and pull.

.6 Locking system: cylinder lock keyed to building keying system.

.7 Finish:

.7 Side, back panels, top, bottom and shelves; pre-painted galvanized, white in colour.

2.3 METAL SHELVING (STG1, STG5, STG7, STG8, STG9)

.1 Shelf:

.1 Cold-rolled furniture-grade steel,1.27 mm (18 ga.) . Double formed on all four sides. Corners are closed with double thickness steel forming a no-slip notch for the shelf clip.

.2 Clip: 12-gauge compression type; cadmium plated.

.3 Reinforcement: 25 mm x 12 GA. bent angle of steel, installed in the front and rear flange of the shelf to provide additional shelf capacity.

.4 Number of shelves per unit as indicated in drawings.

.2 T-Posts

.1 38 mm x 50 mm x 3.17 mm double-formed steel in a "T" style with a smooth, unperforated face.

.3 Closed End Panel Assembly

.1 Two "T" posts welded to a cold-rolled steel side panel to form a single unit providing greater strength and easier handling.

.2 Provide closed end panel between adjacent shelving units.

.4 Back Panel

.1 Cold-rolled steel panel attached to uprights with cadmium-plated back clips.

.5 Base Plates

.1 Formed top and bottom to provide support for the bottom shelf in addition to closing the space under the shelf.

.6 Finish

.1 Prepared components for painting by being cleaned, iron phosphatized and rinsed. Electrostatically apply high-grade alkyd enamel. Bake to provide a hard, long lasting, furniture-grade finish.

.7 Minimum Shelf Capacity

.1 Shelf dimensions: 36 inch wide by maximum 15 inches deep: minimum load capacity 630 pounds.

.2 Shelf dimensions: 48 inch wide by maximum 15 inches deep: minimum load capacity 315 pounds.

Part 3 Execution

3.1 PREPARATION

.1 Verify dimensions and Project conditions prior to fabrication.

.2 Verify floor substrate is level and ready to receive storage system.

3.2 INSTALLATION GENERAL STORAGE CABINETS

.1 Assemble and install cabinets in accordance with manufacturer's written instructions.

.2 Install storage cabinets in numbers and configurations shown in drawings.

.3 Securely fasten cabinets to blocking in walls.

3.3 INSTALLATION METAL SHELVING

.1 Assemble and install cabinets in accordance with manufacturer's written instructions.

.2 Install storage cabinets in numbers and configurations shown in drawings.

.3 Ensure shelving units are installed square and plumb.

.4 Align shelving units adjacent to each other when they are installed end to end.

.5 Install shelving units parallel and perpendicular to walls according to the layout.

3.4 CLEANING

.1 Remove protective wrappings.

.2 Clean metal surfaces using clean water and mild detergent. Do not use abrasive agent, steel wool, or harsh chemicals. Rinse with clean water.

3.5 DEMONSTRATION

.1 Demonstrate to Owner's designated representatives, complete operation and required maintenance for mobile storage system.

3.6 SCHEDULE

.1 Refer to drawings for quantity and location.

END OF SECTION

PART 1 General

1.1 RELATED SECTIONS

.1 Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

.1 ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

.2 ASTM B241 - Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

.3 CAN/CSA-B72-M87 (R2013) - Installation Code for Lightning Protection Systems.

1.3 SUBMITTALS

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

.2 Shop Drawings:

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

.2 Shop drawings shall clearly indicate detailed dimensions, base, attachment details, anchor requirements, and imposed loads.

.3 Product Data: Provide data on pole, accessories, and configurations.

.4 Maintenance Data: Provide lubrication and periodic maintenance requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

.2 Protect flagpole and accessories from damage or moisture.

PART 2 Products

2.1 POLE MATERIALS

.1 Aluminum: Tapered shaft, 7.5 meters in length. Colour: clear anodized.

2.2 COMPONENTS AND ACCESSORIES

.1 Finial Ball: Aluminum, 150mm diameter

.2 Fixed steel base attached to concrete pile.

.3 Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

.4 Cleats: 230mm size, aluminum with stainless steel fastenings, two per halyard.

.5 Cleat Box: Aluminum, with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box.

.6 Pulleys: nylon or brass.

.7 Halyard: lockable internal, stainless steel aircraft control cable.

.8 Lightning control: ground spike conforming to CAN/CSA B72.

.9 Counterweight: stainless steel neoprene-covered.

PART 3 Execution

3.1 INSTALLATION

.1 Install flagpoles and fittings in accordance with manufacturer's instructions.

3.2 ERECTION TOLERANCES

.1 Maximum Variation From Plumb: 25mm.

3.3 ADJUSTING

.1 Adjust operating devices so that halyard functions smoothly.

END OF SECTION

PART 1 General

1.1 SECTION INCLUDES

.1 Ventilated metal shelves with integral closet rod.

.2 Ventilated metal shelving on matching adjustable metal shelving standards.

.3 Prefinished aluminum guardrails.

.4 Petroleum Spill Kit.

.5 Security Mirror.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry

.2 Section 06 40 00 – Architectural Woodwork

.3 Section 09 21 16 – Gypsum Board Assemblies

.4 Section 09 91 23 – Interior Painting

1.3 REFERENCE STANDARDS

.1 National Building Code of Canada 2010 edition.

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 01 33 00 Submittal Procedures. Provide overall layouts, colors, dimensions, product and accessory information, support and anchorage details.

.2 Include product data indicating contents of spill kit.

PART 2 Products

2.1 VENTILATED METAL SHELVES

.1 Type 1: Indicated R+S on Drawings. Prefinished Ventilated Metal Wire Shelf with Integrated Closet Rod: 400 mm (16” depth). Length to suit - see drawings. Matching supporting brackets, anchors and accessories as per manufacturer’s written instructions to suit application. Color: White.

.1 Basis of design: ClosetMaid or approved equivalent.

.2 Type 2: Indicated as #S on Drawings where # represents number of shelves required. Prefinished Ventilated Metal Wire Shelving on matching metal adjustable shelf standards: 400mm (16” depth). Length to suit - see drawings. Matching corner shelving, supporting

brackets, anchors, shelf standards and accessories as per manufacturer's written instructions to suit application. Color: White.

.1 Basis of design: ClosetMaid or approved equivalent.

.3 Shelves, standards, brackets and all accessories are to be from a single manufacturer.

2.2 PREFINISHED ALUMINUM GUARDRAILS

.1 Base Rail: Powder-coated aluminum. White. Compatible with pickets and spacers.

.2 Hand Rail: Powder-coated aluminum. White.

.3 Regular Pickets:Powder-coated aluminum. Space pickets to meet National Building Code of Canada requirements. White.

.4 Spacers: Powder-coated aluminum. Compatible with pickets, stair pickets and base rail components. White.

.5 Stair Kit with Regular Stair Pickets: Powder-coated aluminum. White.

.6 End Posts/Mid-posts: 1800 mm max spacing. Complete with Post Attachment kit from manufacturer.

.7 Layout and Dimensions: See drawings.

.8 Accessories, Fasteners and Connectors: By manufacturer to suit layout. See drawings. Powder-coated aluminum. White.

.9 All components are to be supplied from a single manufacturer.

.10 All components must meet requirements of National Building Code of Canada.

.11 Basis of design: RailBlazers by Peak Products (1-877-883-7325) or approved alternate.

2.3 PETROLEUM SPILL KIT

.1 Quantity: one.

.2 Spill Volume: min. 300 L (80 US gallon) absorbent capacity.

.3 Type: Suitable for gasoline and petroleum products.

.4 Container: UV resistant, lockable, no-flat wheeled container.

.5 Minimum Contents:

.1 2 - exterior diameter 200mm x 3000mm long; 100% polypropylene absorbent booms.

.2 2 - exterior diameter 125mm x 3000m long; 100% polypropylene long absorbent booms.

.3 2 – exterior diameter 75mm x 3000m long; 100% polypropylene absorbent booms.

.4 120 –400 mm x 500 mm; 100% polypropylene UV resistant absorbent mat pads.
.5 2 – 400 mm x 432 mm x 25mm ht. skimmer absorbent pillows.
.6 Loose absorbent.
.7 24 pair of neoprene gloves.
.8 4 sets Tyvek Level D overalls.
.9 8 - disposable PVC boot protectors.
.10 Response shovel.
.11 30 - "handle with care" disposal bags.
.12 6 – tamperproof seal labels.

.6 Acceptable manufacturer:

.1 New PIG Corporation, One Pork Avenue, Tipton, PA, USA 1-855-493-4647.
.2 Approved equivalent.

2.4 SECURITY MIRROR

.1 Arrangement: Quarter dome (90 Degree) corner installation, ceiling mount.
.2 Base material: optical grade 100% virgin acrylic.
.3 Reflective material: Vacuum metalised 99% pure aluminum.
.4 Size: 450mm x 450mm (18" x 18") .
.5 Basis of Design: DuraVision or approved equivalent.

PART 3 Execution

3.1 INSTALLATION – VENTILATED METAL SHELVING

.1 Comply with manufacturer's installation requirements and instructions.

.2 Length to suit locations. See drawings.

.3 Coordinate installation of continuous wood blocking behind all adjustable shelf standards. Attach standards to studs at a maximum spacing of 400mm on centre.

.4 Ensure support and anchorage is adequate to meet intended use.

3.2 INSTALLATION – PREFINISHED ALUMINUM GUARDRAILS

.1 Comply with manufacturer's installation requirements and instructions.

.2 Length to suit locations. See drawings for details.

.3 Ensure support and anchorage is adequate to meet intended use and to comply with National Building of Canada requirements.

3.3 INSTALLATION - PETROLEUM SPILL KIT

.1 Comply with manufacturer's installation requirements and instructions.

.2 Place as shown on drawings.

3.4 INSTALLATION – SECURITY MIRROR

.1 As per manufacturer's written instructions.

.2 Secure to ceiling with tamper-proof fasteners.

3.5 CLEANING

.1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

3.6 SCHEDULE

.1 Ventilated Metal Shelves:

.1 Type 1: Rooms 155, H101, H102, H104A, H104B, H112, H113.

.2 Type 2: Rooms H106, H107.

.2 Prefinished Aluminum Guardrails:

.1 See drawings for locations.

.3 Petroleum Spill Kit:

.1 See drawings for location.

.4 Security Mirror:

.1 See drawings for locations.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Appliances for Police Building and Housing Units.

1.2 REFERENCES

.1 CAN/CSA C300-08: Energy Performance and Capacity of Household Refrigerators, Refrigerator-Freezers, Freezers, and Wine Chillers.

.2 CAN/CSA-C22.2 NO. 150-M89 (R2014): Microwave ovens.

.3 CAN/CSA-E60335-2-43:13 – Household and Similar Electrical Appliances – Safety – Part 2-11

.4 CAN/CSA-C361-12 – Test Method for Measuring Energy Consumption and Drum Volume of Electrically Operated Household Tumble-Type Clothes Dryers

.5 CAN/CSA-C62301:11 – Household Electrical Appliances – Measurement of Standby Power

.6 CAN/CSA-E60335-2-6:13-Safety of Household and Similar Electrical Appliances – Safety – Part 2-6

.7 CAN/CSA-C360-03 (2009) – Energy Performance, Water Consumption and Capacity of Household Clothes Washers

.8 CAN/CSA-F325-M91 (R2010) – Residential Mechanical Ventilation Systems

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 furniture 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 incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry and well-ventilated area.

.2 Store and protect furniture from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 WARRANTY

.1 Provide 1 year parts and labour warranty.

Part 2 Products

2.1 REFRIGERATORS

.1 Refrigerators are to be from same manufacturer.

.2 Type FR1 – top freezer

.1 Width: maximum 30 inches.

.2 Height: maximum 69 inches.

.3 Capacity:

.1 Overall capacity: minimum 18 cubic feet.

.2 Freezer: maximum 4 cubic feet.

.4 Temperature controls: electronic.

.5 Shelving: adjustable in refrigerator with storage in refrigerator door.

.1 Refrigerator: minimum 3. Glass.

.5 Refrigerator Drawers: min. 2.

.6 Door: reversible.

.7 Light: refrigerator and freezer compartments.

.8 Defrost system: frost free.

.9 Energy Star qualified: No.

.10 Legs/Wheels: adjustable.

.11 Finish: white.

.12 Acceptable Manufacturers

.2 Kenmore, KitchenAid, Whirlpool, Frigidaire, LG or approved equivalent.

.3 Type FR2 – bottom freezer

.1 Width: maximum 30 inches.

.2 Height: maximum 69 inches.

.3 Capacity:

.1 Overall capacity: minimum 18 cubic feet.

.2 Freezer: minimum 5 cubic feet.

.4 Temperature controls: electronic.

.5 Shelving: adjustable in refrigerator with storage in refrigerator door.
  .1 Refrigerator: minimum 3. Glass.
.5 Refrigerator Drawers: Min. 2.
.6 Door: reversible.
.7 Light: refrigerator and freezer compartments.
.8 Defrost system: frost free.
.9 Energy Star qualified: No.
.10 Legs/Wheels: adjustable.
.11 Finish: white.
.12 Acceptable Manufacturers
  .2 Kenmore, KitchenAid, Whirlpool, Frigidaire, LG or approved equivalent.

2.2 RANGES

.1 Ranges are to be from same manufacturer.

.2 Type RNG – residential range

.1 Width: maximum 30 inches.
.2 Cooktop: 5 elements min.
  .1 2- 150mm (6") radiant 1200W min.
  .2 1 - 6/9" Expandable 3000W min.
  .3 1- 9/12" Expandable 3000W min.
  .4 1-100W warming zone.
  .5 Black Glass surface.
  .6 Hot surface warning light.
.3 Cabinet: White.
.4 Storage Drawer: Yes.
.5 Control Panel: White aluminum. Rear location. Small appliance outlet: 1 min. Timer: Erc. Clock: digital.
.6 Controls: electronic.
.7 Oven:
  1. Capactiy: 5.3 cu. Ft. min.
  2. Bake Element Pass: 8
  3. Bake Element Power (W) – 3500 min.
  4. Broil Element Pass: 8
  5. Broil Element Power (W) – 4000 min.
  6. Voltage: 220/240V
  7. Cavity Material: Porcelain on Steel
  8. Convection function.
  9. Hidden Bake Element.
  10. Oven Light.

11. Self Clean function.
12. Auto Shut off function.
13. 2 adjustable wire racks. 6 rack positions.

.8 Door: large vision lite.

.9 Energy Star qualified: No.

.10 Legs: adjustable.

.11 Acceptable Manufacturers

.1 Kenmore, KitchenAid, Whirlpool, Frigidaire, LG or approved equivalent.

2.3 RANGE HOODS

.1 Range hoods are to be from same manufacturer.

.2 Type RHD – residential range hood. See mechanical specification.

2.4 CHEST FREEZERS

.1 Freezers are to be from same manufacturer.

.2 Type DFRZ –chest-style freezer

.1 Dimensions: maximum 889 high x 1092 wide x 597 mm deep (35" high x 43" wide x 23.5" deep)

.2 Capacity:

.1 Freezer: more than 8 cu. Ft. and less than 10 cu. Ft.

.3 Temperature controls: mechanical.

.4 Defrost system: manual.

.5 Defrost Water Drain: yes.

.6 Freezer Interior Light: no.

.7 Number of Storage Baskets: one.

.8 Power Light Indicator: yes.

.9 Voltage: 115.

.10 Compressor Noise Level (dB): 0.

.11 Energy Star qualified: no.

.12 Finish: white.

.13 Acceptable Manufacturers

.1 Kenmore, KitchenAid, Whirlpool, Frigidaire, LG or approved equivalent.

2.5 ELECTRIC WASHING MACHINES

.1 Washing machines and Dryers are to be matching pair, from same manufacturer.

.2 Type WASH: top load washing machine.

.1 Cabinet Height: maximum 37 inches. With lid open: max. 52 inches.

.2 Cabinet Depth: maximum 28 inches.
.3 Cabinet Width: maximum 28 inches.
.4 Washer Interior Capacity: minimum 4.0-4.5 cubic feet.
.5 Circuit rating/Voltage: 15 amps/ 110/120 V
.6 Top and Lid: powder coated white.
.7 Cabinet: white. Insulated for noise reduction.
.8 Wash basket material: stainless steel.
.9 High efficiency: No.
.10 Max spin speed: min. 770
.11 Wash agitator motion: Wash plate.
.12 Dispenser: Bleach.
.13 Number of Water Temperatures: Min. 5.
.14 Wash Cycles: Min. 7 with end of cycle signal.
.15 Energy Star compliant: No.
.16 Acceptable Manufacturers
.1 Kenmore, Panasonic, Bosch, Samsung, Whirlpool LG, GE or approved equivalent.

2.6 ELECTRIC CLOTHES DRYERS

.1 Washing machines and Dryers are to be matching pair, from same manufacturer.

.2 Type DRY– front load

.1 Cabinet Height: maximum 37 inches. To top of control panel: 43 inches.
.2 Cabinet Depth: maximum 29 inches with door closed.
.3 Cabinet Width: maximum 29 inches.
.4 Dryer Interior Capacity: minimum 7.0 cubic feet.
.5 Drum Material: Powder coated.
.6 Power Source: 220/240V
.7 Min. Circuit Rating: 30 amps
.8 Venting: back (standard).
.9 Control type: Electromechanical.
.10 Top and Lid: powder coated white.
.11 Cabinet: white. Insulated for noise reduction.
.12 Sensor dry: yes.
.13 Dry cycles: Min. 3.
.14 High efficiency: No.
.15 Energy Star compliant: No.
.16 End of cycle signal: yes.
.17 Timed dry: yes.
.18 Wrinkle reduction: yes.
.19 Acceptable Manufacturers:

.1 Kenmore, Panasonic, Bosch, Samsung, Whirlpool LG, GE or approved equivalent.

2.7 MICROWAVES

.1 Microwaves are to be from same manufacturer.

.2 Type MIC

.1 Width: maximum 22 inches.

.2 Height: maximum 13 inches.

.3 Depth: maximum 16 inches.

.4 Capacity: minimum 1.6 cubic feet.

.5 Power: minimum 1100 watts.

.6 Options:

.1 Turntable, auto defrost, auto reheat, auto cook, timer, minimum 10 programmable power levels.

.7 Oven liner: painted steel.

.8 Finish: white.

.9 Acceptable Manufacturers

.1 Kenmore, Panasonic, Bosch, Samsung, Whirlpool LG, GE or approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 Install according to manufacturer's written instructions.

.2 Install in locations as indicated on drawings.

.3 Set digital clocks to display correct time.

3.2 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Remove masking or protection after installation.

.3 Clean finished surfaces as recommended by panel manufacturer.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for residential casework in Housing Units. For architectural woodwork in Police Buildings and hardwood casings at both Police Building and Housing Units see Section 06 40 00 Architectural Woodwork. For wire shelving see Section 10 90 00 Miscellaneous Specialties.

1.2 RELATED SECTIONS

.1 Section 06 40 00 – Architectural Woodwork

.2 Section 10 90 00 – Miscellaneous Specialties

1.3 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI/HPVA HP-1-2009, Standard for Hardwood and Decorative Plywood.
.2 ANSI/NPA A208.1-2009, Particleboard.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.3 Canadian Standards Association (CSA International)

.1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.
.2 CSA O112.4 Series-M1977(R2006), Standards for Wood Adhesives.
.3 CSA O121-08(R2013), Douglas Fir Plywood.
.4 CSA O141-05(R2009), Softwood Lumber.

.4 National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA LD-3-2005, High-Pressure Decorative Laminates (HPDL).

.5 National Hardwood Lumber Association (NHLA)

.1 Rules for the Measurement and Inspection of Hardwood and Cypress 2011.

.6 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

1.4 PERFORMANCE REQUIREMENTS

.1 Materials and installation shall be in metric measurement as specified.

1.5 SUBMITTALS

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

.2 Provide shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.1 Indicate details of construction, profiles, jointing, fastening and other related details.

.1 Scales: profiles full size, details half full size.

.2 Indicate materials, thicknesses, finishes and hardware.

.3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Provide duplicate samples: sample size 300 x 300 mm or 600 mm long unless specified otherwise.

.2 Provide two (2) samples of each wood species for review.

.3 Provide duplicate colour samples of laminated plastic for colour selection.

.4 Provide duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.

.4 Quality assurance submittals:

.1 Manufacturer's Instructions: manufacturer's installation instructions.

1.6 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

.3 Delivery, Storage, and Handling:

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

.1 Protect millwork against dampness and damage during and after delivery.

.2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

.4 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Softwood lumber: unless specified otherwise, S4S, moisture content 19% or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Hardwood lumber: moisture content 6% or less in accordance with following standards:

.1 National Hardwood Lumber Association (NHLA).

.3 Douglas fir plywood (DFP): to CSA O121, standard construction.

.1 Urea-formaldehyde free.

.4 Hardwood plywood: to ANSI/HPVA HP-1.

.1 Urea-formaldehyde free.

.5 Engineered Combination core – 5 ply veneer: to ANSI A208-1

.1 Urea-formaldehyde free.

.6 Laminated plastic for flatwork: to NEMA LD3, Grade VGL, Type HD, 1.6 mm thick; based on solid, woodgrain, printed pattern, and metallic, colour range with satin, matt, textured, and embossed finish.

.7 Laminated plastic backing sheet: Grade BK, Type HD not less than 0.5 mm thick or same thickness and colour as face laminate.

.8 Thermofused Melamine: to NEMA LD3 Grade VGL.

.1 High wear resistant thermofused melamine: equal or exceed 400 cycles (Minimum standard for HPL abrasion test).

.9 Nails and staples: to CSA B111.

.10 Wood screws: plain, type and size to suit application.

.11 Splines and dowels: wood and metal.

.12 Sealant: in accordance with Section 07 92 00 - Joint Sealants.

.13 Laminated plastic adhesive:

.1 Adhesive: contact adhesive to CAN/CGSB-71.20.

.1 Maximum VOC limit 250 g/l.

.2 Adhesives urea-formaldehyde free.

2.2 MANUFACTURED UNITS

.1 Cabinets:

.1 Construction: frameless.

.2 Furring, blocking, nailing strips, grounds and rough bucks

.1 S2S is acceptable for concealed products.

.2 Board sizes: "standard" or better grade.

.3 Dimension sizes: "standard" light framing or better grade.

.4 Urea-formaldehyde free.

.3 Case bodies (sides, tops, floors, dividers).

.1 Construction: Thermofused melamine, square edge, min.16.0 mm thick.

.2 Edge banding: provide 0.5mm matching color melamine edge.

.3 Exposed Exterior and Exposed Interior Surfaces: to match Panolam W190 Gunstock Walnut, Satin Texture

.4 Semi Exposed and Concealed Surfaces colour: white.

.5 Shelf support: Precision drilled 5.0mm diameter holes at 32mm spacing.

.6 Feet: provide min. four (4) 100mm high height-adjustable feet per base cabinet complete with clips for attachment of toe kick.

.4 Rails:

.1 Construction: Industrial particleboard core, square edge, min. 16.0 mm thick, laminated with thermofused melamine to match case body.

.2 Exposed Surfaces: to match Panolam W190 Gunstock Walnut, Satin Texture.

.3 Semi Exposed and Concealed Surfaces colour: white.

.5 Backs:

.1 Construction: Hardboard, square edge, min. 6.3 mm thick.

.2 Colour: white.

.6 Shelving:

.1 Construction: Thermofused melamine, min. 16.0 mm thick.

.2 Edge banding: provide 0.5 mm matching colour melamine edge banding.

.3 Colour: white.

.4 Quantity: See drawings.

.7 Toe Kick:

.1 Construction: Thermofused melamine, min. 16.0 mm thick.

.2 Exposed Exterior Surface: to match Panolam W190 Gunstock Walnut, Satin Texture

.3 Accessories: Screw-on plate for clip attachment to base cabinet feet.

.4 Location: at base of all base cabinets and at all returns on end runs of casework.

.2 Drawers:

.1 Sides, Back and Bottom:

.1 Thermofused melamine: min. 16.0 mm thick.

.2 Colour: white.

.2 Fronts:

.1 Construction: Five piece flat panel. See drawings.

.1 Drawer fronts less than 184 mm high: 38 mm wide solid oak stiles and rails min. 19.0 mm thick, with min. 6.3 mm thick composite core insert with horizontal grain oak veneer.

.2 Drawer fronts greater than 184 mm high: 57 mm wide sold oak stiles and rails min. 19.0 mm thick with min. 6.3 mm thick composit core insert with horizontal grain oak veneer.

.2 Exposed Surface Color: stained to match Panolam W190 Gunstock Walnut, Satin Texture

.3 Doors:

.1 Construction: Five piece shaker door (square flat panel door). See drawings.

.1 57 mm wide solid oak stiles and rails min. 19.0 mm thick, with min. 6.3 mm thick composite core insert with vertical grain oak veneer.

.2 Color: stain to match Panolam W190 Gunstock Walnut, Satin Texture

.4 Countertops:

.1 High-pressure plastic laminate: fully formed w/coved splash, waterfall edge at countertop edge, top of back and side splash. Backsplash and sidesplash finish to match countertop unless indicated otherwise on drawings.

.2 Color: to match Pionite MT340 Rock Around the Clock. Suede finish.

2.3 FABRICATION

.1 Assemble cabinets in flush overlay style.

.2 Set nails and countersink screws apply plain wood filler to indentations, sand smooth and leave ready to receive finish.

.3 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.

.4 Shelving to cabinetwork to be adjustable unless otherwise noted.

.5 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

.6 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

.7 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.

.8 Ensure adjacent parts of continuous laminate work match in colour and pattern.

.9 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 2400 mm. Keep joints 600 mm from sink cutouts.

.10 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not mitre laminate edges.

.11 Apply laminate backing sheet to reverse side of core of plastic laminate work.

2.4 HARDWARE

.1 Hinges: European concealed hinges, 110 degree opening. Only screw fastened hardware will be accepted, no friction fit hardware will be accepted. Use plastic insertion dowels to receive screws of hinge baseplates.

.1 Acceptable manufacturers: Hettich, Blum, Hafele or Richelieu.

.2 Drawer slides: full extension, bearing type, double wall, secured to sides of drawers and to gable, 25kg static load capacity, integral stop, silent-closing.

.1 Acceptable product: Hettich Summit System

.2 Approved equivalent.

.3 Shelf standards: Locking clip support pin for 5mm diameter holes, steel pin with mounded on clear plastic.

.4 Pulls: Metal handle pull.

.1 Acceptable products: Richelieu BP458128195 or Hettich Anzio 116 0018

.2 Approved equivalent.

.5 Clear plastic silencers to be installed on all cabinet doors.

Part 3 Execution

3.1 INSTALLATION

.1 Install prefinished millwork at locations shown on drawings. Position accurately, level, plumb straight.

.2 Fasten and anchor millwork securely. Provide heavy duty fixture attachments for wall mounted cabinets.

.3 Use draw bolts in countertop joints.

.4 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.

.5 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant.

.6 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.

.7 Fit hardware accurately and securely in accordance with manufacturer's written instructions.

.8 Site apply laminated plastic to units as indicated. Adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where indicated or approved. Slightly bevel arises.

.9 For site application, offset joints in plastic laminate facing from joints in core.

.10 Coordinate installation of continuous wood blocking behind all cabinets.

3.2 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Clean millwork and cabinet work, inside cupboards and drawers and outside surfaces.

.3 Remove excess glue from surfaces.

3.3 PROTECTION

.1 Protect millwork and cabinet work from damage until final inspection.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 08 54 13 - Fiberglass Windows

1.2 DESIGN REQUIREMENTS

.1 Design roller shades to following requirements:

.1 Be designed in a manner that allows wear susceptible parts to be replaceable by either the user or the manufacturer.

.2 A guarantee of at least five years of available replacement parts following discontinue of the products manufacture.

.3 Be accompanied by instructions for replacing or repairing worn parts, including inventory numbers for parts and procedures for ordering replacement parts.

.4 A program that allows for the refurbishing or return of used roller shades.

.5 Be designed in a manner that permits effective disassembly of components in order to permit recycling of materials for which recycling markets exist.

1.3 SHOP DRAWINGS

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

.2 Indicate dimensions in relation to window jambs, operator details, head and sill anchorage details, hardware and accessories details.

1.4 SAMPLES

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

.2 Submit duplicate samples of manufacturer's standard colours for selection by Consultant.

.3 After approval samples will be returned for incorporation into the Work.

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS / PRODUCTS

.1 Color Scheme 1 – Police Building:

.1 Basis of Design: Hunter Douglas Designer Dual Roller Shade FR. Slimline Double Bracket. Two shades in single cassette. Independent shade operation. Independent concealed clutches and metal beaded cord loop with cord tensioner. White anodized aluminum cassette with matching end caps. Rear shade: Shearweave 2410 openness of 3%. Front shade: Shearweave 7000 openness to be 0%.

.1 Width Range for Single Shade: 305-3660 mm (12-144”).

.2 Height Range for Single Shade: 305-3048 mm (12-120”).

.3 Mounting: Inside window opening. Refer to drawings.

.4 Fabric Color: Consultant to select fabric colours from manufacturer's standard range. Submit samples as per Section 01 33 00.

.2 Acceptable manufacturers:

.1 Hunter Douglas.

.2 Altex SunProject.

.3 Approved equivalent.

.2 Color Scheme 2 - Housing Units (H Series Rooms):

.1 Basis of Design: Hunter Douglas Designer Dual Roller Shade FR. Slimline Double Bracket. Two shades in one cassette. Independent shade operation. Independent concealed clutches and metal beaded cord loop with cord tensioner. White anodized aluminum cassette with matching end caps. Rear shade: Shearweave 2410 openness of 3%. Front shade: Shearweave 7000 openness to be 0%.

.1 Width Range for Single Shade: 305-3660 mm (12-144").

.2 Height Range for Single Shade: 305-3048 mm (12-120").

.3 Mounting: Inside window opening. Refer to drawings.

.4 Fabric Color: Consultant to select fabric colours from manufacturer's standard range. Submit samples as per Section 01 33 00.

.2 Acceptable manufacturers:

.1 Hunter Douglas.

.2 Sunproject Moduline.

.3 Approved equivalent.

2.2 MATERIALS AND FABRICATION

.1 To manufacturer's standard.

Part 3 Execution

3.1 INSTALLATION

.1 Include centre brackets where necessary to prevent deflection of headrail.

.2 Adjust to provide for operation without binding.

.3 Use non-corrosive metal fasteners for installation, concealed in final assembly.

.4 Install blinds mounted to inside of jambs.

.5 Provide white aluminum cassette typical at all locations.

3.2 SCHEDULE

.1 Police Building

Room Number	Number Of Shades per Room	Window Type
107.2	1	B
111	1	A
126	2	F
152	1	B
153	1	B
156	1	A

.2 Housing Units

Room Number	Number Of Shades per Room	Window Type
H100	1	G
H103	1	M
H108	1	K
H109	2	J
H109	2	H
H111	1	L

END OF SECTION

Part 1 General

1.1 REFERENCES

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

ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.

.2 Canadian Standards Association (CSA International)

CSA-G40.20/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel.

CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

CSA W48-06(R2011), Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

CSA W59-13, Welded Steel Construction (Metal Arc Welding).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets for furniture 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 incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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: Store materials indoors and in accordance with manufacturer's recommendations in clean, dry and well-ventilated area.

.4 Store and protect furniture from nicks, scratches, and blemishes.

.5 Replace defective or damaged materials with new.

1.5 WARRANTY

.1 Provide 1 year parts and labour warranty.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21.

.2 Steel pipe: to ASTM A53/A53M standard weight.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Stainless steel tubing: to ASTM A269, commercial grade seamless welded with AISI No. 4 finish.

2.2 DRYING TABLE (DTAB)

.1 Work surface: stainless steel, 18 gauge top with 56 mm backsplash complete with minimum 2 heavy gauge channel supports.

.2 Hemmed safety edges.

.3 Legs: tubular 42 mm stainless steel with 25 mm adjustable levelling feet.

.4 Table top size 1524 mm long x 914 mm wide x 914 mm high

2.3 INTERVIEW TABLE (ITAB)

.1 Stainless steel top wrapped over steel plate.

.2 Stainless steel: No 7 finish.

.3 Steel finish: Chemically degreased & 1 coat universal rust inhibitive primer, paint.

.4 Table top size 1220 mm long x 760 mm wide x 750 mm high.

.5 Fasteners: roundhead security screws.

2.4 FLOOR STOOL (ST)

.1 Seat Top: 14 gauge type 304 stainless steel top 305mm diameter x 38 mm deep with a spun #4 finish.

.2 Reinforcement: 200 mm x 200 mmx7 gauge steel reinforcement plate, stitch welded to under side of seat & weld to pedestal.

.3 Pedestal: 50 mm schedule 40 (60 mm od) steel pipe pedestal, with overall height 457 mm from floor to top of seat.

.4 Base plate: 200 mm x 200 mm x 6 mm steel base plate, w/ 4- 12.7 mm diameter holes for bolting to floor. Weld to bottom of pedestal. All joints welded & ground smooth

.5 Finish: Chemically degreased & 1 coat universal rust inhibitive primer

.6 Standard of Acceptance: Kach Model No. 517, SecurityCosmos.com: Model 10-125-85-001 or approved equivalent.

Part 3 Execution

3.1 INSTALLATION

.1 Install according to manufacturer's written instructions.

3.2 DRYING TABLE (DTAB)

.1 Install one (1) table where indicated on drawings.

3.3 INTERVIEW TABLE (ITAB)

.1 Form 2 mm thickness stainless steel wrapped over 6 mm thickness steel plate top, welded to 2mm x 102 mm single steel round or square leg.

.2 Weld table leg to stainless steel base plate 400 mm square x 6 mm thickness with four 12.7 mm holes for fastening to floor.

.3 Fabricate table, leg and base with no exposed sharp edges.

.4 All joints welded & ground smooth.

.5 Place blocking between floor joists as required to suit holes for fasteners.

.6 Mechanically fasten table to floor.

.7 Paint steel leg. Refer to Section 09 91 23 Interior Painting.

.8 Install one (1) table where indicated on drawings.

3.4 FLOOR STOOL (ST)

.1 Place blocking between floor joists as required to suit holes for fasteners.

.2 Secure stool pipe support to floor as recommended by manufacturer.

.3 Install stools where indicated.

.4 Install stools in accordance with manufacturer's instructions, reviewed shop drawings and as directed by the Departmental Representative.

.5 Provide three (3) stools where indicated on drawings.

3.5 SEALANT

.1 Apply clear silicone sealant to exposed plate edges on floor plate and underside of floor base plate edges and around floor anchor bolts. Strike smooth to a 45° level.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Remove masking or protection after installation.

.3 Clean finished surfaces as recommended by panel manufacturer.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Building modules constructed "off-site" in a controlled environment; a significant portion of the work is to be completed at the modular builder's facility (plant).

.2 All police building and housing unit modules for this project must be constructed at a single plant in a single location.

.3 Building modules shall include:

.1 All specified interior and exterior finishes, specialties and accessories.

.2 Mechanical systems as noted.

.3 Electrical systems as noted.

.4 Preparation and protection of building modules for shipment to site.

.5 Shipment of building modules to site.

.6 Erection of building modules on prepared foundation.

.7 Repairs to modules on site after transportation.

1.2 RELATED REQUIREMENTS

.1 Section 01 11 00 – Summary of Work.

1.3 REFERENCES

.1 CSA Group

.1 CAN/CSA A277-01 (R2005), Procedure for Certification of Factory-Built Houses.

.2 Saskatchewan Department of Highways

.2 Clearance restrictions. Section 13 42 00.01 Appendix – Highway 102 Churchill River at Otter Rapids.

.3 Road and loading restrictions.

1.4 PLANT LEASE AGREEMENT

.1 The General Contractor and modular builder (Subcontractor) shall enter into a short term lease agreement with the Owner.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Co-ordination: co-ordinate work of this Section with all requirements of technical specifications.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 Required submittals:

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

.2 As referenced in other Sections of technical specifications.

.2 Shop Drawings (Building Modules):

.1 If alternate structural methods or layouts are proposed for the modular components:

.1 Verify that the structural design meets the design intent and assume all costs associated with this verification.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada.

.2 Indicate on drawings related provisions required for mechanical, electrical and other work.

.3 Indicate weight of each Building Module. Refer to 1.8.2 - Transportation Requirements and 2.1 - Designed Requirements.

1.7 QUALITY ASSURANCE / QUALITY CONTROL

.1 Modular builder shall have a QA/QC program in place for the design, fabrication, delivery and installation of building modules. The QA/QC program is subject to review and approval by the Departmental Representative prior to award of contract.

.2 Construct all modules in a single location in a heated facility to CAN/CSA A277. Provide and pay for any and all third party inspections required to ensure this standard is maintained. Provide copies of all third party inspections to Departmental Representative.

.3 Modular builder shall be responsible to have the building modules and systems inspected and tested at the facility as required by the requirements of the technical specifications and as may be required by the Owner, Province, or any other Authority Having Jurisdiction in addition their QA/QC program and CAN/CSA A277.

.4 Provide Inspection and Test Plan (ITP) to include:

.1 Schedule of in-plant reviews of selected modules by all required parties. Confirm list of required parties at pre-construction meeting.

.2 The condition of selected building module will be reviewed by all required parties for condition prior to its preparation for shipment.

.3 Test all mechanical and electrical systems and connections installed in factory prior to shipping in accordance with specifications including but not limited to Sections 23 08 01 and 23 05 94. Document test results and provide copies for Operations and Maintenance manuals. Systems shall be retested on site once final connections are completed.

.5 Comply with all applicable Provincial, National and Municipal Building Codes.

.6 Mock-ups:

.1 Refer to individual specification sections for required mock-ups.

.2 To expedite construction, mock-ups may be pre-qualified or constructed for review and approval by Departmental Representative prior to construction of modules. Confirm requirements at pre-construction meeting.

.3 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

1.8 DELIVERY, STORAGE AND HANDLING

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

.2 Building module transportation requirements:

.1 Arrange for all costs associated with transportation permits, and conduct a road survey of any and all maximum vehicular loading regulations and obstructions prior to transportation. Height, width and loading restrictions apply. Refer to Section 13 42 00.01 Appendix – Highway 102 Churchill River at Otter Rapids.

.2 Prepare building modules for shipment to site wrapped and protected in accordance with industry best practices to prevent damage from weather, dirt or debris during transport.

.3 Ensure openings between modules are temporarily framed and protected prior to being wrapped for shipment.

.4 Ship loose items shall be catalogued and marked for proper placement and use in each section. Ship loose items shall be installed by General Contractor at the site.

.5 Provide additional bracing to units as required by means of cable bracing or other means in order to prevent damage during building relocation.

.6 Include appropriate insurance for modules during transportation.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Designed weight of each building module is to ensure transportation Gross Vehicle Weight (GVW) does not exceed 41,500 kg. Ensure compliance with seasonal road restrictions.

2.2 MATERIALS

.1 Use only materials specified in other Sections of technical specifications.

2.3 FABRICATION

.1 Refer to the drawings and technical specifications.

.2 Floor Construction:

.1 Differences in floor elevation between each module at the seam line are not acceptable.

.2 Floor finishes, as scheduled, are to be installed prior to shipping.

.3 Wall Construction:

.1 All gypsum board shall be mechanically fastened.

.2 Differences in the wall planes at each seam line (hold back area) between modules are not acceptable.

.3 All walls (except for hold-backs at seam lines) are to receive at minimum tape, and prime coat of paint at the plant. Shipping module units with unfinished gypsum partitions is not permitted.

.4 Walls receiving finishes other than paint are to be completely finished prior to shipping.

.4 Roof Construction:

.1 Design roof structure to support the specified minimum live loads plus all dead loads for structure, finishes, ground snow loads, imposed snow loads, and building equipment.

.2 Roofing system shall be as specified in Division 7 of the technical specifications. Comply with all specified warranty requirements.

2.4 MECHANICAL SYSTEMS

.1 Schedule of work to be completed on site (not in plant) including but not limited to:

.1 Final cleaning, testing and commissioning.

.2 Plumbing lines and all associated fittings, valves and accessories running in the crawlspace including connections to pipe terminations in modules.

.3 Installation of trench drain and associated interceptors.

.4 Ductwork and all associated fittings and accessories running in space below modules including connections to ductwork terminations in modules.

.5 Installation and connection of equipment located in the space below modules (heaters, fans, etc.)

.6 Cross module connections for all mechanical systems routing between modules (all pipes, ducts, control wiring).

.7 Final placement and connection of all roof mounted equipment (includes placement of equipment, connection of equipment and all ductwork and piping on roof).

.8 Installation of water meter.

.9 Installation of Soil Gas Collector and associated accessories and discharge.

.10 Service connections in space below modules.

.11 Testing and certification of fire protection system and all other mechanical systems as required by individual specification sections.

2.5 ELECTRICAL SYSTEMS

.1 Schedule of work to be completed on site (not in plant) including but not limited to:

.1 Commissioning.

.2 Connection of cross over connections from module to module (looped, tagged, and identified in plant).

.3 Home run wiring.

.4 Low voltage devices, wiring, and systems.

.5 Site lighting installation including power cabling.

.6 Standby Power Generator installation including power and control cabling.

.7 Power cabling to Fuel Storage tank system.

.8 Garage (Outbuilding 157) power and lighting systems installation including power cabling to Garage.

.9 Room 151 remote pedestal keyed switch.

.10 Fire alarm cabling.

.11 Security System/Card Access Cabling.

.12 Site testing and verifications.

Part 3 Execution

3.1 VERIFICATION OF CONDITIONS

.1 Verify areas to receive components of this Section are free of impediments interfering with access and installation.

3.2 ERECTION

.1 Set building modules on prepared foundations in accordance with reviewed Shop Drawings.

.2 A qualified supervisor from the building module manufacturer shall be on site during time of delivery and set.

.3 Provide skilled workers trained and approved by the building manufacturer to place the modular units in accordance with the building manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

.1 Maintain all requirements of QA/QC program and specified tolerances between building modules.

3.1 WARRANTY

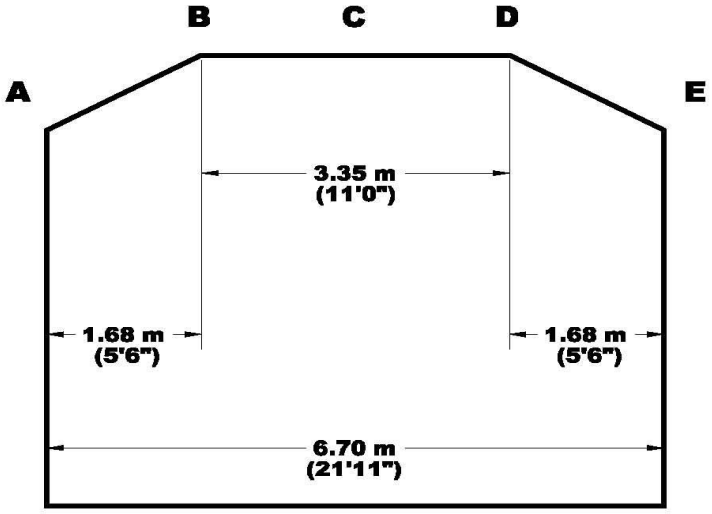
.1 Submit manufacturer's standard warranty form for each product as required in the technical specifications.

.2 Extended warranties: Where extended warranties are listed in other specification Sections they shall be passed through from the building module manufacturer to the General Contractor.

END OF SECTION

Appendix

Highway 102 - Churchill River at Otter Rapids



Maximum vertical clearances at:

A = 4.57 m (15'0")

B = 5.48 m (18'0")

C = 5.48 m (18'0")

D = 5.48 m (18'0")

E = 4.57 m (15'0")

Steel Truss Bridge with steel grate deck

Part 1 - General

1.1 RELATED WORK

.1	Access Doors	Division 08
.2	Fire Extinguishers	Division 10
.3	Fire Suppression	Division 21
.4	Plumbing	Division 22
.5	Heating, Ventilating and Air Conditioning	Division 23
.6	Integrated Automation	Division 25

1.2 INTENT

.1 Provide a complete and fully operational mechanical system with facilities and services to meet requirements described herein and in complete accord with applicable codes and ordinances.

.2 Contract documents for mechanical scope are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.

.3 Should any discrepancies occur on drawings or in specifications which leaves doubt as to the intent and meaning of the drawings and specifications, obtain a ruling from the designer before submitting tender. If this is not done, it will be assumed that the most expensive alternate has been allowed for in the bid.

.4 Follow manufacturer's recommended installation details and procedures for equipment supplemented by details given herein and on plans subject to approval of the Departmental Representative.

.5 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment to satisfaction of the Departmental Representative at no extra cost.

.6 Provide labour and materials required to install, test and place into operation complete mechanical system. Provide additional material for modifications required to correct minor job conflictions.

.7 Connect to equipment furnished in other Sections and by Departmental Representative, including uncrating equipment, moving in place and installing complete, start-up and test.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer’s written instructions.
- .3 Store and manage hazardous materials in accordance with cepa, tdga AND Regional and Municipal Regulations.

.2 Waste Management and Disposal:
- .1 Due to location, recycling is not required. Remove from site and dispose of packaging materials at appropriate disposal facilities.

.3 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
.4 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
.5 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial**.**

1.4 MATERIALS

.1 Replace materials or workmanship below specified quality and relocate work wrongly placed to satisfaction of the Departmental Representative.

.2 Materials and equipment installed shall be new, full weight and of the best quality specified. Use same brand or manufacturer for each specific application. Statically and dynamically balance rotating equipment for minimum vibration and low operating noise level.

.3 Each major component of equipment shall have manufacturer's name, address, catalog and serial number in a conspicuous place.

.4 Install materials and equipment in a neat and workmanlike manner by competent specialists.

1.5 CUTTING AND PATCHING

.1 Locate and provide holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves at no extra cost.

.2 Drill for expansion bolts, hanger rods, brackets, and supports.

.3 Do no cutting or burning of structural members of building frame without obtaining prior written approval from the Departmental Representative.

.4 Provide openings and holes required in precast members for mechanical work. Cast holes larger than 100 mm (4") in diameter. Field-cut smaller than 100 mm (4").

.5 All patching of finished construction of building shall be performed under the sections of specifications covering these materials.

1.6 SEMI-FINAL AND FINAL INSPECTIONS

.1 Perform the following items prior to semi-final inspection.
.1 Heating and air conditioning systems capable of operation with alarm controls functional and automatic controls in operation generally, but not necessarily finally calibrated.
.2 Necessary tests on equipment made including those required by authorities and certificates of approval obtained.
.3 Rough balance of air and water systems completed.
.4 Valve tagging completed and equipment identified. Equipment and piping painted and escutcheons installed.
.5 Equipment lubricated as per manufacturer's data.
.6 Warranty forms have been mailed to manufacturer. Provide copy of original warranty for equipment which has warranty period longer than one year.

.7 Systems chemically cleaned, flushed and water treatment initiated. Provide report from manufacturer's representative to confirm status of treatment.
.8 Submit sample of Operating/Maintenance Manuals. Arrange Operating and Maintenance Instructions and submit schedule for approval.
.9 Review and ensure access doors are suitably located and equipment easily accessible including plumbing cleanouts.
.10 Have noise and vibration control devices and flexible connections inspected by manufacturer's representative and submit written report.
.11 Equipment alignment carried out by qualified millwright and certified report submitted.
.12 Check operations of plumbing systems and fixtures and ensure fixtures are solidly supported.
.13 Fan plenums cleaned, temporary filters removed and permanent filters installed.

.2 Provide declaration in writing that semi-final deficiencies and the following items have been completed prior to the final inspection:
.1 Equipment cleaned inside, outside and lubricated. Plumbing fixtures and brass cleaned.
.2 Final balancing completed and rough data of balance reports submitted.
.3 Final calibration of controls completed including point-to-point verification and confirmation that sequences are fully operational.

1.7 SHOP DRAWINGS

.1 Submittal procedures in accordance with Division 1.

.2 Submit materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalog material. Do not assume applicable catalogues are available in the Departmental Representative's office. Maintenance and operating manuals are not suitable submittal material.

.3 Clearly mark each sheet of printed submittal material (using arrows, underlining or circling) to show particular sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pump seals, materials or painting.

.4 Include dimensional data for roughing in and installation, technical data sufficient to check that equipment meets requirements of drawings and specifications, wiring, piping, and service connection data, motor sizes complete with voltage ratings and schedules as applicable.

.5 Shop drawings to show all information identified under individual product specifications and in general shall show the following:
.1 Mounting arrangements.
.2 Operating and maintenance clearances.
.3 Detailed drawings of bases, supports, and anchor bolts.
.4 Acoustical sound power data, where applicable.
.5 Points of operation on performance curves.
.6 Manufacturer to certify current model production.
.7 Certification of compliance to applicable codes.

.6 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.8 OPERATING AND MAINTENANCE MANUALS

.1 Provide services of qualified and experienced personnel to prepare proper documentation and to instruct the Operating Staff in the operation and preventative maintenance of each piece of equipment and system supplied and installed. Complete and turn over documentation prior to final inspection.

.2 Provide 215 mm x 280 mm (8-1/2" x 11") capacity extension type catalogue binders bound with heavy fabric, hot stamped in gold lettering front and spine. Refer to Division 1 for colour and quantity.

.3 Each binder shall be indexed according to the following indexing system:

.4 Tab-1.0 Mechanical Systems: Title page with clear plastic protection cover.

.5 Tab-1.1 List of Mechanical Drawings.

.6 Tab-1.2 Description of Systems: Provide complete description of each system. Include detailed system description and components comprising that system, explanation of how each component interfaces with others to complete the system, location of each thermostat, controller or operating setpoints. Refer to 21 05 01, 1.1.5 for additional required information.

.7 Tab-1.3 Operation Division: Provide complete and detailed operation of each major component. Include how to energize and exact location of switches and controls, how the component interfaces with other components, operation of controls, including the operational sequence, operational characteristic changes for summer or winter operation, and how to accomplish the changeover, complete troubleshooting sequence, setpoints cannot be maintained, and safeguards to check if equipment goes off line. Refer to 21 05 01, 1.1.5 for additional required information.

.8 Tab-1.4 Maintenance and Lubrication Division: Provide detailed preventative maintenance and lubrication schedule for each of the major components to include daily, weekly, monthly, semi-annual and yearly checks and tasks. Explain how to proceed with each task required for each piece of typical equipment such as bearings, drives, motors and filters. Compile this information for each typical piece of equipment separate from the shop drawings section. Refer to 21 0-5 01, 1.1.5 for additional required information.

.9 Tab-1.5 List of Equipment Suppliers and Contractors: Provide complete list of equipment suppliers and contractors, including address and telephone number. Outline procedures for purchasing parts and equipment. Include steps to take in order to purchase new parts.

.10 Tab-Certification (2.0, 2.1, etc.): Include copy of test data degreasing and flushing of heating system analysis of system water taken at time system was put into operation, hydrostatic or air tests performed on piping systems, equipment alignment certificates, copy of balancing data for air and water systems, copy of valve tag identification and pipe colour code, inspection approval certificates for plumbing system, hot air heating and ventilation systems and fire damper schedule.

.11 Tab-Shop Drawings and Maintenance Bulletins (3.0, 3.1, etc.): Provide materials as received in compliance with clause "Shop Drawings".

.12 The divider tabs shall be laminated mylar plastic, and coloured according to section. The colouring is as follows: Mechanical Systems - 1.0 - 1.5 - Orange, Certification - 2.0 - 2.4 - Green, Shop Drawings and Maintenance - 3.0 - 3.17 - Yellow. Plastic tabs with typed insertions will not be accepted.

.13 Submit documents to the Departmental Representative for approval prior to being turned over to the Departmental Representative. At completion of project, hold a Seminar to instruct the Operating Staff in operation and preventative maintenance of each piece of equipment and system supplied and installed.

.14 Provide one digital copy on compact disk of the final operation and maintenance manual in each of the manuals (six in total).

1.9 RECORD DRAWINGS

.1 Refer to Division 1.

.2 Keep on site, an extra set of white prints and specifications recording changes and deviations daily. Allow for the work required to transfer site changes to Departmental Representative's original tracings and for providing the Departmental Representative with set of sepias marked "Record Drawings". Co-ordinate through Departmental Representative's office. Addenda corrections and Departmental Representative initiated construction changes to original tracings will be the responsibility of the Departmental Representative.

.3 Contractor shall utilize a different colour water proof ink for each service.

.4 Contractor shall ensure that white prints are available on site for reference purposes and inspection.

.5 Record drawings shall identify location of fire dampers, major control lines, access doors, tagged valves and actual room names or numbers.

.6 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.7 Submit to Departmental Representative for approval and make corrections as directed.

1.10 IDENTIFICATION

.1 Refer to Section 23 05 54, Mechanical Identification.

1.11 TEMPORARY FACILITIES

.1 Refer to General Requirements - Division 01.

1.12 SUPERVISION

.1 Refer to General Requirements - Division 01.

1.13 TEMPORARY HEAT AND/OR VENTILATION

.1 Refer to General Requirements - Division 01.

.2 Do not use the permanent system for temporary heating or ventilation purposes, without written permission from the Departmental Representative.

.3 Thoroughly clean and overhaul permanent equipment used during the construction period, replacing worn or damaged parts. Exchange equipment or components operating improperly at final inspection with new equipment or components.

.4 Use of permanent systems for temporary heat shall not modify the terms of warranty.

.5 Operate heating systems under conditions which ensure no temporary or permanent damage. Operate fans at proper resistance with filters installed. Change filters at regular intervals. Operate with proper safety devices and controls installed and fully operational. Operate water systems with proper water treatment.

.6 Where air systems are used during temporary heating, provide filter media on return and exhaust air outlets. Clean duct systems which have become dirty.

.7 When permanent systems are used for temporary heat, provide alarm indicating system failure. Connect alarm to independent alarm company system.

.8 Replace mechanical seals in pumps used for temporary heating purposes with new mechanical seals, regardless of condition.

.9 Provide one year warranty from date of Substantial Completion.

1.14 EQUIPMENT PROTECTION AND CLEAN-UP

.1 Protect equipment and materials in storage on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

.2 Protect equipment with polyethylene covers and crates.

.3 Operate, drain and flush out bearings and refill with new change of oil, before final acceptance.

.4 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.

.5 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

1.15 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the Departmental Representative of mechanical equipment supplied under contract and claimed complete before final acceptance shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Take responsibility for damage caused by defective materials or workmanship during temporary or trial usage.

1.16 ELECTRICAL MOTORS

.1 Supply mechanical equipment complete with electrical motors.

.2 Provide NEMA premium efficiency motors to CEMA and CSA standards for hard, continuous service, designed to limit temperature rise to 40 deg.C (100 deg.F) for open housing and 50 deg.C (125 deg.F) for drip proof housing, and operate at 1800 RPM unless otherwise specified.

.3 Motors shall have ball or roller type bearings with grease lubrication fittings.

.4 Motors used in conjunction with variable frequency drives shall be suitable for inverter duty, as specified by NEMA MGI-1993, Part 31. Refer to electrical specifications for inverters.

.5 Refer to mechanical equipment schedule and electrical specification for voltage, phase and cycle.

1.17 ACCESS DOORS

.1 Supply access doors for furred ceilings, ducts or spaces for servicing equipment and accessories or for inspection of safety, operating and fire devices for installation under section erecting the walls or ceilings.

.2 Provide access doors in ductwork in accordance with Section 23 33 00 - Air Duct Accessories

.3 Provide service access door in accordance with Section 08 31 00.01 - Access Doors - Mechanical.

1.18 COMMISSIONING

.1 Mechanical Contractor is responsible to ensure all mechanical systems are fully commissioned and detailed commissioning forms are completed and reviewed with Departmental Representative. Refer to Sections 01 91 13 General Commissioning (Cx) Requirements, 01 91 33 Commissioning Forms, 01 91 41 Commissioning Training for details on Mechanical Contractors responsibilities in addition to all commissioning activities identified under Division 21, 22, 23 and 25. As part of the commissioning process, the contractor is required to complete the Site Standard Equipment Labelling and Tracking sheets for the equipment they supplied, the sheets will be provided by the owner.

1.19 INSTRUCTION OF OPERATING STAFF

.1 Provide trained personnel to instruct operating staff on maintenance, adjustment and operation of mechanical equipment. Instruct staff on changes or modification in equipment made under terms of guarantee.

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

.3 Where specified elsewhere in Mechanical manufacturers to provide demonstrations and instructions.

.4 Use operation and maintenance data manual for instruction purposes. On completion of instruction, turn one manual over to chief operating personnel, the balance to Departmental Representative.

.5 Record every instruction and training session on digital video, include copies with O&M Manual.

.6 Time allocated for Instruction:

Plumbing Fixtures	One-half (1/2) hour instruction per fixture type.
Fire Protection	One (1) hour instruction
Pumps	One-half (1/2) hour instruction per pump type.
Tanks	One-half (1/2) hour instruction
Fans	One (1) hours instruction
Domestic Water Heater	Two (2) hours instruction
Split AC Units	One (1) hour instruction
Packaged Roof Top Units	One (1) hour instruction
Packaged Roof Top Unit Controls	Two (2) hour instruction
Semi-Custom Roof Top Units	Two (2) hour instruction
Semi-Custom Roof Top Unit Controls	Two (2) hour instruction
Electric Heaters	One (1) hours instruction
Furnace and Controls	Two (2) hour instruction
ERV and controls	One (1) hours instruction
Stand Alone Controls	One (1) hour instruction per controller type

1.20 SUBSTANTIAL COMPLETION

.1 The mechanical portion of the project shall be deemed substantially complete when ALL mechanical systems are operational as designed. In addition, the air and/or water balance must be completed with the report submitted and approved by the Departmental Representative and the temperature control system must be complete, as designed, operational, with all control components calibrated and the maintenance manuals in final form must be submitted. The date will be established by the Departmental Representative and will set the date for the start of the one (1) year warranty on all mechanical systems.

1.21 EXCESSIVE ADMINISTRATION

.1 Following the "Substantial Completion" Inspection a "Final" Inspection will be conducted and a follow up inspection will be conducted to "check off" all outstanding mechanical deficiencies.

.2 If the mechanical portion of the project is not 100 percent complete at the time of the deficiency “checkoff” inspection, the cost of the failed deficiency “check-off” inspection and any and all additional inspections will be back charged directly to the Mechanical Contractor.

.3 The cost of each excessive inspection will be $2,000.00 plus travel, and will be deducted directly from the total Mechanical Contract amount.

.4 If the contractor fails the deficiency “checkoff” inspection, no additional money will be released and a subsequent inspection will be scheduled when the Contractor re-verifies that they are 100% complete.

.5 This process will repeat until the contractor can demonstrate that the project is 100% complete with all deficiencies rectified.

1.22 ALTERNATE AND SEPARATE PRICES

.1 Referenced specification sections and drawings contain pertinent requirements for materials and methods to achieve work described herein.

.2 Coordinate pertinent related work and modify surrounding work as required to complete project under each alternate designated.

.3 Alternate products may vary in operation or construction, but shall meet or exceed the requirements of the specifications, drawings and the specified equipment for performance capacities, controllability and equipment options.

.4 Revisions required to adapt equipment other than that specified shall be made without extra charge to the Departmental Representative.

1.23 ALTERNATE MATERIALS & EQUIPMENT

.1 The design is based on the materials and equipment as specified. Any alternate materials or equipment that meet or exceed the performance, quality and design intent of that specified will be accepted unless specifically noted otherwise under this article.

.2 If alternate material or equipment will alter the design intent, make proposals to supply said materials or equipment in writing to the Departmental Representative at least ten working days prior to closing date of tender for Mechanical Trade. Any material or equipment that alters the design intent must be formally approved to be accepted.

.3 All proposed equipment is subject to the requirements of the drawings and specifications. Revisions required to adapt equipment other than that specified shall be made without extra charge to the contract. All suppliers, except those specified, shall guarantee in writing that their individual proposed products meet or exceed the performance and quality of specified products. If the departmental representative determines at any time that the equipment or material being supplied does not meet or exceed the performance, quality or design intent of that being specified, the contractor shall replace the article in question with a suitable product at the contractors expense.

.4 The following products shall be supplied as specified, there is no other products/ manufacturers that will be accepted:

- .1 Cell Comby, as listed in Section 22 42 03
- .2 Security Floor Drains and mounting, as listed in Section 22 42 01
- .3 Security Sprinkler heads, as listed in Section 21 13 13.
- .4 Security HVAC grilles, as listed in Section 23 37 13.
- .5 Any other products specifically noted to be supplied as specified.

1.24 SERVICE CONNECTIONS

.1 Connect to new sanitary sewer service, as indicated on Civil drawings and specifications. Mechanical contractor shall install piping within building to 2400mm outside perimeter of building. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing. Coordinate work with Site Services contractor.

.2 Connect to new water service, as indicated on Civil drawings and specifications. Provide new water service in building complete with water meter with bypass valves to requirements of authority having jurisdiction. Provide necessary thrust blocks on underground water piping as required and detailed. Provide sleeve in wall for service main and adequately support at wall with reinforced concrete bridge. Caulk enlarged sleeve and make watertight with plyable material. Securely anchor service main inside to concrete wall. Provide 18 gauge galvanized sheet metal sleeve around service main to 152 mm (6") above floor and 2 m (6') minimum below grade. Size for minimum 50 mm (2") of loose fill insulation. Provide backflow preventer at meter location to the stricter requirements of authority having jurisdiction or specified models. Mechanical contractor shall install piping within building to 2400mm outside perimeter of building. Coordinate work with Site Services contractor.

Part 2 - Materials

2.1 NOT USED

.1 Not Used

Part 3 - Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 General

1.1 REFERENCES

.1 Federal Sprinkler Standard, FCC#403 - Sprinkler Systems.

.2 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
- .1 ANSI/NFPA 13- 2013, Installation of Sprinkler Systems.

.3 Underwriters Laboratories of Canada (ULC)
- .1 ULC S543- 1984, Internal Lug Quick Connect Couplings for Fire Hose.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures and in accordance with ANSI/NFPA 13, working plans and design requirements.

.2 Sprinklers shall be referred to on drawings, submittals and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.3 ENGINEERING DESIGN CRITERIA

.1 Design system in accordance with required and advisory provisions of ANSI/NFPA 13, using following parameters:
- .1 Hazard:
  - .1 To suit occupancy as indicated.
- .2 Pipe size and layout:
  - .1 Hydraulic design.
  - .2 Sprinkler head layout: to ANSI/NFPA 13.
- .3 Water supply:
  - .1 Conduct flow and pressure test of water supply in vicinity of project to obtain criteria for bases of design in accordance with ANSI/NFPA13. Base design for bidding in accordance with the following: Water pressure at new municipal hydrant is estimated to be as follows: Flowing – 650 GPM at 40 PSI.
  - .2 New service line as indicate on site plans.
- .4 Zoning:
  - .1 System zoning as indicated.

.2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.

.3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings

.4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

.5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.

.6 Location of Sprinkler Heads:
- .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 required hazard occupancy.
- .2 Uniformly space sprinklers on branch.
- .3 Sprinklers in secure areas shall be located in accordance with RCMP Security standards, as indicated on drawings.

.7 Water Distribution:
- .1 Make distribution uniform throughout the area in which sprinkler heads will open.
- .2 Discharge from individual heads in hydraulically most remote area to be 100% of specified density.

.8 Density of Application of Water:
- .1 Size pipe to provide specified density when system is discharging total maximum required flow.
- .2 Sprinkler Discharge Area:
  - .1 Area: hydraulically most remote area as defined in NFPA 13.
- .3 Outside Hose Allowances:
  - .1 Include allowance in hydraulic calculations for required outside hose streams.
- .4 Friction Losses:
  - .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 EXTRA MATERIALS

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

.2 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

2 Products

2.1 PIPE, FITTINGS AND VALVES

.1 Pipe:
- .1 Steel Pipe: ASTM A53 or A120, Schedule 40 black, with malleable iron or forged steel welding type fittings, screwed or welded.

.2 Fittings and joints to ANSI/NFPA 13:
- .1 Ferrous: screwed, welded, flanged or roll grooved.

.1 Grooved joints shall consist of two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts.
.1 Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity. Couplings shall be fully installed at visual pad-to-pad offset contact. (Tongue and recess type couplings, or any coupling that requires exact gapping of bolt pads on each side of the coupling at specified torque ratings, are not allowed.) Victaulic Style 009-EZ, 005, and 07.
.2 Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for seismic applications. Victaulic Style 77.

.2 Copper tube: screwed, soldered, brazed, or roll grooved.
.1 Grooved joints shall be manufactured to copper-tube dimensions, with housings cast with offsetting angle-pattern bolt pads. Victaulic Style 606.

.3 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.

.4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.

.5 Rubber gasketted grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.

.6 Fittings: ULC approved for use in wet pipe sprinkler systems.

.7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.

.8 Side outlet tees using rubber gasketted fittings are not permitted.

.9 Sprinkler pipe and fittings: metal.

.3 Valves:
.1 ULC listed for fire protection service.
.2 Up to NPS 2: bronze, screwed or grooved ends, OS & Y; gate or indicating ball valve. Victaulic Style 728.
.3 NPS 2 1/2 and over: cast ductile iron, flanged or roll grooved ends, indicating butterfly valve. Victaulic Style 705W.
.4 Swing or spring-actuated check valves. Victaulic Series 717.
.5 Ball drip.
.6 Gate valves: open by counterclockwise rotation.
.7 Provide rising stem valve beneath each alarm valve in each riser when more than one alarm valve is supplied from same water supply pipe.
.8 Check valves: flanged clear opening swing-check type with flanged inspection and access cover plate for sizes 10 cm and larger.
.9 Provide gate valve in piping protecting elevator hoistways.

.4 Pipe hangers:
.1 ULC listed for fire protection services in accordance with NFPA.
.2 Refer to 23 05 05 and 23 05 29 for more detail.

2.2 GATE VALVES

.1 50 mm and under: Bronze body, bronze trim, non-rising stem, handwheel, inside screw, double disc, solder or threaded ends. To ASTM B61.

.2 Over 50 mm: Iron body, bronze trim, rising stem, handwheel, OS&Y, double disc or wedge, flanged or grooved ends. Victaulic series 771.

.3 Valves: Bear UL label or marking, manufacturer's name and pressure rating on valve body.

2.3 GLOBE VALVES

.1 Valves Up to 50 mm: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable composition disc, solder or screwed ends, with back seating capacity. To ASTM B61.

.2 Valves Over 50 mm: Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

.3 Valves: Bear UL label or marking, manufacturer's name and pressure rating on valve body.

2.4 BALL VALVES

.1 Valves 50 mm (2") nominal and under: bronze to ASTM B584, chrome-plated brass ball, stainless steel stem, with weatherproof actuator, handwheel, supervisory switches, and grooved or threaded. UL/FM approved. Victaulic Series 728.

2.5 BUTTERFLY VALVES

.1 Valves: UL/FM approved, Iron Body, Bronze disc, resilient replaceable liner seat, wafer or lug ends, extended neck, handwheel and gear drive.

.2 Weatherproof actuator with handwheel, supervisory switches.

.3 Victaulic Series 705W.

2.6 SWING CHECK VALVES

.1 Valves Up to 50 mm: Bronze swing disc, renewable disc and seat, flanged ends to ASTM B61. Design for either horizontal or vertical mounting.

.2 Valves over 50 mm: UL/ULC/FM pattern, iron body, bronze mounted, regrind-renew bronze or elastomer coated ductile iron disc and seat ring, bolted cap or one-piece body, flanged or grooved ends. Design for either horizontal or vertical mounting with stainless steel spring and shaft. Victaulic Series 717

2.7 SPRINKLER VALVE

.1 Provide approved Automatic Sprinkler Valve with one or two pole (as required) flow detectors with alarm circuits, pressure switch, pressure retard chamber, outside water motor gong, outside electric gong, inside electric gong, and circuit breaker.

2.8 ABOVE GROUND PIPING SYSTEMS

.1 Provide fittings for changes in direction of piping and for connections.
- .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
- .2 Perform welding in shop; field welding will not be permitted.
- .3 Conceal piping in areas with suspended ceiling and as indicated on drawings.

2.9 SPRINKLER HEADS

.1 General: to ANSI/NFPA 13 and ULC listed for fire services.

.2 New sprinkler heads to match equivalent types. Confirm on site.

.3 Temperature rating on fusible links shall suit specific hazard area with minimum of safety 10 deg.C.

.4 Sprinklers shall be listed with and bear certification marking of nationally recognized testing agency.

.5 Sprinklers with O-rings are not allowed.

.6 Provide minimum 12 mm (1/2") nominal diameter discharge orifice, except when approved by authorities having jurisdiction.

.7 Provide chrome plated finish for sprinklers in all areas: except mechanical rooms where bronze finish is acceptable.

.8 All pendant type heads to be semi-recessed where possible.

.9 All sprinkler heads located in Mechanical Rooms, Storage Rooms, IT/Equipment and other areas susceptible to damage to be complete with wire guards.

.10 Sprinkler heads shall be located in the centre half or quarter point of ceiling tiles.

.11 Provide quick response heads in all light hazard areas.

.12 Sprinkler body shall be integrally cast with hex-shaped wrench boss to reduce the risk of damage during installations.

.13 Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss integrally cast in the sprinkler body

.14 Provide security sprinkler heads in provost area.

2.10 UPRIGHT SPRINKLER HEAD

.1 Provide glass bulb type in areas indicated on drawings or specified. Bronze in mechanical rooms, chrome elsewhere.

2.11 PENDANT SPRINKLER HEAD

.1 Provide semi-recessed polished chrome glass bulb type in areas indicated on drawings or specified.

2.12 SIDE WALL SPRINKLER HEAD

.1 Provide polished chrome glass bulb type in areas indicated on drawings or specified.

2.13 SECURITY PENDANT SPRINKLER HEAD

.1 Only sprinklers listed as approved by RCMP Security Standards are permitted for installation in Cells. Sprinklers in cells shall be stamped with manufacturer and model number on faceplate of sprinkler.

.2 Escutcheons shall be ordered and supplied with heads.

.3 Approved sprinklers heads are as follows:
- .1 Viking Model HQR-2 institutional quick response standard coverage/extended coverage flush pendant sprinkler with sprinkler base part number 10554, sprinkler identification number VK410 and escutcheon package base part number 10627.

2.14 WET SPRINKLER SYSTEM

.1 Provide complete with the following:
- .1 Alarm valve.
- .2 Indicating control valves.
- .3 Inside electric gongs and circuit closer.
- .4 Specified water gauges.
- .5 Piping and fittings.
- .6 Valves.
- .7 Hangers.
- .8 Floor and ceiling escutcheon plates.
- .9 Backflow Preventer
- .10 Outside water gongs and circuit closer (this is required by authority)
- .11 Outside electric gongs and circuit closer

.2 Provide one alarm valve complete with excess pressure pump or retard chamber and standard accessories, drain valves, check valves, alarm connections and water gauges. Provide indicating type valves for controlling water supply and alarm shut-off.
- .1 Alarm valve internal components shall be replaceable without removing the valve from the installed position.
- .2 Victaulic Series 759 alarm valve with Series 752.

.3 Connect outside water rotary gong to alarm valve required by Authority Having Jurisdiction.

.4 Provide 100 mm (4") electric gong operated by alarm device.

.5 Provide standard water flow, valve alarm devices and main control valve. Provide trouble transmitter low air circuit closer for complete central station electrical supervision of system, including battery and rectifier and locate adjacent to alarm valve.

.6 Provide excess pressure pump capable of pumping system to 172 kPa (25 psi) within 30 minutes, in excess of normal pressure. Provide pump with supports, safety valve, gauge, starter and connections to wet pipe sprinkler system. Set safety valve 10 kPa (1.5 psi) above operating pressure. Excess pressure pump is not required if alarm valve utilized meets requirements of NFPA 13 without a pressure pump.

2.15 MAKE-UP PRESSURE PUMP (if required)

.1 Provide electrically operated excess pressure pump to maintain higher pressure in sprinkler discharge piping.

.2 Pump shall be capable of producing pressure of 400 kPa in excess of that normally carried.

.3 Provide pump with necessary control valves, check valves, and relief valves with such on supply side of fire pump.

.4 Manually start and stop pump by operation of switch located near sprinkler valve.

.5 Control pump by combined manual/automatic start interconnected with high-low pressure switch installed on sprinkler discharge line.

.6 Rigidly support pump.

2.16 FIRE DEPARTMENT CONNECTION

.1 Siamese fire department connection as indicated to supply fire hose and standpipe system and sprinkler system.

.2 Type: Flush mounted non-freeze wall type with brass finish.

.3 Outlets: Provide connection with two 63 mm (2-1/2") nominal female hose connections fitted with caps and chains of matching material. Threads of 63 mm (2-1/2") nominal connection shall conform to those of local fire department.

.4 At the low-point near each fire department connection, install a 90 degree elbow with drain connection to allow for system drainage to prevent freezing. Elbow shall be Victaulic #10-DR

.5 Include horizontal check valve and automatic drip discharging to nearest floor drain for connection.

.6 Identify pumper connection with sign having raised letters at least 25 mm (1") in size cast on plate or fitting reading "Standpipe - Fire Department Connection".

2.17 SUPERVISORY SWITCHES

.1 General: to ANSI/NFPA 13 and ULC listed for fire service.

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

.3 Flow switch type:
.1 With normally open and normally closed contacts and supervisory capability.

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

2.18 SIGNS

.1 Signs for control drain and test valves: to ANSI/NFPA 13.

2.19 SPARE PARTS CABINET

.1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. Number and types of extra sprinkler heads as specified in NFPA 13.

.2 Construct to sprinkler head manufacturer‘s standard.

2.20 INSPECTOR'S TEST CONNECTION

.1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.

.2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.

.3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.21 ESCUTCHEON PLATES

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

.2 Provide polished stainless steel plates in finished spaces.

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

3 Execution

3.1 GENERAL INSTALLATION

.1 Install piping in accordance with NFPA 13 for sprinkler systems and in accordance with manufacturer's recommendations.

.2 Allow for expansion and contraction when installing pipe hangers.

.3 Install signs required by local Fire Protection Department.

.4 Secure outdoor signs with stainless steel bolts.

.5 Locate outside alarms on wall of building adjacent to fire department connection.

.6 Mechanical grooved joints may be used instead of threaded or welded joints.

.7 Grooved joints shall be installed in accordance with the manufacturer’s latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be moulded and produced by the coupling manufacturer.

.8 Die cut screw joints with full cut standard taper pipe threads with read lead and linseed oil or other non-toxic joint compound applied to male threads only.

.9 Provide gate valves or approved butterfly valves, low points of piping and apparatus.

.10 Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.2 SYSTEM TESTS

.1 Hydrostatically test entire system. Test shall be witnessed by Fire Marshall.

3.3 INSPECTION

.1 Do not recess, paint or conceal piping accessories or work prior to inspection and approval by authorities having jurisdiction or authorized representative.

3.4 FIRE DEPARTMENT CONNECTION

.1 Make connections for standpipe system before domestic water connection and meter. Provide two check valves on black steel pipe, or single soft seated check valve on galvanized steel or copper pipe with gate valves on both sides of check valves.

.2 During construction, make one standpipe outlet available on each floor without delay, for department use.

.3 Where the static pressure exceeds 690 kPa at hose station, provide pressure reducing valve to prevent pressure on hose exceeding 620 kPa.

.4 Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

3.5 FIELD QUALITY CONTROL

.1 Subject systems and equipment to operational test.

.2 Hydrostatically test water supply connections and fire department connections at 345 mm (13") in excess of normal working pressure but not less than 1400 kPa (203 psi) for 2 hours without loss under supervision.

.3 Upon complete installation of piping and apparatus for sprinkler systems, test joints for tightness and good condition of piping. When testing with water, install pressure gauge at highest point of installation. If impossible to test whole installation in single operation, subdivide into several zones and test each zone in manner described.

.4 The grooved coupling manufacturer’s factory trained representative shall provide on-site training for Contractor’s field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site and review Contractor is following best recommended practices in grooved product installation. (A distributor’s representative is not considered qualified to conduct the training or job site visits).

.5 During tests, stop any leaks and remove and repair any defective part. Perform test over again until satisfactory results are obtained.

.6 Provide hydraulic pump, temporary connections and labour required for tests.

3.6 SPRINKLER SYSTEM

.1 Install alarm valves and gongs as indicated or as specified.

.2 When water service is for building domestic supply and fire protection system, install testable double check valve and indicating control valve on branch line for fire protection system immediately after branch connection.

.3 Install horizontal valves with stems upright where space allows.

.4 Do not allow sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

.5 Sprinkler bulb protector shall be removed by hand after installation. Do not use tools or any other devices to remove the protector that could damage the bulb in any way.

.6 Centre sprinkler heads in two directions in ceiling tile and provide piping offsets as required.

.7 Apply strippable tape or paper cover to ensure concealed sprinkler head cover plates do not receive field paint finish.

3.7 PROTECTION OF COMPLETE WORK

.1 Paint exposed steel pipe and fittings, except special finishes, in accordance with Architectural Specifications.

.2 Assume responsibility for protecting sprinkler heads during painting. Replace damaged and painted components.

.3 Provide red wire guards for sprinkler heads in mechanical and electrical rooms and around ventilation equipment, and all other areas required by code or intended usage.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Materials and installation for domestic water service used in the following:
- .1 Incoming domestic water service, up to NPS 2 1/2.
- .2 Hard domestic hot and cold water services inside building.
- .3 Soft tubing inside building.
- .4 Soft buried tubing outside building, as in between potable water source and meter inside building.

.2 Sustainable requirements for construction, verification and operation.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
- .1 ANSI/ASME B16.15-06, Cast Bronze Threaded Fittings, Classes 125 and 250.
- .2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
- .3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- .4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.

.2 ASTM International Inc.
- .1 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 ASTM A536-84(2004)e1, Standard Specification for Ductile Iron Castings.
- .3 ASTM B88M-05, Standard Specification for Seamless Copper Water Tube (Metric).

.3 American National Standards Institute/American Water Works Association (ANSI)/ (AWWA)
- .1 ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canada Green Building Council (CaGBC)
- .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.
- .2 Rating System Addenda for New Construction and Major Renovations LEED Canada-NC Version 1.0-Addendum 2007.
- .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.5 Canadian Standards Association (CSA International)
- .1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.

.6 Department of Justice Canada (Jus)
- .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.8 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
.1 MSS-SP-67-02a, Butterfly Valves.
.2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS-SP-71-05, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
.4 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.

.9 National Research Council (NRC)/Institute for Research in Construction
.1 NRCC 38728, National Plumbing Code of Canada (NPC) - 1995.

.10 Transport Canada (TC)
.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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

.3 Closeout Submittals:
.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 Products

2.1 WATER PIPING, BURIED

.1 Copper tubing type K annealed; wrought copper fittings 95/5 solder or silver braze joints. Copper tubing to be in long lengths and with no buried joints.

.2 Plastic "BLUE BRUTE" pipe and fittings; solvent weld joints.

.3 All piping and fitting shall be rated to a minimum of 1034 kPa (150 PSI)

2.2 WATER PIPING, UNBURIED

.1 Type L hard copper; with cast brass or wrought copper fittings; 95/5 solder joints.

.2 Stainless steel pipe, Schedule 10; grooved fittings.

.3 Cross Linked Polyethylene (PEX) pipe with mechanical joints.

.4 Polypropylene: Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389 or CSA B137.11. All pipe shall be made in an extrusion process. Hot water piping shall contain a fiber layer (faser) to restrict thermal expansion. All pipe shall comply with the rated pressure requirements of ASTM F 2389 or CSA B137.11. Fittings: Fittings shall be

manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. All pipe and fittings shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11. The pipe and fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe system shall be plenum-rated with pipe wrapped and/or insulated with standard pipe insulation, field installed. The pipe wrap or insulation shall meet the requirements of CAN/ULC-S102.2-03 or ASTM E84. The system shall have a Flame Spread Classification of less than 25 and Smoke Development rating of less than 50. It is assumed pipe will be exposed to direct UV light and shall be provided with a Factory applied, UV-resistant coating or alternative UV protection.

2.3 FITTINGS

.1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.

.2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.3 Cast copper, solder type: to ANSI/ASME B16.18.

.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

.5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.

.6 NPS 1 1/2 and smaller: wrought copper to ANSI/ASME B16.22; with 301stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

2.4 JOINTS

.1 Rubber gaskets, latex-free mm thick: to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.5 GATE VALVES

.1 NPS 2 and under, soldered:
- .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, screwed:
- .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.

.3 NPS 2 1/2 and over, in mechanical rooms, flanged:
.1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 - Valves - Cast Iron.

.4 NPS 2 1/2 and over, other than mechanical rooms, flanged:
.1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

2.6 GLOBE VALVES

.1 NPS2 and under, soldered:
.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 - Valves - Bronze.
.2 Lockshield handles: as indicated.

.2 NPS 2 and under, screwed:
.1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01 - Valves - Bronze.
.2 Lockshield handles: as indicated.

2.7 SWING CHECK VALVES

.1 NPS 2 and under, soldered:
.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, screwed:
.1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.

.3 NPS 2 1/2 and over, flanged:
.1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, regrind seat, bronze disc, bolted cap specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

2.8 BALL VALVES

.1 NPS 2 and under, screwed:
.1 Class 150.
.2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS 2 and under, soldered:
.1 To ANSI/ASME B16.18, Class 150.
.2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01 - Valves - Bronze.

2.9 BUTTERFLY VALVES

.1 NPS 2-1/2 and over, wafer:
.1 To MSS-SP-67, Class 200.

.2 Cast iron body, ductile iron chrome plated disc, stainless steel stem, EPT liner.
.3 Lever operated, NPS8 and over, gear operated.

.2 NPS 2-1/2 and over, grooved ends:
.1 Class 300 psig CWP, bubble tight shut-off, bronze body EPDM coated ductile iron disc with integrally cast stem.
.2 Operator:
.1 NPS 4 and under: lever handle.
.2 NPS 6 and over: gear operated.

3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install in accordance with NPC.

.2 Install pipe work in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified herein.

.3 Assemble piping using fittings manufactured to ANSI standards.

.4 Install cold piping below and away from all other hot piping so as to maintain temperature of cold water as low as possible.

.5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.3 ROUTES AND GRADES

.1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furrings to a minimum.

.2 Slope water piping 25 mm in 12 m (1" in 40') and arrange to drain at low points.

.3 On closed systems, equip low points with 20 mm (3/4") drain valves and hose nipples. Provide, at high points, collecting chambers and high capacity float operated automatic air vents.

.4 Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting.

.5 Grade horizontal drainage and vent piping 22 mm per meter (1/4" per foot) minimum unless otherwise indicated on drawings.

3.4 VALVES

.1 Isolate equipment, fixtures and branches with gate valves.

.2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.

.3 Install valves with stems upright or horizontal, not inverted.

.4 Install gate, ball and butterfly valves for isolating service, to isolate equipment, part of systems or vertical risers.

.5 Install globe, ball or angle valves for throttling service and control device or meter bypass.

.6 Use plug cocks in water systems for throttling service. Use non-lubricated plug cocks only when shut-off or isolation valves are also provided.

.7 Provide drain valves at main shut-off valves, low points of piping and apparatus.

3.5 PRESSURE TESTS

.1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.6 FLUSHING AND CLEANING

.1 Disinfect and rinse entire system to requirements of authority having jurisdiction and RCMP site standards.

.2 Flush entire system for minimum of 8 hours. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean copper. Let system flush for additional 2 hours, then draw off another sample for testing.

.3 Upon completion, provide laboratory test reports on water quality for Departmental Representative approval. Include one copy of approved test reports in Operation and Maintenance Manual.

3.7 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensators are installed properly.

3.8 START-UP

.1 Timing: start up after:
- .1 Pressure tests have been completed.
- .2 Disinfection procedures have been completed.

.3 Certificate of static completion has been issued.
.4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:
.1 Establish circulation and ensure that air is eliminated.
.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
.3 Monitor piping HWS and HWC piping systems for freedom of movement, pipe expansion as designed.
.4 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.9 PERFORMANCE VERIFICATION

.1 Scheduling:
.1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

.2 Procedures:
.1 Verify that flow rate and pressure meet Design Criteria.
.2 Verify performance of temperature controls.
.3 Verify compliance with safety and health requirements.
.4 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
.5 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

.3 Reports:
.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, using report forms as specified in Section 01 91 13 - General Commissioning (Cx) Requirements: Report Forms and Schematics.
.2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.10 OPERATION REQUIREMENTS

.1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 05 - Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The installation of drainage waste and vent piping. Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
- .1 ASTM B32-03, Specification for Solder Metal.
- .2 ASTM B306-02, Specification for Copper Drainage Tube (DWV).
- .3 ASTM C564-03a, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canadian Standards Association (CSA International).
- .1 CSA B67-1972 (R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
- .2 CAN/CSA-B70-02, Cast Iron Soil Pipe, Fittings and Means of Joining.
- .3 CAN/CSA-B125-01, Plumbing Fittings.

1.3 QUALITY ASSURANCE

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

2 Products

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary, storm and vent Type DWV to: ASTM B306.
- .1 Fittings.
  - .1 Cast brass: to CAN/CSA-B125.
  - .2 Wrought copper: to CAN/CSA-B125.
- .2 Solder: 95:5, type TA, to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

.1 Above ground sanitary, storm and vent: to CAN/CSA-B70.
- .1 Joints.
  - .1 Hub and spigot.
    - .1 Caulking lead: to CSA B67.
  - .2 Mechanical joints.
    - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework.

.2 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

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

3.3 PERFORMANCE VERIFICATION

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

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

.3 Storm water drainage:
- .1 Verify domes are secure.
- .2 Ensure weirs are correctly sized and installed correctly.
- .3 Verify provisions for movement of roof system.

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

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 The installation of drainage waste and venting piping - plastic.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
  .1 ASTM D2564-02, Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA International).
  .1 CSA-Series B1800-02, Plastic Nonpressure Pipe Compendium.
  .2 CSA-B181.2-02, PVC Drain, Waste and Vent Pipe and Pipe Fittings.
  .3 CSA-B182.1-02, Plastic Drain and Sewer Pipe and Pipe Fittings.

2 Products

2.1 PIPING AND FITTINGS

.1 For buried and or above ground DWV piping to:
  .1 CSA-B181.1.
  .2 CSA-B181.2.
  .3 CSA-B182.1.

2.2 JOINTS

.1 Solvent weld for PVC: to ASTM D2564.

3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 05 - Installation of Pipework.

.2 Install in accordance with Provincial Plumbing Code and local authority having jurisdiction.

.3 Refer to 23 05 05 Installation of Pipework for fire stopping requirements.

3.2 TESTING

.1 Pressure test buried systems before backfilling.

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

3.3 PERFORMANCE VERIFICATION

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

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

.3 Storm water drainage:
- .1 Verify domes are secure.
- .2 Ensure weirs are correctly sized and installed correctly.
- .3 Verify provisions for movement of roof system.

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

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute/Canadian Standards Association (ANSI/CSA)
- .1 ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
- .2 ANSI Z21.10.1A-2006/CSA 4.1A-2006, Addenda 1 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
- .3 ANSI Z21.10.1b-2006/CSA 4.1b-2006, Addenda 2 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
- .4 ANSI Z21.10.3A-2007/CSA 4.3-2007, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.

.2 Canada Green Building Council (CaGBC)
- .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.
- .2 Rating System Addenda for New Construction and Major Renovations LEED Canada-NC Version 1.0-Addendum 2007.
- .3 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.3 Canadian Standards Association (CSA International)
- .1 CSA B51-03(R2007), Boiler, Pressure Vessel, and Pressure Piping Code.
- .2 CAN/CSA-B139-04, Installation Code for Oil Burning Equipment.
- .3 CAN/CSA-B140.0-03, Oil Burning Equipment: General Requirements.
- .4 CAN/CSA-B149.1-05, Natural Gas and Propane Installation Code.
- .5 CAN/CSA-B149.2-05, Propane Storage and Handling Code.
- .6 CSA B140.12-03, Oil-Burning Equipment: Service Water Heaters for Domestic Hot Water, Space Heating, and Swimming Pools.
- .7 CAN/CSA C22.2 No.110-94(R2004), Construction and Test of Electric Storage Tank Water Heaters.
- .8 CAN/CSA-C191-04, Performance of Electric Storage Tank Water Heaters for Household Service.
- .9 CAN/CSA-C309-M90 (R2003), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

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

.3 Shop Drawings:
- .1 Indicate:
  - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 WARRANTY

.1 For the Work of this Section 22 30 05 - Domestic Water Heaters, 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to number of years specified for each product.

.2 Contractor hereby warrants domestic water heaters in accordance with CCDC2, but for number of years specified for each product.

1.5 ADDITIONAL MATERIAL

.1 Contractor shall provide additional spare water heater(s), as indicated in the equipment schedule. Spare water heater(s) shall be turned over to owner at substantial completion. Spare water heater shall be turned over in original shipping crate, unopened.

2 Products

2.1 TANKLESS UNDER COUNTER ON-DEMAND ELECTRIC WATER HEATER

.1 Unit to be cUL listed.

.2 Tankless on demand under counter Water Heater Unit shall have ABS UL 94 Vo rated or enameled-steel cover

.3 Unit to be complete with flow switch to activate heating and integral flow restrictor to ensure temperature rise.

.4 Heater body and element shall be glass reinforced

.5 Element shall be replaceable cartridge insert.

.6 Unit shall have a replaceable filter in the inlet connector.

.7 Element shall be iron free, nickel-chrome material.

.8 Heater shall be fitted with 3/8" or 1/2" compression nuts and sleeves or 3/4" NPT fittings to eliminate need for soldering.

.9 Maximum operating pressure of 150 psi.

.10 Unit to have high temperature limit switch to protect against element burn out.

.11 Warranty - Heaters shall be designed for durability and guaranteed against failure due to leaks of Heater Body/Element Assembly for a period of 10 years. Field serviceable element with replaceable cartridge element (1 year warranty)

.12 Refer to equipment schedule for capacity and performance.

2.2 WALL HUNG ELECTRIC WATER HEATER

.1 Wall hung electric water heater and integral tank.

.2 Fully Automatic Controls - Fast acting surface-mount thermostat for automatic temperature control. Factory installed sensitive manual reset energy cut-off for safety to prevent overheating.

.3 Direct Heat Transfer With a Single Immersed Element—Screw-in style element copper or incoloy.

.4 Steel Tank - Heavy gauge steel automatically formed, rolled, and welded.

.5 Tank Lining - enamel lined to provide superior tank protection from the highly corrosive effects of hot water. Enamel to be fused to the steel surface by firing at a temperature of over 1600°F (871°C).

.6 Tank to be insulated with 1" Non-CFC Foam Insulation. Insulation to cover the sides and top of tank, reducing the amount of heat loss.

.7 Factory Installed Heavy Duty Wall Mounting Bracket—no additional brackets or modifications required to mount unit.

.8 Water Connections - 3/4" NPT factory installed true dielectric fittings to extend water heater life and ease installation. Located on the bottom for easier installation.

.9 Unit to be complete with protective Magnesium Anode Rod and T&P Relief Valve

.10 Unit to be ETL listed and certified to 300 psi (2068 kPa) test pressure and 150 PSI (10.4 kPa) working pressure.

.11 Warranty- 5-Year Limited Tank Warranties / 1-Year Limited Warranty on Component Parts)

.12 Refer to equipment schedule for capacity and performance.

2.3 UPRIGHT ELECTRIC WATER HEATER

.1 Upright electric water heater and integral tank.

.2 Fully Automatic Controls - Fast acting surface-mount thermostat for automatic temperature control. Factory installed sensitive manual reset energy cut-off for safety to prevent overheating (Maximum setting 160 Deg.F.).

.3 Direct Heat Transfer With a Single Immersed Element - Screw-in style element copper or incoloy.

.4 Steel Tank - Heavy gauge steel automatically formed, rolled, and welded.

.5 Tank Lining - enamel lined to provide superior tank protection from the highly corrosive effects of hot water. Enamel to be fused to the steel surface by firing at a temperature of over 1600°F (871°C).

.6 Tank to be insulated with 2" Non-CFC Foam Insulation. Insulation to cover the sides and top of tank, reducing the amount of heat loss.

.7 Unit to have factory installed cold water inlet sediment reducing device to help prevent sediment build up in tank.

.8 Water Connections - 3/4" NPT factory installed true dielectric fittings to extend water heater life and ease installation.

.9 Unit to be complete with protective Magnesium Anode Rod, T&P Relief Valve and Low Restriction Brass Drain Valve

.10 Unit to be ETL listed and certified to 300 psi (2068 kPa) test pressure and 150 PSI (10.4 kPa) working pressure.

.11 Warranty - 5-Year Limited Tank Warranties / 1-Year Limited Warranty on Component Parts)

.12 Refer to equipment schedule for capacity and performance.

2.4 TRIM AND INSTRUMENTATION

.1 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.

.2 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install in accordance with manufacturer's recommendations.

.2 Provide structural steel for horizontal mounted tanks.

.3 Provide insulation between tank and supports.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.
.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and installation for plumbing specialties and accessories.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).
- .1 ASTM A126-95 (2001), Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
- .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.

.2 Canadian Standards Association (CSA International).
- .1 CSA-B64 Series-01, Backflow Preventers and Vacuum Breakers.
- .2 CSA-B79-94 (R2000), Floor, Area and Shower Drains, and Cleanouts for Residential Construction.
- .3 CSA-B356-00, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .1 Material Safety Data Sheets (MSDS).

.4 Plumbing and Drainage Institute (PDI).
- .1 PDI-G101-96, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
- .2 PDI-WH201-92, Water Hammer Arresters Standard.

1.3 SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
- .2 Indicate dimensions, construction details and materials for specified items.

.3 Shop Drawings:
- .1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions, construction and assembly details and accessories.

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

.5 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

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

.2 Provide materials, equipment and labour to install plumbing as required by Provincial and Local Codes and as specified herein.

.3 Provide water and drainage connections to equipment furnished in other sections of this specification and by the Departmental Representative.

.4 Fittings of same type shall be product of one manufacturer.

2 Products

2.1 FLOOR DRAINS

.1 Floor Drains: to CSA B79.

.2 Provide trap primer tapping on all floor drains where trap primers are required by Code and authority having jurisdiction.

.3 FD-1 – Regular Floor Drain
- .1 Type 1 (General Duty): Epoxy coated cast iron body with double drainage flange, reversible clamping collar with primary and secondary weep holes, combined two piece body and adjustable nickel-bronze strainer. Shower and washroom floor drains shall have a removable perforated sediment bucket.
- .2 Type 2 (Heavy Duty): Epoxy coated cast iron body with double drainage flange, reversible clamping collar with primary and secondary weep holes, combined two piece body and adjustable heavy duty nickel-bronze strainer.
- .3 Type 3 (Combination Funnel Floor Drain): Epoxy coated cast iron body with double drainage flange, reversible clamping collar with primary and secondary weep holes, combined two piece body and adjustable nickel-bronze strainer with integral 102 mm x 229 mm oval nickel bronze funnel.

.4 FD-2 (Security Drain) Floor drain for security areas shall be 75 mm (3") drain with flush mounted tamper proof grille. Grille openings shall have a maximum dimension of 12mm (note that square openings shall be 12mm or less on diagonal dimension of opening). Grille shall be secured with security screws and each screw shall be mounted using Loctite Liquid Thread Locker, Series 262 Mil-Spec S-46163A Type II Grade 0 (no equivalent product).

2.2 TRENCH DRAINS TD-1

.1 Trench Drains: to CSA B79.

.2 Interior Trench Drain: Presloped polyester polymer concrete trench drain with stainless steel edge rail channel system and stainless steel grate. System to be rated for Load Class B to EN 1433.

.3 Material: The trench system bodies shall be manufactured from polyester polymer concrete with minimum properties as follows: Compressive Strength – 14,000 PSI, Flexural Strength – 4,000 PSI, water absorption – 0.07%, frost proof, salt proof

.4 The nominal clear opening shall be 4" (100mm) with overall width of 6.30" (160mm). Pre-cast units shall be manufactured with either an invert slope of 0.5% and have a wall thickness of at least 0.67" (16mm). Each unit will feature a partial radius in the trench bottom and a male to female interconnecting end profile. Units shall have horizontal cast in anchoring keys on the outside wall to ensure maximum mechanical bond to the surrounding bedding material and concrete surface. The stainless steel edge rail will be integrally cast in by the manufacturer to ensure maximum homogeneity between polymer concrete body and edge rail. Each edge rail shall be at least 1/4" (6mm) thick.

.5 Grates and Frame: longitudinal grates manufactured from 16 ga. Grade 304 Stainless steel. Frame to be anchored into concrete with 0.25" x 3" long anchors no more than 17" on center to ensure entire load is carried to floor and not to polymer drain. After removal of grates there shall be uninterrupted access to the trench to aid maintenance. Grates shall be secured with a locking mechanism utilizing multiple locking points per grate.

.6 Basis of Design is ACO KlassikDrain – KS100

2.3 CLEANOUTS

.1 Cleanout: Adjustable floor cleanout with lacquered cast iron body and anchor flange, secondary O ring test seal, 4" diameter cleanout opening and combined scoriated satin finished nickel bronze cover and plug top assembly with stainless steel vandal-proof allan key screws and primary gasket seal. Provide membrane clamp for all membrane floors. Specification based on Mifab Model C1100.

.2 Access Covers:
- .1 Wall Access: face or wall type, polished nickel bronze with chrome plated cap, round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
- .2 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top and:
  - .1 Plugs: bolted bronze with neoprene gasket.
  - .2 Cover for Unfinished Concrete Floors: round, nickel bronze, gasket, vandal-proof screws.
  - .3 Cover for Terrazzo Finish: Polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.
  - .4 Cover for Tile and Linoleum Floors: polished nickle bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.
  - .5 Cover for Carpeted Floors; polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal–proof locking screws.
- .3 Provide bolted cover plates on all vertical rainwater leaders.

2.4 WATER HAMMER ARRESTORS

.1 Stainless steel bellow type or copper piston type to PDIWH201.

.2 Air chamber same size as supply line or 19 mm minimum, and minimum 450 mm long.

2.5 EXTERIOR RECESSED HOSE BIBBS AND SEDIMENT FAUCETS (HB-1)

.1 A.S.S.E. 1019-B certified encased key operated non-freeze self-draining wall hydrant with A.S.S.E. 1011 approved anti-siphon and vandal resistant integral vacuum breaker and 19 mm diameter male hose connection. Length to suit wall thickness. Hydrant assembly complete with neoprene plunger to control both the flow and drain functions, hardened bronze operating stem, drain port under the hexagon nut, heavy duty brass casing, 360 degree swivel inlet connection, heavy duty chrome plated bronze head casting, polished chrome plated face plate and satin finished nickel bronze box with hinged locking cover with cylinder key lock. Operating key to be furnished with each hydrant.

.2 Specification based on Mifab Model MHY-20.

2.6 INTERIOR HOSE BIBBS AND SEDIMENT FAUCETS (HB-2)

.1 Cast brass anti-contamination faucet; exposed type, mild climate, anti-contamination wall faucet with 19 mm male hose connection and anti-siphon vacuum breaker. Exterior finish to be polished chrome plated, operating handle to be cast iron wheel handle, and inlet connection to be 19 mm F.P.T. unless specifically noted as 12 mm on drawings. Vacuum breaker to be certified to the ASSE Standard 1011 and listed by IAPMO.

.2 Specification based on Mifab Model MHY-90.

2.7 EXTERIOR HOSE BIBBS AND SEDIMENT FAUCETS (HB-3)

.1 Encased self draining. moderate climate narrow wall hydrant with A.S.S.E. 1011 certified anti-siphon vandal resistant vacuum breaker. Unit to be complete with cylinder key lock. Casing to be stainless steel. Assembly to have 90 degree water supply connection.

.2 Specification based on Mifab Model MHY-55.

2.8 EXTERIOR HOSE BIBBS AND SEDIMENT FAUCETS (HB-4)

.1 Exterior non-freeze wall hydrant complete with stainless steel surface mounted lockable service box.

.2 Hydrant: A.S.S.E. 1019-B certified exposed type, self draining, non freeze wall hydrant with A.S.S.E. 1011 approved anti-siphon and vandal resistant integral vacuum breaker with 3/4" (19) male hose connection. Hydrant assembly complete with neoprene plunger to control both the flow and drain functions, hardened bronze operating stem, drain port under the hexagon nut, heavy duty brass casing, 360 degree swivel inlet connection, heavy duty chrome plated bronze head casting and polished chrome plated face plate. Operating key to be furnished with each hydrant.

.3 Service Box: Provide and install surface mounted lockable service box over hydrant. Box to be fabricated from 18 gage, type 304 stainless steel with full length piano hinged door. Door to be key lock operated. All exposed stainless steel surfaces including interior shall be polished to a satin finish. Box size to suit hydrant utilized.

.4 Specification based on Hydrant: Mifab Model MHY-10, Service Box: Custom

2.9 TRAP SEAL PRIMERS (Electronic)

.1 Group Trap Seal Primer:
- .1 MIFAB Series MI-100-10 (6-10 outlet ports) enclosed electronic trap seal primer system with timer, ½" F.I.P. plastic ball valve, lead free bronze vacuum breaker, 1/2" solenoid valve and plastic Manifold with distribution ports. Electrical components to include single point power connection at 120VAC, manual override switch, minimum 5 amp breaker, 24 hour timer with relay and adjustable delay. All components to be factory assembled and installed into a 16 gauge satin coated steel box for recessed (standard) or surface mounted installation as indicated on drawings. The entire assembly is tested and certified to the ASSE 1044 Standard. 100 p.s.i. operating pressure.
- .2 Specification based on Mifab Model MI 100.

.2 Air Gap Fitting:
- .1 Copper air gap fitting complete with a 12 mm male NPT fitting at the inlet supply incorporating a stream directing nozzle, a 12 mm NPT female outlet, and a ANSI/ASME A112.1.2 air gap in plumbing systems standard.
- .2 Specification based on Mifab Model MI-GAP.

2.10 VACUUM BREAKERS

.1 Breakers: To CSA-B64 Series.

2.11 STRAINERS

.1 Size 50 mm and under: Screwed brass, Y pattern with 0.7 mm stainless steel perforated screen.

.2 Size 63 mm to 100 mm: Flanged iron body with bolted cap, Y pattern with 1.2 mm stainless steel perforated screen.

.3 Size 127 mm and larger: Flanged iron body, basket pattern with 3 mm stainless steel perforated screen.

.4 Screen free area shall be minimum three times area of inlet pipe. Provide valved drain and hose connection off strainer bottom.

2.12 EYE WASH EW-1

.1 Eyewash: wall mounted recessed swing down eye/face wash with drain pan shall include stainless steel cabinet for recess mounting in finished wall. Unit shall include all welded 16 gauge type 304 stainless steel construction, chrome plated brass eye/face wash supply fittings, ½" IPS brass rotating plug-type valve with Teflon coated O-ring seals. Supplied with in-line strainer to prevent debris from affecting the valve, and 2" IPS drain. Unit shall have (2) polypropylene 'FS Plus' spray heads with integral filters and 3.2 GPM flow control orifices. Activate valve by rotating 90 degree from stored position. Unit shall include ANSI compliant sign. Unit shall be fully factory assembled and hydrostatically tested to meet or exceed ANSI Z358.1 - 2009, and come with a full 2 year warranty.

.2 Tempering System: prepackaged, fully engineered and tested system that mixes hot and cold water to supply tempered water to eyewash fixtures requiring flow up to 5 gpm. System consists of a thermostatic mixing valve, a high temperature limit valve, a bypass valve, and an outlet temperature gauge. Unit is constructed of bronze, brass, copper and stainless steel. Maximum inlet pressure: 125 psi. Maximum inlet temperature: 180 deg.F (82 deg.C). Recommended inlet temperature: 140 deg.F (60 deg.C). Pressure requirements: 50 psi to adequately supply water for eye/face wash. Inlet and Outlet: 1/2" IPS. Dielectric outlet union provided.

.3 Provide check valves on hot and cold supply risers.

.4 Design based on: Eyewash Guardian GBF1735DB, Tempering System Guardian TMV.

2.13 HOSE REEL HR-1

.1 Spring retractable hose reel, all steel construction with baked-on powder coat finish. Hose reel to have the following features:
- .1 Hose anti latch-out feature ensures hose retracts every time.
- .2 Guide arm is field adjustable for wall or ceiling mounting positions.
- .3 Dual pedestal base and guide arm design are structurally reinforced.
- .4 Five-in-one, heat-treated aluminium casting incorporates main shaft, ratchet, spring arbor and inlet/outlet plumbing in one-piece casting.
- .5 Containerized spring assembly to provide safe and easy handling during maintenance.
- .6 Two sealed ball bearings for smooth rotation of main shaft.

.2 Unit to be complete with 23m (75ft) of 19mm (3/4") I.D. low pressure PVC hose rated to 65 Deg.C (150 Deg.F) at 17 Bar (250 PSI).

.3 Wall-Mounted Swing Bracket: Provide bracket matched to hose reel that shall pivot approximately 180°. All steel construction with a durable baked on powder coat finish.

.4 Unit to be complete with 19mm (3/4") flexible inlet hose assembly to connect from hosebibb to reel inlet. Length to match site requirements, assumed to be 0.91m (3').

.5 Unit to be complete with all required mounting accessories.

.6 Specification is based on ReelCraft Series 8000, Model D83075 OLP reel with hose, 601034-3 inlet hose, 600980 swing bracket.

2.14 LAUNDRY SERVICE BOX (Fire Rated LB-1)

.1 Fire Rated double outlet washing machine outlet box complete with ¼ turn brass ball valves with copper seat connections and 50mm PVC drain opening. Fire rating to meet or exceed fire rating on Architectural wall detail.

.2 Box to be bulk molded compound of thermoset fire-rated plastic.

.3 Unit to be complete with drain piece sleeve of galvanized steel with integrated intumescent pad.

.4 Unit to be complete with bulk molded compound thermoset fire-rated plastic plugs.

.5 Unit to be complete with PVC test cap.

.6 Unit to be complete with box fire rated pad, UL classified FyreWrap Insulation Material

.7 Unit to have adjustable mounting bracket to secure into stud wall.

.8 Unit to be complete with snap-on faceplate that accommodates up to two-layers of 5/8" drywall.

.9 Specification based on Oatey Fire Rated.

2.15 LAUNDRY SERVICE BOX (Standard LB-2)

.1 Double outlet reversible drain washing machine outlet box complete with ¼ turn brass ball valves with copper seat connections and 50mm PVC drain opening.

.2 Box made of 20 gauge steel with two support brackets.

.3 Faceplate made of 18 gauge steel

.4 Specification based on Oatey Metal.

2.16 EXPANSION TANKS

.1 Construction: Welded steel with heavy duty butyl air/water interface, tank style to match equipment schedule. Tank shall be cleaned, prime coated, and supplied with steel support saddles; with tappings for installation of accessories.
- .1 Pressure rating: 860 kPa.
- .2 Size: As noted on equipment schedule.

.2 Tank shall be tested and stamped to ASME SEC 8-D.

.3 Quick Connect Air Inlet:
.1 Expansion Tank: Inlet tire check valve, manual air vent, tank drain, and pressure relief valve.

.4 Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow preventer, test cocks, strainer, vacuum breaker, and valved bypass.

.5 Hot Water Heating System:
.1 Select expansion tank pressure relief valve to match heater.
.2 Set pressure reducing valve at select 35 kPa.

.6 Precharge air side to 84 kPa (12 PSI) initial fill pressure of system.

2.17 AUTOMATIC FLOW RESTRICTOR

.1 Automatic flow control valve complete with isolation and strainer, sized for design flow rate

.2 Construction: Forged or cast brass or bronze body with union on inlet, temperature and pressure test ports on inlet and outlet. To be rated for potable applications.

.3 Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 13.7 kPa.

.4 Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

.5 In-line strainer with 20 mesh stainless steel filter screen and drain valve.

.6 Isolation Valve: Ball valve with Teflon seats, refer to valve specifications.

2.18 SOLIDS INTERCEPTOR TANK (IT-1)

.1 Interceptor shall be lifetime guaranteed and made of seamless, rotationally-molded High Density Polyethylene with minimum 3/8" uniform wall thickness furnished for above grade installation.

.2 Interceptor shall be furnished with filter basket and connection for extending handle for access from floor above. Filter basket to utilize fine filter with openings 0.03” x 0.025”.

.3 Cover shall provide water/gas-tight seal and have a minimum 2,000 lbs load capacity.

.4 Refer to drawings for tank connection sizes, connections to match pipe size.

.5 Maximum unit weight – 90 lbs

.6 Unit shall be “floor” mounted on steel plate with plate suspended from structure in crawlspace. Contractor to provide plate and supports, which shall be rated for 2000 lbs.

.7 Unit to be complete with teleguide field adjustable service access risers as required to permit service access from floor above. Coordinate service access, access extensions and mounting height.

.8 Internal components to be removable for service/maintenance.

.9 Basis of Design: Schier Prospector™ solids interceptor model PS-35-B

2.19 OIL AND SAND INTERCEPTOR TANK (IT-2)

.1 Interceptor shall be lifetime guaranteed and made of seamless, rotationally-molded High Density Polyethylene with minimum 3/8" uniform wall thickness furnished for above grade installation.

.2 Unit to be furnished with internal inlet and outlet diffusers. The inlet diffuser shall split incoming effluent into two paths that utilize the entire liquid volume of the tank for efficient oil separation. Diffuser to be complete with calibrated openings that greatly reduce effluent turbulence such that effluent enters the main chamber without disturbing the existing oil or sediment layers. The outlet diffuser shall be designed such that the intake only allows effluent to exit free of oil.

.3 Tank to have built-in flow control set to 35 gpm and vent connections

.4 Cover shall provide water/gas-tight seal and have a minimum 2,000 lbs load capacity.

.5 Refer to drawings for tank connection sizes, connections to match pipe size.

.6 Maximum unit weight – 80 lbs

.7 Unit shall be "floor" mounted on steel plate with plate suspended from structure in crawl space. Contractor to provide plate and supports, which shall be rated for 2000 lbs.

.8 Unit to be complete with teleguide field adjustable service access risers as required to permit service access from floor above. Coordinate service access, access extensions and mounting height.

.9 Internal components to be removable for service/maintenance.

.10 Basis of Design: Schier oil/sand separator model # OS-35

2.20 SOIL GAS MAT

.1 Soil gas collector system comprised of soil gas mat collector and matched riser. Soil gas mat to be installed on ground below fill material and crawlspace membrane.

.2 Soil Gas Collector Core: A polystyrene core with a compressive strength of 4300 PSF in accordance with ASTM D-1621 (Modified). Core to be a double sided waffle like geometry ¾" x 5/8".

.3 Soil Gas Collector Fabric:
Weight – 4 in accordance with ASTM D-1910,
Tensile Strength – 145 in accordance with ASTM D-1682
Elongation at break (96) – 115 in accordance with ASTM D-1682-64
Mullen burst strength (PSD) - 170 in accordance with ASTM D-75 1
Puncture strength – 5 in accordance with ASTM D-75 1
A.O.S.(Equivalent sieve) - 70/100 in accordance with COE CW-02215
Modulas at 10% elongation (Lbs) - 785 in accordance with ASTM D-1682
Trap tears (Lbs) - 75 in accordance with ASTM D-2263
Coefficient of permeability (Cm/sec) - 0.03 in accordance with ASTM D-737
Permittivity (Sec-1) - .8 in accordance with ASTM D4491-85
Accelerated weathering strength (Fed) - 80 in accordance with STD #191-5804

.4 Soil Gas Collector Binding to be sewn with nylon thread.

.5 Basis of Design: Professional Discount Supply Soil Gas Collector™

2.21 BACK FLOW PREVENTERS

.1 Reduced Pressure Back flow Preventers: Bronze body with bronze and plastic parts and stainless steel springs; two independent spring loaded check valves; diaphragm type differential pressure relief valve; check valve for diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks; Back siphonage protection shall include provision to admit air directly into the reduced pressure zone via a separate channel from the water discharge channel, or directly into the supply pipe via a separate vent. Refer to equipment schedule for size.

.2 Double Check Valve Assemblies: Bronze body with stainless steel springs; two independent check valves with intermediate atmospheric vent, tight closing resilient seated shut-off valves, and test cocks. Each check module shall have a captured spring and be accessible through a bolted cover plate. Seats shall be replaceable without special tools. Refer to equipment schedule for size.

.3 Quality Assurance:
- .1 Reduced pressure backflow preventers shall meet the requirements of ASSE Std. 1013; AWWA Std. C-511-92; and CSA B64.4.
- .2 Double Check Valve assemblies shall meet the requirements of ASSE No. 1015; AWWA C510-92; CSA B64.5 and UL Classified File No. EX3185.

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 INSTALLATION

.1 Install in accordance with Provincial Codes, and local authority having jurisdiction.

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

3.3 CLEANOUTS

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

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

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

.4 Lubricate cleanout plugs with mixture of graphite and linseed oil. Prior to building turnover remove cleanout plugs, relubricate and reinstall using only enough force to ensure permanent leak proof joint.

3.4 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures as required to eliminate water hammer.

3.5 HOSE BIBBS AND SEDIMENT FAUCETS

.1 Install at bottom of risers, at low points to drain systems, and as indicated.

.2 Install complete with isolation valve upstream of hose bibbs.

3.6 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as required by Code and/or where indicated on drawings. Trap primers shall be electronic.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.

.3 Install plastic PEX tubing to floor drain.

3.7 STRAINERS

.1 Install with sufficient room to remove basket.

3.8 VACUUM BREAKERS

.1 Install vacuum breakers on plumbing lines where contamination of domestic water may occur; generally make-up lines, hose bibbs, and flush valves.

3.9 HOSE REEL

.1 Install hose reel on wall bracket to permit reel to be placed against wall with hose end facing door.

.2 Connect to hose bibb with flexible inlet hose supplied with reel. Ensure hose bibb location is suitable for length of hose purchased.

3.10 START-UP

.1 Timing: Start-up only after:
- .1 Pressure tests have been completed.
- .2 Disinfection procedures have been completed.
- .3 Certificate of static completion has been issued.
- .4 Water treatment systems operational.

.2 Provide continuous supervision during start-up.

3.11 EXPANSION TANKS

.1 Support tanks inside building from building structure.

.2 Refer to equipment schedule and drawings for size and configuration.

.3 Adjust expansion tank pressure to suit actual site conditions.

.4 Install lockshield type valve at inlet to tank.

3.12 AUTOMATIC FLOW RESTRICTOR

.1 Install automatic flow control valve complete with additional isolation valve to permit servicing of valve without draining system.

3.13 TESTING AND ADJUSTING

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

.2 Application tolerances:
- .1 Pressure at fixtures: within tolerance allowable by manufacturer.
- .2 Flow rate at fixtures: +/- 10%.

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

.4 Floor drains:
- .1 Verify operation of trap seal primer.
- .2 Prime, using trap primer. Adjust flow rate and timer to suit site conditions.
- .3 Check operations of flushing features.
- .4 Check security, accessibility, removeability of strainer.
- .5 Clean out baskets.

.5 Vacuum breakers, backflow preventers, backwater valves:
- .1 Test tightness, accessibility for O&M of cover and of valve.
- .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
- .3 Verify visibility of discharge from open ports.

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

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

.8 Water hammer arrestors:
- .1 Verify proper installation of correct type of water hammer arrester.

.9 Strainers:
- .1 Clean out repeatedly until clear.
- .2 Verify accessibility of cleanout plug and basket.
- .3 Verify that cleanout plug does not leak.

.10 Hose bibbs, sediment faucets:
- .1 Verify operation of vacuum breakers.

.11 Training:
- .1 In accordance with Section 21 05 01 Common Work Results - Mechanical, Training of Operation and Maintenance Personnel, supplemented as specified.
- .2 Demonstrate full compliance with Design Criteria.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The supply and installation of Plumbing Fixtures and Trim.

.2 Products Installed but not Supplied Under this Section:
- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
- .2 CAN/CSA-B125-01, Plumbing Fittings.
- .3 CAN/CSA-B651-95 (R2001), Barrier-Free Design.

1.3 SUBMITTALS

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

.2 Closeout Submittals:
- .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity, material, water consumption and details of all items noted under specification..
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

1.4 GENERAL REQUIREMENTS

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be product of one manufacturer. Fittings of same type shall be product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

1.5 JOB CONDITIONS

.1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 WATER CLOSET WC-1 (Accessible/Standard Detachment Water Closet)

.1 Handicapped close coupled floor mounted 300 mm rough-in, tank style with 4.8 LPF (1.1 GPF) siphon jet flushing action. Water closet to be capable of flushing 1000 grams of waste under bulk waste removal protocols conducted by a CSA certified laboratory. Water closet to be complete with 5 year limited warranty.

.2 Bowl/Tank: 419 mm (16-1/2") high, white, vitreous china, elongated bowl, oversized flush valve, 54 mm (2-1/4") fully glazed trapway, siphon jet, 2 bolt caps, insulated tank complete with fittings and bolt down lid on tank.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Seat: White, elongated, open front, moulded plastic seat with cover and self-sustaining stainless steel hinges and stainless steel insert post.

.5 Design based on the following: Bowl/Tank - American Standard Cadet 3 FloWise Right Height Elongated, Seat - Bemis 1950SS, Supplies – Delta 47T2312SD

2.3 WATER CLOSET WC-2 (Housing Water Closet)

.1 Handicapped close coupled floor mounted 300 mm rough-in, tank style with 4.8 LPF (1.1 GPF) siphon jet flushing action. Water closet to be capable of flushing 1000 grams of waste under bulk waste removal protocols conducted by a CSA certified laboratory. Water closet to be complete with 5 year limited warranty.

.2 Bowl/Tank: 419 mm (16-1/2") high, white, vitreous china, elongated bowl, oversized flush valve, 54 mm (2-1/4") fully glazed trapway, siphon jet, 2 bolt caps, insulated tank complete with fittings and bolt down lid on tank.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Seat: White, elongated, closed front, moulded plastic seat with cover and self-sustaining stainless steel hinges and stainless steel insert post.

.5 Design based on the following: Bowl/Tank - American Standard Cadet 3 FloWise Right Height Elongated, Seat - Bemis 1900SS, Supplies – Delta 47T2312SD

2.4 WATER CLOSET WC-3 (Lavatory toilet combination for Secure Facility)

.1 Provide and install 450 mm (18") wide Lav/Toilet Suicide Resistant Comby. Contractor to confirm angled left, central or angled right units based on plans. Provide hemispherical cabinet design to reduce the risk of fixture being used as a suicide device. Fixture shall be fabricated from 14 gauge, type 304 stainless steel. Constructions hall be seamless welded exposed surfaces shall have a satin finish. Provide D shaped lavatory bowl.

.2 Fixture shall have air controlled pneumatically operated, push button valves. Valves shall require less than 2.3 kg to activate. Valves to comply with NSF 61, section 9-1997 lead free requirements.

.3 Provide BPH hemispherical penal bubbler and hemispherical penal pushbuttons. Provide toilet bowl housing to prohibit the attachment of objects. Toilet shall be concealed blowout jet type with an elongated bowl, self-draining flushing rim, and an integral contoured seat with a sanitary high polish finish.

.4 Toilet trap shall pass a 66 mm (2-5/8") diameter ball and shall be fully enclosed. Toilet shall conform to ANSI 112.19.2M. Cabinet interior shall be sound deadened with fire resistant material. Fixture shall withstand loading of 1360 kg without permanent damage. Fixture shall be furnished with necessary fasteners for proper installation.

.5 Fixture shall be furnished with necessary fasteners for proper installation. The following options shall be provided with the units: Pinned cleanout plug, rear outlet P-trap, wall sleeve (Contractor to confirm wall depth) and 75 mm (3") waste outlet. Acceptable product: Acorn Penal-Ware 144-2-BPH-4-FV (1.6)-PC-PT-SW-W03 or Willoughby Model ECW-18060R/L-MOD.

.6 Provide a hot water tempering valve on the hot water supply line to the lavatory. Acceptable product: Symmons Model 4-10B. Note: unit shall be stamped with the manufacturer's model number on the face of the unit. Fixture to be installed with epoxy sealant between all flush mounted surfaces and the walls and/or floor.

2.5 LAVATORY L-1 (Accessible Wall hung Lavatory)

.1 Bowl: ADA compliant wall hung stainless steel lavatory, 600 mm x 480 mm with 540mm x 340mm x 150mm deep basin, 19 Ga type 304 stainless steel with seamless welded bowl, 100mm center set, with overflow and faucet ledge. Exposed surfaces are #4 Satin Finish

.2 Trim: ADA compliant chrome plated single lever manual faucet, 0.5 GPM/1.9 LPM vandal proof spray head, 100mm centerset, cast brass lead free waterway, ceramic drip-free disc valve cartridge, 89 mm lever.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Tailpiece and Trap: offset grid drain assembly with open grid stainless steel strainer. Chrome plated cast brass adjustable P-trap complete with cleanout, plug with chain and escutcheon.

.5 Insulate trap and supplies with Truebro Lavguard accessibility approved pipe insulation assembly complete with PVC jackets for supplies tailpiece and trap assembly, white.

.6 Design is based on the following: Bowl – Franke WT600C-8, Trim – Delta 22C151, Carrier: Zurn - Z1231, Supplies - Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.6 LAVATORY L-2 (Standard Wall hung Lavatory)

.1 Bowl: ADA compliant wall hung stainless steel lavatory, 600 mm x 480 mm with 540mm x 340mm x 150mm deep basin, 19 Ga type 304 stainless steel with seamless welded bowl, 100mm center set, with overflow and faucet ledge. Exposed surfaces are #4 Satin Finish

.2 Trim: ADA compliant chrome plated single lever manual faucet, 0.5 GPM/1.9 LPM vandal proof spray head, 100mm centerset, cast brass lead free waterway, ceramic drip-free disc valve cartridge, 89 mm lever.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Tailpiece and Trap: grid drain assembly with open grid stainless steel strainer. Chrome plated cast brass adjustable P-trap complete with cleanout, plug with chain and escutcheon.

.5 Design is based on the following: Bowl – Franke WT600C-8, Trim – Delta 22C151,, Carrier: Zurn - Z1231, Supplies - Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.7 LAVATORY L-3 (Counter Top Manual)

.1 Bowl: ADA compliant self-rimming countertop lavatory, 533 mm x 457 mm, 18 ga. type 304 stainless steel, mirror finish rim with #4 stain finish basin, hole drilling to match trim, back overflow with faucet ledge. Basin to be undercoated to reduce condensation.

.2 Trim: ADA compliant chrome plated single lever manual faucet, 0.5 GPM/1.9 LPM vandal proof spray head, 100mm centerset, cast brass lead free waterway, ceramic drip-free disc valve cartridge, 89 mm lever.

.3 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.4 Tailpiece and Trap: open grid drain assembly with open grid strainer. Chrome plated cast brass adjustable P-trap complete with cleanout, and escutcheon.

.5 Provide anti-scald temperature mixing controls: pressure independent thermostatic mixing valve complete with integral check valves, service isolation valves, and vandal resistant temperature setting adjustments.

.6 Design based on the following: Bowl – Franke OV1812/6, Trim – Delta 22C151, Supplies – Delta 47T2312SD, Tailpiece – Delta 33T290-1, Trap - Delta 33T311.

2.8 URINAL UR-1

.1 Wall hung siphon jet flush valve urinal 1.9 LPF (0.5 GPF). Urinal to be complete with 5 year limited warranty.

.2 Bowl: Vitreous china, top spud siphon-jet action with integral fully glazed trapway. Bowl to have anti-microbial surface equivalent to a double coated mirror finish. Nominal Dimensions: 356 mm (14") wide x 356 mm projection x 546 mm (21-1/2") high.

.3 Flush Valve: 1.9 litre exposed chrome plated automatic hard wire operated diaphragm style flush valve with recessed wall mounted infrared sensor, sensor range adjustment, true mechanical override button, dual filtered bypass, high back pressure vacuum breaker, adjustable tailpiece, bak-chek angle stop with vandal resistant cap and cast wall flange with setscrew. Provide 102mm square electrical box for mounting sensor plate and box mount hard wired transformer to convert 120V / 1 phase to 24 VA 50 A.

.4 Carrier, epoxy coated with heavy gauge steel uprights with welded feet supports and with top and bottom universal steel hanger plates with plated hardware, heavy gauge epoxy coated steel offset uprights, plated hardware. Each carrier to support one unit. Carrier to be suitable for installation in 102 mm (4") finished metal stud wall.

.5 Design based on the following: Bowl/Valve - Sloan WEUS-1005.1401-0.5 G2, Carrier – Watts CA-321.

3. Execution

3.1 INSTALLATION

.1 Install each fixture that is to be operational with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

.2 Provide chrome plated rigid or stainless steel flexible supplies to fixtures that are to be operational complete with screwdriver stops, reducers and escutcheons.

.3 Install wall mounted lavatories, urinals and water closets with approved wall carriers, model to suit installation.

.4 Mounting heights:
- .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified by architect.
- .2 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

.5 Install hose and faucets and hose connections with vacuum breakers.

3.2 PLUMBING FIXTURE ROUGH-IN SCHEDULE

.1 Rough-in fixture piping connections in accordance with the following table of minimum sizes or as required for particular fixtures:

	Hot Water	Cold Water	Waste	Vent
Lavatories	12 mm (½") (½")	12 mm (1-1/2")	38 mm (1-1/4")	32 mm
Water Closet (flush valve)	-----	32 mm (1-1/4")	75 mm (3")	51 mm (2")
Water Closet (tank)	-----	12 mm (1/2")	75 mm (3")	51 mm (2")
Urinals (flush valve)	-----	19 mm (3/4")	51 mm (2")	38 mm (1-1/2")
Hose Bibbs	19 mm (3/4")	19 mm (3/4")	-----	-----

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:
- .1 Adjust water flow rate to design flow rates.
- .2
- .3 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:
- .1 Aerators or Laminar Flow Control: operation, cleanliness.
- .2 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:
- .1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The supply and installation of Plumbing Fixtures and Trim.

.2 Products Installed but not Supplied Under this Section:
- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
- .2 CAN/CSA-B125-01, Plumbing Fittings.
- .3 CAN/CSA-B651-95 (R2001), Barrier-Free Design.

1.3 SUBMITTALS

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

.2 Closeout Submittals:
- .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity, material, water consumption and details of all items noted under specification.
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

1.4 GENERAL REQUIREMENTS

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be product of one manufacturer. Fittings of same type shall be product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

1.5 JOB CONDITIONS

.1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 SINK SK-1 (Single Compartment)

.1 Bowl: single compartment, 18-10 stainless steel, 18 gauge, self-rimming sink 520 mm x 510 mm x 250 mm, complete with 89 mm removable drain assembly and 89 mm crumb cup strainer.

.2 Trim: heavy duty cast brass 200mm (8") center two handle sink faucet complete with 150mm (6") radius vandal resistant spout with 5.7 L/minute vandal resistant laminar flow control and limited swing. Handles to be 152mm (6") wrist blade handles.

.3 Trap: cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Design based on the following: Bowl - Franke LBS6810P-1, Trim - Delta 26C3925-LS, Supplies – Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.3 SINK SK-2 (Exhibit Sink)

.1 Bowl: Type 304, 18-10 stainless steel, 16 gauge, 690 mm x 700 mm floor mounted single compartment sink with 225 mm backsplash and 610 mm x 610 mm x 360 mm deep basin with 89 mm (3-1/2") crumb cup waste assembly. Unit to have stainless steel tubular legs with adjustable feet.

.2 Trim: 203 mm two handle wall mount centerset complete with 150 mm radius, 264 mm high vandal resistant gooseneck swivel spout with 5.7 LPM (1.5 GPM) antimicrobial laminar flow control. ADA compliant 102 mm wrist blade handles. Unit to have integral check stops.

.3 Trap: Cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Provide check valves on hot and cold supply risers.

.6 Design based on: Bowl - Kindred Model SL2424-1, Trim - Delta 28T6924, Supplies - Delta Model 47T2512SD.

2.4 SINK SK-3 (Breath Testing)

.1 Bowl: single compartment, 18-10 stainless steel, 18 gauge, self-rimming sink 520 mm x 510 mm x 250 mm, complete with 89 mm removable drain assembly and 89 mm crumb cup strainer.

.2 Trim: Polished chrome-plated cast brass faucet body with integral shanks, quarter turn ceramic disc cartridges and a 6-1/4" [159mm] centerline swing double bend spout. Unit is furnished with a 1.0 GPM [3.8 L] pressure compensating vandal resistant laminar flow control in base of spout (complying with ANSI A112.18.1 Standard for flow), 2-1/2" [64mm] vandal-resistant color coded metal lever handles, mounting hardware and 1/2" NPSM coupling nuts for standard lavatory risers.

.3 Trap: cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Design based on the following: Bowl - Franke LBS6810P-1, Trim – Zurn Z812Y1 with G67694-FC-22F spout, Supplies – Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.5 SINK SK-4 (Secure Kitchenette)

.1 Bowl: single compartment, 18-10 stainless steel, 18 gauge, self-rimming sink 520 mm x 510 mm x 250 mm, complete with 89 mm removable drain assembly and 89 mm crumb cup strainer.

.2 Trim: heavy duty cast brass 200mm (8") center two handle sink faucet complete with 150mm (6") radius vandal resistant spout with 5.7 L/minute vandal resistant laminar flow control and limited swing. Handles to be 152mm (6") wrist blade handles.

.3 Trap: cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, screwdriver stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Design based on the following: Bowl - Franke LBS6810P-1, Trim - Delta 26C3925-LS, Supplies – Delta 47T2312SD, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.6 SINK SK-5 (Double Compartment)

.1 Bowl: double compartment, type 302 18-8 stainless steel, 20 gauge, self-rimming sink 560x840 overall dimensions with 430 mm x 380 mm x 200 mm depth, complete with 89 mm removable drain assembly and 89 mm crumb cup strainer.

.2 Trim: heavy duty cast brass 200mm (8") center two handle sink faucet complete with 200mm (8") wallform swing spout with 5.7 L/minute standard aerator. Handles to be 102mm (4") blade handles.

.3 Trap: cast brass adjustable swivel pattern P-trap with cleanout.

.4 Supplies and Riser Tubes: chrome plated angle supplies with lockshield stem, oval handle stop, 9.5 mm O.D. x 305 mm long flexible braided stainless steel riser and stainless steel escutcheon plate.

.5 Design based on the following: Bowl - Franke LBD7508P-1, Trim - Delta 26C3234, Supplies – Delta 47T2512, Tailpiece - Delta 33T290-1, Trap - Delta 33T311.

2.7 MOP SINK MS-1 (Floor Mount Mop Sink)

.1 Bowl: 610 mm x 610 mm x 254 mm deep white moulded stone, floor mounted sink with 24 mm wide shoulders, SS strainer, complete with 76 mm brass drain assembly.

.2 Trim: Exposed wall type supply with cross handles, spout adjustable wall brace, vacuum breaker, pail hook and 3/4" hose thread on spout. Unit to be complete with hose and hose bracket, strainers, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges. Provide 760 mm of 12 mm diameter plain end reinforced hose, hose clamp and mop hanger. Provide stainless steel bumper guards.

.3 Provide and install check valves on hot and cold supply risers.

.4 Design is based on the following: Bowl - Fiat MSB2424, Spout: Fiat 830-AA, Hose and Bracket - Fiat 832AA, Mop Hangar - Fiat 889-CC, Bumper Guards - Fiat E-88-AA.

3 Execution

3.1 INSTALLATION

.1 Install each fixture that is to be operational with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

.2 Provide chrome plated rigid or stainless steel flexible supplies to fixtures that are to be operational complete with screwdriver stops, reducers and escutcheons.

.3 Install wall mounted lavatories, urinals and water closets with approved wall carriers, model to suit installation.

.4 Mount fixtures above finished floor as noted on Architectural drawings.

.5 Install hose and faucets and hose connections with vacuum breakers.

.6 Mounting heights:
- .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified by architect.
- .2 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

3.2 PLUMBING FIXTURE ROUGH-IN SCHEDULE

.1 Rough-in fixture piping connections in accordance with the following table of minimum sizes or as required for particular fixtures:

	Hot Water	Cold Water	Waste	Vent
Sink	12 mm (½")	12 mm (½")	38 mm (1-1/2")	32 mm (1-1/4")
Mop Sink	19 mm (3/4")	19 mm (3/4")	50 mm (2")	38 mm (1-1/2")

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:
- .1 Adjust water flow rate to design flow rates.
- .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:
- .1 Aerators or laminar flow control: operation, cleanliness.
- .2 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:
- .1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 The supply and installation of Plumbing Fixtures and Trim.

.2 Products Installed but not Supplied Under this Section:
- .1 Install rough-in for equipment supplied by others, complete with valves on hot and cold water supplies, waste and vent.
- .2 Equipment installed by others.
  - .1 Connect with unions.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
- .1 CAN/CSA-B45 Series-02, Plumbing Fixtures.
- .2 CAN/CSA-B125-01, Plumbing Fittings.
- .3 CAN/CSA-B651-95 (R2001), Barrier-Free Design.

1.3 SUBMITTALS

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

.2 Closeout Submittals:
- .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity, material, water consumption and details of all items noted under specification..
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

1.4 GENERAL REQUIREMENTS

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be product of one manufacturer. Fittings of same type shall be product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

1.5 JOB CONDITIONS

.1 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

2 Products

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

2.2 SHOWER SH-1 (Standard Shower)

.1 Cabinet: Acrylic finish reinforced fibreglass shower, one piece seamless unit with smooth rounded corners, integrated shelves and without cap. Complete with centre drain and textured floor. Shower shall not exceed 1065 mm (41-7/8") x 890 mm (35") and a height of 1830mm (72"). Colour - White.

.2 Trim: Concealed in-wall single lever pressure balancing mixing valve control, polished chrome plated metal trim, integral stops and checks, and vandal resistant metal lever handle; combination integral diverter and adjustable stop screw to limit handle turn. Wall-mounted shower head with arm and flange, and polished chrome plated finish. Wall/hand shower with flexible metal hose, in-line vacuum breaker, wall connection and flange, 30" slide bar for hand shower mounting. Volume control - 7.6 LPM flow control. Unit to be vandal resistant. Trim to have 5-year warranty in commercial installation. Shower trim to mounted such that there is a minimum 1830mm (6') clearance below bottom edge of discharge head.

.3 Design based on: Cabinet – MAAX SS42, Trim - Symmons - Temptrol 96-500-B30-L-V-2.0-X-CHKS-VP

2.3 SHOWER SH-2 (Security Shower)

.1 Cabinet: Refer to Architectural.

.2 Shower Trim:

.1 Shower system shall be complete with shower head, push button actuator and remote valve installed in service space above shower room.

.2 Shower panels shall be fabricated from 14 gauge, type 304 stainless steel and shall have a satin finish. Trim shall be stainless steel or chrome-plated brass. Shower valve shall be Air-Control, metering, nonhold open type. Fixture shall be furnished with necessary fasteners for proper installation.

.3 Shower is arranged to be installed on finished wall. Back of shower is provided with anchor tappings. Fixture is fabricated from 14 gauge, type 304 stainless steel with a satin finish.

.4 Shower Head - chrome plated brass and vandal-resistant. The nozzle is threaded into the body and then locked into place by a set screw from the rear. The spray pattern can only be changed by use of an allen wrench inserted through the nozzle. Unit shall have penal locakable up/down ball joint

.5 Valve - pneumatically operated, pushbutton Air-Control valve using atmospheric air. Hemispherical pushbutton is vandal-resistant and requires less than 5 pounds to activate valve. Valve is metering, non-hold open type. Valve timing is adjustable from 5 to 60 seconds. Valve to be single temperature with 1.6 GPM flow control and can be remotely located up to 10 feet from the operating pushbutton. Valve conforms with lead free requirements of NSF61, Section 9, 1997.

.6 Provide and install the remote electronic modular valve controller system using low voltage, 24 VAC power. Unit to be complete with transformer for 120 VAC to 24 VDC. Provide a solenoid valve made with non-corrosive wet parts. Stainless steel fixture pushbutton shall be vandal resistant and shall pneumatically actuate the Modular Valve Controller, with no electrical impulse at the pushbutton. Valve timing/lockout cycle shall have 10 preset intervals ranging from 1 second to 9 minutes, easily adjustable with a knob. Modular Valve Controller shall have colored lights to indicate system is functioning and permit easy trouble shooting.

.3 Design based on: Shower Panel – Acorn Penal-Ware 1743-MVC1-F1.6-MT-SW-PZZ-PBH

2.4 SHOWER SH-3 (Housing Shower)

.1 Cabinet: Acrylic finish reinforced fibreglass shower, one piece seamless unit with smooth rounded corners, integrated shelves, towel bar and without cap. Unit to have seat opposite shower head. Complete with centre drain. Shower shall not exceed 1505 mm (59-1/4") x 800 mm (31-1/2") and a height of 2150mm (84.6"). Colour - White.

.2 Trim: Concealed in-wall single lever pressure balancing mixing valve control, polished chrome plated metal trim, integral stops and checks, and vandal resistant metal lever handle; combination integral diverter and adjustable stop screw to limit handle turn. Wall-mounted shower head with arm and flange, and polished chrome plated finish. Wall/hand shower with flexible metal hose, in-line vacuum breaker, wall connection and flange, 30" slide bar for hand shower mounting. Volume control - 7.6 LPM flow control. Unit to be vandal resistant. Trim to have 5-year warranty in commercial installation. Shower trim to mounted such that there is a minimum 1830 mm (6') clearance below bottom edge of discharge head.

.3 Design based on: Cabinet – MAAX Montego 60-II, Trim - Symmons - Temptrol 96-500-B30-L-V-2.0-X-CHKS-VP

2.5 TUB/SHOWER T-1 (Housing Tub)

.1 Cabinet: Acrylic finish reinforced fibreglass combination tub and shower, one piece seamless unit with smooth rounded corners, integrated shelves, soap dish, towel bar and without cap. Unit to have seat opposite shower head. Shower shall not exceed 1524 mm (60") x 787.4 mm (31") and a height of 1905mm (75"). Colour - White.

.2 Trim: Concealed in-wall single lever pressure balancing mixing valve control, polished chrome plated metal trim, integral stops and checks, and vandal resistant metal lever handle; combination integral diverter and volume control and adjustable stop screw to limit handle turn. Wall-mounted shower head with arm and flange, and polished chrome plated finish. Wall/hand shower with flexible metal hose, in-line vacuum breaker, wall connection and flange, 30" slide bar for hand shower mounting. Unit to be complete with Tub spout. Volume control - 7.6 LPM (2.0 GPM) flow control for shower heads. Unit to be vandal resistant. Trim to have 5-year warranty in commercial installation. Shower trim to mounted such that there is a minimum 1830mm (6') clearance below bottom edge of discharge head.

.3 Design based on: Cabinet – MAAX Montego 60-II 1P, Trim - Symmons - Temptrol 96-600-B30-L-V-2.0-X-CHKS-VP

3. Execution

3.1 INSTALLATION

.1 Install each fixture that is to be operational with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.

.2 Provide chrome plated rigid or stainless steel flexible supplies to fixtures that are to be operational complete with screwdriver stops, reducers and escutcheons.

.3 Mounting heights:
- .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified by architect.
- .2 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

3.2 PLUMBING FIXTURE ROUGH-IN SCHEDULE

.1 Rough-in fixture piping connections in accordance with the following table of minimum sizes or as required for particular fixtures:

	Hot Water	Cold Water	Waste	Vent
Shower	12 mm (½")	12 mm (½") (2")	50 mm (1-1/4")	38 mm

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:
- .1 Adjust water flow rate to design flow rates.
- .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:
- .1 Aerators or Laminar Flow Control: operation, cleanliness.
- .2 Vacuum breakers, backflow preventers: operation under all conditions.

.4 Thermostatic controls:
- .1 Verify temperature settings, operation of control, limit and safety controls.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Use of mechanical systems during construction.

1.2 USE OF SYSTEMS

.1 Use of new permanent heating and ventilating systems for supplying temporary heat or ventilation is permitted only under following conditions and with the express written permission of Departmental Representative:
- .1 Entire system is complete, pressure tested, cleaned, flushed out.
- .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
- .3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
- .4 There is no possibility of damage.
- .5 Supply ventilation systems are protected by 80% filters, inspected daily, changed every week or more frequently as required.
- .6 Return systems have approved filters over openings, inlets, outlets.
- .7 Systems will be:
  - .1 Operated as per manufacturer's recommendations and instructions.
  - .2 Operated by Contractor.
  - .3 Monitored continuously by Contractor.
- .8 Warranties and guarantees are not relaxed.
- .9 Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at own expense and under supervision of Departmental Representative.
- .10 Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, replace filters in air systems.

.2 Filters specified in this Section are over and above those specified in other Sections of this project.

.3 Exhaust systems are not included in approvals for temporary heating ventilation.

.4 Contractor shall not assume at time of bidding that permission will be given to use permanent heating and/or ventilation systems.

2 Products

2.1 NOT USED

3 Execution

3.1 NOT USED

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.2 REGULATORY REQUIREMENTS

.1 Conform to ASME B31.9 - Building Services Piping.

.2 Contractor to supply shop drawings for all grooved end components. Do piping system work including hangers in accordance with ANSI B31.1. Install all grooved end components as per manufacturer's latest recommendations. All grooved joint couplings, fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

.3 All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.3 WELDING

.1 Welding materials and labour must conform to ASME Code and the Provincial Board of Labour Regulations.

.2 Use welders fully qualified and licensed by Provincial Authorities.

1.4 SUBMITTALS

.1 Submit shop drawings to requirements of Section 01 33 00.

.2 Submit shop drawings and product data for manufactured products and assemblies required for this project. Include data on pipe material, pipe fittings, valves and accessories.

.3 Shop drawings shall clearly indicate product description, make, model, dimensions, component sizes, rough-in requirements, location, type, size, service clearances, finishes, and pressure rating.

.4 Submit copies of valve "ordering schedule" for approval before ordering valves.

1.5 QUALITY ASSURANCE

.1 Domestic water, drainage and vent piping shall meet the requirements of the National Building Code and the Provincial and Municipal Codes.

.2 Automatic sprinkler system piping shall conform to the requirements of NFPA No. 13.

.3 Contractor to supply shop drawings for all grooved end components. Do piping system work including hangers in accordance with ANSI B31.1-1983. Install all grooved end components as per manufacturer's latest recommendations. All grooved joint couplings, fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

.4 All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

2 Products

2.1 PIPE

.1 Refrigerant Piping
- .1 Copper Tubing: ASTM B280, Type ACR hard drawn or annealed. Fittings: ASME B16.22 wrought copper. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 640 to 805 degrees (1190 to 1480 degrees F).

.2 Equipment Drains/Overflow
- .1 Steel Pipe: ASTM A53 or A120, Schedule 40 galvanized, with galvanized cast iron or malleable iron fittings, screwed joints or grooved mechanical couplings.
- .2 Plastic Pipe buried or crawlspace may be PVC Pipe: Schedule 40 or SDR 21 or 26, with PVC fittings, solvent weld or grooved mechanical joints.
- .3 Plastic Pipe in ceiling space shall be fire rated PVC Pipe: Schedule 40 or SDR 21 or 26, with fire rated PVC fittings, solvent weld or grooved mechanical joints. Rating to meet 25/50 flame and smoke spread.
- .4 Copper Pipe: Type L hard copper, with cast brass or wrought copper fittings, 95/5 solder.

.3 Sanitary Drainage and Vent (unburied)
- .1 Cast iron pipe and fittings; hub-and spigot, neoprene gaskets; or hubless with neoprene gaskets and stainless steel clamp-and-shield assemblies.
- .2 Type "M" or "DWV" copper with cast brass, or bronze or wrought copper fittings; 95/5 solder joints or grooved mechanical.
- .3 Plastic PVC-XFR-15/50 or CPVC pipe and fittings; solvent weld joints or grooved mechanical.

.4 Water Piping (buried)
- .1 Copper tubing type K annealed; wrought copper fittings 95/5 solder or silver braze joints.
- .2 Plastic "BLUE BRUTE" pipe and fittings; solvent weld joints.
- .3 All piping and fitting shall be rated to a minimum of 1034 kPa (150 PSI)

.5 Water Piping (unburied)
- .1 Type L hard copper; with cast brass or wrought copper fittings; 95/5 solder joints.
- .2 Stainless steel pipe, Schedule 10; grooved mechanical.
- .3 Cross Linked Polyethylene (PEX) pipe, mechanical joints.
- .4 Polypropylene (PP) with heat fused joints.

.6 Use factory fabricated butt welded fittings for welded steel pipes.

.7 Use long radius elbows for steel and cast iron water piping.

3 Execution

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and unions or flanges (as indicated) for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve complete with isolation at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to nearest floor drain where indicated. Discharge to be visible.

.4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 DIELECTRIC COUPLINGS

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: Isolating flanges.

3.5 ROUTE AND GRADES

.1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furrings to a minimum.

.2 Slope water piping 25 mm in 12 m and arrange to drain at low points.

.3 Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting.

.4 Grade horizontal drainage and vent piping 20 mm per meter minimum.

3.6 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.
- .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .2 Do not project branch pipe inside the main pipe.

.6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Install, except where indicated, to permit separate thermal insulation of each pipe.

.10 Provide clearance for proper installation of insulation and for access to valves, air vents, drains and unions. Valves to be complete with valve handle extensions where insulation is thicker than 25mm, extension to suit insulation thickness.

.11 Group piping wherever possible.

.12 Ream pipes, remove scale, welding slag and other foreign material, inside and outside before assembly.

.13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.14 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.

.15 Use grooved mechanical couplings and mechanical fasteners in accessible locations, risers, pipe chases, and in other locations as approved by Departmental Representative. Use flexible couplings at pumps, coils and all vibration isolated equipment in lieu of flexible connectors, all other couplings to be rigid.
- .1 Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions.
- .2 The grooved coupling manufacturer's factory trained representative shall provide on-site training for Contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site and review Contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or job site visits.)

.16 Make connections to equipment and branch mains with unions or flanges, as indicated:
- .1 Unions are not required in installations using grooved mechanical joint couplings (The couplings shall serve as disconnect points.)

.17 Provide non-conducting type connections wherever jointing dissimilar metals in systems. Brass adaptors and valves are acceptable. Refer to dielectric couplings.

.18 Pressfit piping and fittings are not permitted.

.19 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.

.1 For mechanical pipe jointing systems, use adequate numbers of Victaulic Style 77 flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with Victaulic instructions and as approved by the Departmental Representative.) Where expansion loops are required, use Victualic Style 77 couplings on the loops.

.20 Install piping material specified as inside the building to 2.4 meters outside of building unless indicated otherwise on Mechanical Drawings.

.21 Use of PVC or other plastic pipe allowed where approved by the authority having jurisdiction. Plastic pipe run in plenum spaces shall have flame and smoke rating for that purpose. All plastic pipe to be complete with ULC labelled intumescent fire stopping wherever penetrating fire separations. The piping shall be sealed at the penetration by a fire stop that has an F rating not less than the fire resistance rating required for the fire separation when subjected to the fire test method CAN/ULC-S115, “Fire Tests of Firestop Systems,” with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side. Combustible piping shall not be permitted in a vertical service space.

.22 Valves:

.1 Shall be flanged for steam and condensate 38 mm and larger.
.2 Install in accessible locations.
.3 Remove interior parts before soldering.
.4 Install with stems upright or horizontal, not inverted.
.5 Valves accessible for maintenance without removing adjacent piping.
.6 Install globe valves in bypass around control valves.
.7 Use ball valves up to 50 mm or butterfly valves 63 mm and larger at branch take-offs for isolating purposes except where otherwise specified.
.8 Install butterfly valves between weld neck flanges to ensure full compression of liner.
.9 Install ball valves for domestic water.
.10 Use chain operators on valves NPS 2-1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
.11 Install gate, ball and butterfly valves for isolating service, to isolate equipment, part of systems or vertical risers.
.12 Install globe, ball or angle valves for throttling service.
.13 Use plug cocks in water systems for throttling service. Use non-lubricated plug cocks only when shut-off or isolation valves are also provided.
.14 Use butterfly valves in fire protection systems where approved.
.15 Provide drain valves at main shut-off valves, low points of piping and apparatus.
.16 Valve operators to be complete with extensions on systems with insulation thicker than 25mm, extension to suit insulation thickness.

.23 Check Valves:

.1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.
.2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

.24 Provide thermometers, thermometer wells, and sensor wells where thermometers are indicated on drawings and schematics.

.25 Provide plug cocks at all pressure tapping locations.

3.7 SLEEVES

.1 General: Install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Material: Schedule 40 black steel pipe.

.3 Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:
- .1 Concrete, masonry walls, concrete floors on grade: Terminate flush with finished surface.
- .2 Other floors: Terminate 25 mm above finished floor.
- .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:
- .1 Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.
- .2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
- .3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.
- .4 Ensure no contact between copper pipe or tube and sleeve.

3.8 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.

.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.9 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.

.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems. Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11- Cleaning supplemented as specified in relevant sections of Mechanical.

.2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Mechanical or to 1.5 times maximum operating pressure. All installed piping to be tested unless noted otherwise.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of Mechanical.

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Departmental Representative.

.6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Electrical motors, drives and guards for mechanical equipment and systems.
- .2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
- .3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22, 23 and 25. Refer to Division 26 for quality of materials and workmanship. Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
- .1 ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
- .2 Shop Drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan.

.3 Closeout Submittals
- .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial /Territorial regulations.

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

2 Products

2.1 GENERAL

.1 Motors: premium efficiency, in accordance with local Hydro company standards and to ASHRAE 90.1.

.2 Must be inverter duty for all variable frequency drive applications.

.3 Must be CSA approved.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 Motors 373 W (1/2 HP) and under: speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.3 Motors 373 W (3/4 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 208V, unless otherwise indicated.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Departmental Representative for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW (10 HP) and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed in accordance with Section 01 78 00 - Closeout Submittals.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;
- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
- .3 38 mm diameter holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.-

.5 Guard for flexible coupling:
- .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:
- .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
- .2 Net free area of guard: not less than 80% of fan openings.
- .3 Securely fasten in place.
- .4 Removable for servicing.

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 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

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

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Materials and installation for flexible connections, expansion joints, anchors and guides for building services piping.
.2 Sustainable requirements for construction, verification and operation.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  .2 ASTM A105/A105M-03, Standard Specification for Carbon Steel Forgings, for Piping Applications.

1.3 SUBMITTALS

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

.2 Submit product data and indicate for items as applicable:
  .1 Manufacturer, model number, line contents, pressure and temperature rating.
  .2 Movement handled, axial, lateral, angular and the amounts of each.
  .3 Nominal size and dimensions including details of construction and assembly.

.3 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

.4 Data to include:
  .1 Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.

1.4 HEALTH AND SAFETY

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 GENERAL REQUIREMENTS

.1 Verify, prior to installation, required anchors and expansion joints to adequately protect system.

.2 Base expansion calculations on -10 deg.C installation temperature to 100 deg.C for hot water heating and 60 deg.C for domestic hot water, plus 30% safety factor.

2 Products

2.1 FLEXIBLE LOOP EXPANSION JOINT (Manufactured)

.1 Construction to be 3 equal length sections of annular corrugated 321 / 304L stainless steel or bronze for models TFLBSW and TFLBHM close-pitch hose with stainless steel or bronze over-braid that will absorb or compensate for pipe movements in all 6 degrees of freedom (3 coordinate axes, plus rotation about those axes) simultaneously.

.2 The corrugated metal hose, braid(s), and a stainless steel ring-ferrule/band (material gauge not less than .048") must be integrally seal welded using a 100% circumferential, full penetration TIG welds. End fittings shall be selected per application. Fittings must be attached using a 100% circumferential TIG weld.

.3 Braided stainless steel Loops must be suitable for operating temperatures up to 850 degrees F (455 degrees C). Braided bronze Loops must be suitable for operating temperatures up to 400 degrees F (204 degrees C)

.4 Loop must be designed for pressure testing to 1.5 times their maximum rated working pressure and a minimum 4:1 (burst to working) safety factor.

.5 Each braided Loop shall be individually leak tested by the manufacturer using air-under-water and/or hydrostatic pressure.

.6 Loops shall be prepared for shipment in a method that maintains the manufactured length during shipping. Shipping supports must be removed prior to system start-up.

.7 Manufacturers approved hanger assembly kit shall be used to support and hang the Loop. The UL Listed Seismic Wire/Cable assemblies conform to the requirements of the ASCE (American Society of Civil Engineers) guidelines for structural applications of wire rope, in that the cable is pre-stretched and the permanent end fittings maintain the break strength of the cable with a safety factor of two.

.8 The pre-manufactured flexible loop shall be installed and guided following the manufacturer's published installation instructions. Specification is based on a product that does not require pipe guides. Manufactured loops that require pipe alignment guides shall use "Spider" type with outer housing ring affixed to building structure with rigid elements. Units shall be fabricated from carbon steel. Pipe hangers and/or roller supports shall not be considered acceptable for use as guides.

.9 The pre-manufactured flexible loop design shall be tested by an independent third party to confirm simultaneous movement in X, Y, and Z planes plus rotation about those axes. Third party testing will document and confirm motion capabilities of the device. Device testing to include large and irregular movements similar to movement that may be caused by seismic movement analytically using finite element modeling and computer simulation as well as physical testing of the device. Independent third party testing data and documentation are to be furnished upon the engineers request during pre-qualification process or at the time of submission.

.10 The pre-manufactured flexible loop shall meet the requirements of the 2009 International Building Code (IBC) and the American Society of Civil Engineers code requirements for Total Maximum Displacement and accidental torsion as directed in IBC Chapter 13 and ASCE 7-05, Chapter 17.1.2.

.11 When used for potable water (in copper tubing systems) product shall be third party tested and, listed (by a laboratory in compliance with all applicable requirements of ISO/IEC 17025) and marked in accordance with NSF/ANSI 61-2011.

.12 When used for potable water (in copper tubing systems) product shall be third party tested and, listed (by a laboratory in compliance with all applicable requirements of ISO/IEC 17025) and marked in accordance with Section 1417(d) of the Safe Drinking Water Act. Must meet the lead content requirements of Section 116875 of the California Health & Safety Code, and the criteria of NSF/ANSI 372 for low lead.

.13 When used for potable water (in steel piping systems) product shall be third party tested and, listed (by a laboratory in compliance with all applicable requirements of ISO/IEC 17025) and marked in accordance with NSF/ANSI 61-2011

.14 When used for potable water (in steel piping systems) product shall be third party tested and, listed (by a laboratory in compliance with all applicable requirements of ISO/IEC 17025) and marked in accordance with Section 1417(d) of the Safe Drinking Water Act. Must meet the lead content requirements of Section 116875 of the California Health & Safety Code, and the criteria of NSF/ANSI 372 for low lead.

.15 When used for potable water (in stainless steel piping systems) products shall be third party tested and, listed (by a laboratory in compliance with all applicable requirements of ISO/IEC 17025) and marked in accordance with NSF/ANSI 61-2011

.16 When used for potable water (in stainless steel piping systems) products shall be third party tested and, listed (by a laboratory in compliance with all applicable requirements of ISO/IEC 17025) and marked in accordance with Section 1417(d) of the Safe Drinking Water Act. Must meet the lead content requirements of Section 116875 of the California Health & Safety Code, and the criteria of NSF/ANSI 372 for low lead.

.17 Loop material shall reasonably match pipe material.

.18 Pre-Manufactured Loop must have a 5-year full replacement warranty when installed in accordance with all specifications and installation instructions as described in the Manufacturers Installation and Maintenance Instructions. If it is deemed that installation did not meet Manufacturers Installation and Maintenance requirements, then contractor shall be responsible for 5 year warranty.

.19 Specifications are based on the Tri-Flex series of product offered by Flex-Hose including models TFLBSW, TFLSMP, TFLSMN, TFLSVG, TFLSSMP6, TFLSSMN6 and TFLSSVG6.

2.2 GROOVED PIPE EXPANSION JOINTS

.1 Grooved end expansion joints for steel piping:
- .1 Packless, gasketed, slip expansion joints: 2400 kPa maximum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, PTFE modified polyphenylene sulfide coated slide section, with grooved ends. Suitable for axial end movement to 80 mm Victaulic Style 150.
- .2 Expansion joint consisting of a series of grooved end pipe nipples joined in tandem with Victaulic Style 77 flexible couplings. Total joint movement dependent on the number of couplings and nipples used. Victualic Series 155.

2.3 FLEXIBLE CONNECTION

.1 Application: to suit motion as indicated.

.2 Minimum length in accordance with manufacturer's recommendations to suit offset as indicated.

.3 Inner hose: bronze corrugated for copper pipe, inner hose stainless steel corrugated for steel pipe.

.4 Braided wire mesh bronze outer jacket, for copper pipe.

.5 Braided wire mesh stainless steel after jacket for steel pipe.

.6 Diameter and type of end connection: as indicated under Section 23 05 01.

.7 Operating conditions:
- .1 Working pressure: 1034 kPa minimum.
- .2 Working temperature: 232 degrees C minimum.
- .3 To match system requirements.

3 Execution

3.1 INSTALLATION

.1 Install expansion joints and flexible connections in accordance with manufacturer's instructions.

.2 Install pipe anchors and guides as indicated and required. Anchors to withstand 150% of axial thrust.

.3 Provide flexible pipe connectors on pipes connected to all equipment supported by vibration isolation and where shown on drawings and schematics.

.4 Provide structural work and equipment required to control expansion and contraction of piping, loops, pipe offsets, and swing joints and provide corrugated bellows type expansion joints where indicated or required.

.5 Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor at other end.

.6 Rigidly anchor pipe to building structure at points shown and where required, where necessary provide pipe guides so that movement takes place along axis of pipe.

.7 Three Victualic Style 77 couplings may be used in lieu of a flexible connector for vibration attenuation and stress relief. The couplings shall be placed in close proximity to the source of the vibration.

.8 Rigidly anchor pipe to building structure at points shown, and where necessary provide pipe guides so that movement takes place along axis of pipe only.

3.2 CLEANING AND START-UP

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

3.3 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01 - Performance Verification: Mechanical Piping Systems.

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
- .1 ANSI/ASME B31.1-1998, Power Piping.
- .2 ANSI/ASME B31.3-2000, Process Piping Addenda A.
- .3 ANSI/ASME B31.3-2001, Process Piping Addenda B.
- .4 ANSI/ASME Boiler and Pressure Vessel Code-1998:
  - .1 Section I: Power Boilers.
  - .2 Section V: Nondestructive Examination.
  - .3 Section IX: Welding and Brazing Qualifications.

.2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
- .1 ANSI/AWWA C206-97, Field Welding of Steel Water Pipe.

.3 American Welding Society (AWS)
- .1 AWS C1.1-2000, Recommended Practices for Resistance Welding.
- .2 AWS Z49.1-1999, Safety Welding, Cutting and Allied Process.
- .3 AWS W1-2000, Welding Inspection Handbook..

.4 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-48.2-92, Spot Radiography of Welded Butt Joints in Ferrous Materials.

.5 Canadian Standards Association (CSA International)
- .1 CSA W47.2-M1987 (R1998), Certification of Companies for Fusion Welding of Aluminum.
- .2 CSA W48 series-01, Filler Metals and Allied Materials for Metal Arc Welding.
- .3 CSA B51-97, Boiler, Pressure Vessel and Pressure Piping Code.
- .4 CSA-W117.2-01, Safety in Welding, Cutting and Allied Processes.
- .5 CSA W178.1-02, Certification of Welding Inspection Organizations.
- .6 CSA W178.2-01, Certification of Welding Inspectors.

1.2 QUALIFICATIONS

.1 Welders
- .1 Welding qualifications in accordance with CSA B51.
- .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
- .3 Furnish welder's qualifications to Departmental Representative.
- .4 Each welder to possess identification symbol issued by authority having jurisdiction.
- .5 Certification of companies for fusion welding of aluminum in accordance with CSA W47.2.

.2 Inspectors
- .1 Inspectors qualified to CSA W178.2.

1.3 QUALITY ASSURANCE

.1 Registration of welding procedures in accordance with CSA B51.

.2 Copy of welding procedures available for inspection.

.3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

2 Products

2.1 ELECTRODES

.1 Electrodes: in accordance with CSA W48 Series.

3 Execution

3.1 WORKMANSHIP

.1 Welding: in accordance with ANSI/ASME B31.1, B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and applicable requirements of provincial authority having jurisdiction.

3.2 INSTALLATION REQUIREMENTS

.1 Identify each weld with welder's identification symbol.

.2 Backing rings:
- .1 Where used, fit to minimize gaps between ring and pipe bore.
- .2 Do not install at orifice flanges.

.3 Fittings:
- .1 NPS 2 and smaller: install welding type sockets.
- .2 Branch connections: install welding tees or forged branch outlet fittings.

3.3 INSPECTION AND TESTS - GENERAL REQUIREMENTS

.1 Review weld quality requirements and defect limits of applicable codes and standards with Departmental Representative before work is started.

.2 Formulate "Inspection and Test Plan" in co-operation with Departmental Representative.

.3 Do not conceal welds until they have been inspected, tested and approved by inspector.

.4 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by Codes and as specified.

3.4 SPECIALIST EXAMINATIONS AND TESTS

.1 Hydrostatically test welds to requirements of ANSI/ASME B31.1.

.2 Visual examinations: include entire circumference of weld externally and wherever possible internally.

.3 Failure of visual examinations:
- .1 Upon failure of welds by visual examination, perform additional testing as directed by Departmental Representative of total of up to 10% of welds, selected at random by Departmental Representative by radiographic particle tests.

.4 Full radiographic tests for piping systems.
  .1 Spot radiography to CAN/CGSB-48.2.
    .1 Conduct spot radiographic tests of up to 10% of welds, selected at random by Departmental Representative from welds which would be most difficult to repair in event of failure after system is operational.
  .2 Radiographic film:
    .1 Identify each radiographic film with date, location, name of welder, and submit to Departmental Representative. Replace film if rejected because of poor quality.
  .3 Interpretation of radiographic films:
    .1 By qualified radiographer.
  .4 Failure of radiographic tests:
    .1 Extend tests to welds by welder responsible when those welds fails tests.

.5 Magnetic particle tests for piping systems.

3.5 DEFECTS CAUSING REJECTION

.1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

.2 In addition, chilled water systems:
  .1 Undercutting greater than 0.8 mm adjacent to cover bead on outside of pipe.
  .2 Undercutting greater than 0.8 mm adjacent to root bead on inside of pipe.
  .3 Undercutting greater than 0.8 mm at combination of internal surface and external surface.
  .4 Incomplete penetration and incomplete fusion greater than total length of 38 mm in 1500 mm length of weld depth of such defects being greater than 0.8 mm.
  .5 Repair cracks and defects in excess of 0.8 mm in depth.
  .6 Repair defects whose depth cannot be determined accurately on basis of visual examination or radiographic particle tests.

3.6 REPAIR OF WELDS WHICH FAILED TESTS

.1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Bronze - valves.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1-1983 (R2001), Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A276-04, Specification for Stainless Steel Bars and Shapes.
  .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
  .3 ASTM B283-99a, Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
  .4 ASTM B505/B505M-02, Specification for Copper-Base Alloy Continuous Castings.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
  .2 MSS-SP-80-2003, Bronze Gate Globe, Angle and Check Valves.
  .3 MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Specifications.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit data for valves specified in this section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

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

2 Products

2.1 MATERIALS

.1 Valves:
- .1 Except for specialty valves, to be single manufacturer.
- .2 All products to have CRN registration numbers.
- .3 Refer to Section 22 11 16.

.2 End Connections:
- .1 Connection into adjacent piping/tubing:
  - .1 Steel pipe systems: Grooved ends to requirements of manufacturer.
  - .2 Copper tube systems: Solder ends to ANSI/ASME B16.18.
  - .3 Provide flanged ends as indicated under 23 05 05, Installation of Pipework.

.3 Lockshield Keys:
- .1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.

3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal. Refer to 23 05 05 - Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Valves, gate, globe, and check.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings.

.2 American Society for Testing and Materials International (ASTM).
  .1 ASTM A49-01, Specification for Heat-Treated Carbon Steel Joint Bars.
  .2 ASTM A126-95 (2001), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  .3 ASTM B61-93, Specification for Steam or Valve Bronze Castings.
  .4 ASTM B62-93, Specification for Composition Bronze or Ounce Metal Castings.
  .5 ASTM B85-03, Specification for Aluminum-Alloy Die Castings.
  .6 ASTM B209-04, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS SP-70-1998, Cast Iron Gate Valves, Flanged and Threaded Ends.
  .2 MSS SP-71-1997, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
  .3 MSS SP-82-1992, Valve Pressure Testing Methods.
  .4 MSS SP-85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Specifications.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit data for valves specified in this section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

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

2 Products

2.1 MATERIAL

.1 Valves:
- .1 Except for specialty valves, to be of single manufacturer.

.2 Standard specifications:
- .1 Gate valves: MSS SP-70.
- .2 Globe valves: MSS SP-85.
- .3 Check valves: MSS SP-71.

.3 Requirements common to valves, unless specified otherwise:
- .1 Body, bonnet: cast iron to ASTM B209 Class B.
- .2 Connections: flanged ends with 2 mm raised face with serrated finish to ANSI B16.1.
- .3 Inspection and pressure testing: to MSS SP-82.
- .4 Bonnet gasket: non-asbestos.
- .5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.
- .6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.
- .7 Gland packing: non-asbestos.
- .8 Handwheel: Die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49. Nut of bronze to ASTM B62.
- .9 Identification tag: with catalogue number, size, other pertinent data.

.4 All products to have CRN registration numbers.

2.2 GATE VALVES

.1 NPS 2 1/2 - 8, non rising stem, inside screw, bronze trim, solid wedge disc:
- .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly. Class 300.
- .2 Disc: solid offset taper wedge, bronze to ASTM B62.
- .3 Seat rings: renewable bronze to ASTM B62, screwed into body.
- .4 Stem: bronze to ASTM B62.
- .5 Disc: solid offset taper wedge, cast iron to ASTM A126 Class B, secured to wrought steel stem.
- .6 Seat: Integral with body.
- .7 Stem: wrought steel.
- .8 Operator: Handwheel.

.2 NPS 2 1/2-8, outside screw and yoke (OS&Y), bronze trim, solid wedge disc:
- .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 300.
- .2 Disc: solid offset taper wedge, bronze to ASTM B62 up to NPS 3, cast iron with bronze disc rings on other sizes, secured to stem through integral forged T-head disc-stem connection.
- .3 Seat rings: renewable bronze screwed into body.
- .4 Stem: nickel-plated steel.
- .5 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.

.6 Seat rings: integral with body.
.7 Stem: nickel-plated steel.
.8 Pressure-lubricated operating mechanism.
.9 Operator: Handwheel.
.10 Bypass: complete with union and NPS globe valve as Section 23 05 05 - Installation of Pipework.

2.3 UNDERWRITERS APPROVED GATE VALVE

.1 NPS 2 1/2 - 14, OS&Y:
.1 Approvals: UL and FM approved for fire service.
.2 UL and FM Label: on valve yoke.
.3 Body, Bonnet: cast iron to ASTM A126 Class B. Wall thicknesses to ANSI B16.1 and ULC 262 (B).
.4 Bonnet bushing, yoke sleeve: bronze, to FM requirements.
.5 Packing gland: bronze.
.6 Stem: manganese bronze. Diameter to ULC C-262 (B).
.7 Stuffing box dimensions, gland bolt diameter: to ULC C-262 (B).
.8 Bosses for bypass valve, drain: on NPS 4 and over.
.9 Disc: solid taper wedge. Up to NPS 3: bronze. NPS 4 and over: cast iron with bronze disc rings.
.10 Disc seat ring: self-aligning, Milwood undercut on NPS 3 - 12.
.11 Pressure rating:
.1 NPS 2-1/2 - 12: 1.7 Mpa CWP.
.12 Operator: handwheel.
.13 Bypass: complete with union and NPS globe valve as Section 23 05 23.01 - Valves - Bronze.

2.4 GLOBE VALVES

.1 NPS 2 1/2 - 10, OSY:
.1 Body: with multiple-bolted bonnet, Class 300.
.2 WP: 860 kPa steam, 1.4 MPa CWP.
.3 Bonnet-yoke gasket: non-asbestos.
.4 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.
.5 Seat ring: renewable, regrindable, screwed into body.
.6 Stem: bronze to ASTM B62.
.7 Operator: Handwheel.

2.5 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.

.2 Position of bypass valve on main valves.

.3 Size of bypass valve:
.1 Main valve up to NPS 8: NPS 3/4.

.4 Type of bypass valves:
.1 On gate valve: globe, with composition disc, bronze trim, to Section 23 05 23.01 - Valves - Bronze. Pressure rating to match main valve.
.2 On globe valve: globe, with composition disc, bronze trim, to Section 23 05 23.01 - Valves - Bronze. Pressure rating to match main valve.

2.6 VALVE OPERATORS

.1 Install valve operators as follows:
- .1 Handwheel: on valves except as specified.
- .2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in boiler rooms and mechanical equipment rooms.

2.7 CHECK VALVES

.1 Swing check valves, Class 300:
- .1 Body and bolted cover: cast iron to ASTM A126 Class B with tapped and plugged opening on each side for hinge pin.
- .2 Flanged ends: 2 mm raised face with serrated finish.
- .3 Rating: 300 psi steam; 500 psi CWP.
- .4 Disc: rotating for extended life.
  - .1 Up to NPS 3: bronze to ASTM B61.
  - .2 NPS 4 - 8: Iron faced with ASTM B61 bronze.
- .5 Seat rings: renewable bronze to ASTM B61, screwed into body.
- .6 Hinge pin, bushings: renewable, bronze to ASTM B61.
- .7 Hinge: galvanized malleable iron.
- .8 Identification tag: fastened to cover.

3 Execution

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance and equipment removal. Refer to Section 23 05 05 Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Valves Cast Steel, gate, globe, and check.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
- .1 ANSI/ASME B16.5-2003, Pipe Flanges and Flanged Fittings.
- .2 ANSI/ASME B16.10-1992, Face-to-Face and End-to-End Dimensions Valves.
- .3 ANSI/ASME B16.25-1997, Buttwelding Ends.
- .4 ANSI/ASME B16.34-1996, Valves - Flanged, Threaded and Welding End.

.2 American Petroleum Institute (API).
- .1 API 598-1996, Valve Inspection and Testing.

.3 American Society for Testing and Materials International, (ASTM).
- .1 ASTM A49-01, Specification for Heat-Treated Carbon Steel Joint Bars.
- .2 ASTM A193/A193M-04, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
- .3 ASTM A194/A194M-03b, Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
- .4 ASTM A216/A216M-1993 (03), Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service.
- .5 ASTM B85-03, Specification for Aluminum-Alloy Die Castings.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
- .1 MSS SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
- .2 MSS SP-61-2003, Pressure Testing of Steel Valves.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Specifications.
- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit data for valves specified this section.
- .3 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.3 Closeout Submittals:
- .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

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

2 Products

2.1 MATERIAL

.1 Valves:
- .1 Except for specialty valves, to be of single manufacturer.
- .2 Valves to be individually tested.

.2 Requirements common to valves, unless specified otherwise:
- .1 Pressure-temperature ratings: to ANSI B16.34.
- .2 Inspections and tests: to API 598.
- .3 Pressure Testing: to MSS SP-61.
- .4 Flanged valves:
  - .1 Face-to-face dimensions: to ANSI B16.10.
  - .2 Flange dimensions: to ANSI B16.5 with 1.6 mm raised face.
- .5 Butt-weld valves:
  - .1 End-to-end dimensions: to ANSI B16.10.
  - .2 End dimensions: to ANSI B16.25 bored for standard pipe schedule.
- .6 Handwheel: non-heating type with raised rim of die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49.
- .7 Markings: to MSS SP-25.
- .8 Identification:
  - .1 Plate showing catalogue number, size, material of body disc, stem seat, fluid, pressure-temperature rating.
  - .2 Body markings: manufacturer, size, primary service rating, material symbol.
- .9 CRN registration number required for all products.

2.2 GATE VALVES

.1 NPS 2 1/2 - 12, rising stem, OS&Y, solid flexible wedge disc, flanged or butt-weld ends, Class 300:
- .1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB, with full length disc guides designed to ensure correct re-assembly.
- .2 Body/bonnet joint: Flat face with corrugated metallic gasket.
- .3 Bonnet studs: to ASTM A193/A193M Type B7.
- .4 Bonnet nuts: to ASTM A194/A194M Type 2H.
- .5 Stuffing box: including non-galling two-piece ball jointed packing gland, with swing-type eye bolts and nuts.
- .6 Gland packing: containing corrosion inhibitor to prevent stem pitting.
- .7 Yoke sleeve: Ni-Resist, minimum melting point above 954 degrees C.
- .8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.
- .9 Disc: with disc stem ring to connect to stem, guided throughout its travel.
  - .1 NPS 2 1/2 - 6: Solid corrosion and heat resistant 13% chromium steel with minimum hardness of 350 HB.

.2 NPS 8 and larger: Carbon steel faced with corrosion and heat resistant 13 chromium steel with minimum hardness of 350 HB.

.10 Seat ring: seamless carbon steel with hard-faced cobalt-chromium-tungsten alloy seating surface, slipped in, seal welded, ground to match disc.

.11 Stem: heat treated corrosion and heat resistant 13% chromium steel with accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut, T-head disc-stem connection.

.12 Operator: see elsewhere this section.

2.3 GLOBE VALVES

.1 NPS 2 1/2 - 12, rising stem, OS&Y, flanged or butt-weld ends, Class 300:

.1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB.

.2 Body/bonnet joint: Flat face with corrugated metallic gasket.

.3 Bonnet studs: to ASTM A193/A193M Type B7.

.4 Bonnet nuts: to ASTM A194/A194M Type 2H.

.5 Stuffing box: including non-galling two-piece ball-jointed packing gland, with swing-type eye bolts and nuts.

.6 Gland packing: containing corrosion inhibitor to prevent stem pitting.

.7 Yoke bushing: Ni-Resist, minimum melting point above 954 degrees C.

.8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.

.9 Disc: Plug type with 15 degrees taper seat and bottom guide or ball type with 35 degrees taper seat.

.10 Seat rings: with 1.6 mm thick cobalt-chromium-tungsten alloy facings with minimum hardness of 375 HB (cold), slipped in, seal welded, ground to match disc.

.11 Stem: heat treated corrosion and heat resistant 13% chromium steel with bonnet bushing, long engagement with yoke bushing for accurate seating, accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.12 Operator: see elsewhere this section.

2.4 VALVE OPERATORS

.1 Handwheel: on all valves except as specified.

.2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in Boiler Rooms and Mechanical Equipment Rooms.

2.5 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.

.2 Position of bypass valve on main valves.

.3 Size of bypass valve:

.1 Main valve up to NPS 8: NPS 3/4.

.4 Type of bypass valves:

.1 On gate valve: globe, with composition disc, bronze trim, to Section 23 05 22 - Valves - Bronze.

.2 On globe valve: globe, with composition disc, bronze trim, to Section 23 05 22 - Valves - Bronze.

2.6 CHECK VALVES

.1 NPS 2 1/2 and over, flanged or butt-weld ends, Class 300: swing check.
- .1 Body and multiple-bolted cap: cast steel to ASTM A216/A216M WCB.
- .2 Cap studs: to ASTM A193/A193M Type B7.
- .3 Cap nuts: to ASTM A194/A194M Type 2H.
- .4 Body/cap joint: male-female face with corrugated metallic gasket.
- .5 Disc: heat treated corrosion and heat resistant 13% chromium steel.
- .6 Seat rings: heat treated corrosion and heat resistant 13% chromium steel, slipped in, seal welded, ground to match disc.
- .7 Hinge: cast carbon steel.
- .8 Hinge pin: stainless steel (410).

2.7 SILENT CHECK VALVES

.1 Construction:
- .1 Body: Cast steel to ASTM A216 WCB with integral seat.
- .2 Pressure rating: Class 300.
- .3 Connections: Flanged or Wafer ends.
- .4 Double bronze disc with SS seat and stem. Renewable disc, seat, stem and spring. Spring rating must match system design for silent operation and installation.
- .5 Stainless steel spring, heavy duty.
- .6 Seat: regrindable.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's recommendations in upright position with stem above horizontal.

.2 Install valves with unions or flanges to each piece of equipment arranged to allow servicing, maintenance, and equipment removal. Refer to Section 23 05 05 Installation of Pipework.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Plug Valves - Lubricated plug valves, Eccentric plug valves.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1-1983 (R2001), Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings.
  .3 ANSI/ASME B16.11-2001, Forged Fittings, Socket-Welding and Threaded.
  .4 ANSI/ASME B16.25-1997, Butt Welding Ends.
  .5 ANSI/ASME B16.34-1996, Valves - Flanged, Threaded and Welding End.
  .6 ANSI/ASME B16.10-2000, Face to Face and End to End Dimensions of Valves.

.2 American Society for Testing and Materials International (ASTM).
  .1 ASTM A126-95 (2000), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
  .3 ASTM B209-04, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry Inc. (MSS).
  .1 MSS SP-78-1998, Cast Iron Plug Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Specifications.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
  .3 Submit data for valves specified this Section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

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

2 Products

2.1 MATERIAL

.1 Valves:
  .1 Except for specialty valves, to be of single manufacturer.
  .2 Products to have CRN registration number.

2.2 ECCENTRIC PLUG VALVES

.1 General:
- .1 Dead-tight shut-off on liquids and gases at pressure differentials up to 1.2 MPa in forward direction, 520 kPa in reverse direction.

.2 Up to NPS 2, screwed ends:
- .1 Body: cast iron to ASTM B209 Class B.
- .2 Plug:
  - .1 NPS 1/2 and 3/4: bronze to ASTM B62.
  - .2 NPS 1 to NPS 2: bronze to ASTM B62.
- .3 Bearings: permanently lubricated, bronze to ASTM B62 in upper and lower journals.
- .4 Seals: double-seal consisting of:
  - .1 Plastic seat coating between plug and body.
  - .2 Resilient seal moulded into groove in plug face.
  - .3 Seal materials: BUNA Stem seals with Neoprene (gas service) plug seals.
  - .4 VITON stem seals with Fluorinated hydrocarbon plug seals (over 149 deg.C).
  - .5 Isobutene Isoprene stem seal with isobutene-isoprene plug seals (up to 121 deg.C)
- .5 End connections: screwed.
- .6 Operators: lever with adjustable memory stop.

.3 NPS 2 1/2 to NPS 4, flanged ends:
- .1 Body: cast iron to ASTM B209 Class B.
- .2 Plug: nickel-plated cast iron to ANSI.
- .3 Bearings: permanently lubricated, bronze to ASTM B62 in upper and lower journals.
- .4 Seals: double-seal consisting of:
  - .1 Plastic seat coating between plug and body.
  - .2 Resilient seal moulded into groove in plug face.
  - .3 Seal materials: BUNA Stem seals with Neoprene plug seals (gas service)
  - .4 VITON stem seals with Fluorinated hydrocarbon plug seals (over 149 deg.C).
  - .5 Isobutene Isoprene stem seal with isobutene-isoprene plug seals (up to 121 deg.C)
- .5 End connections: flanged to ANSI B16.1 or roll grooved.
- .6 Operators: lever.

2.3 LUBRICATED PLUG VALVES

.1 Principle of operation:
- .1 Special sealing compound used to effect tight seal. When line pressure applied to valve in closed position, parallel plug forced against downstream side of valve. The metal-to-metal contact and sealing compound ensures leak-tight seal.

.2 Testing to specifications: MSS SP-78 for non-shock pressure at specified temperature.

.3 End connections:
- .1 NPS 1/2 to 2: screwed ends.
- .2 NPS 2½ to 12: flanged ends.

.4 Valve:
- .1 Body: cast iron to ASTM A126 Class B semi-steel.
- .2 Pressure rating: NPS 1/2 to 12:
  - .1 Screwed end valves: screwed to NPT standards.

.2 Flanged end valves: flanged to ANSI B16.1 Class 300. Flanged valves NPS 2-8 face dimensions in accordance with ANSI B16.10 short pattern, making them interchangeable with Class 300 flanged cast iron gate valves.

.3 Hydrostatic tests: body 300 psig. Seat: 100 psig.

.3 Plug: tapered, with regular pattern port - 90 degrees from full open to fully closed, complete with PFTE thrust ring: 100% full port.

.4 Number of ports: as required.

.5 Ends: with ends screwed to ANSI B1.20.1, butt welding to ANSI B16.25, socket-welding to ANSI B16.11.

.6 Lubrication system, nickel-plated.

.7 Lubricant: to suit type, temperature and pressure of contained fluid.

.8 Provide sealing compound injection gun designed for use with pre-packed sealing compound cartridges and valve fitted with button head nipples and combination sealing screws.

.9 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leakproof operation, and corrosion preventing film. Lubricant receptacle to hold additional lubricant. Lubricant screw for lubrication. Check valve to prevent reverse flow of lubricant. O-rings between body and plug.

.5 Operator:

.1 Up to NPS 5: manual lever.

.6 3 port and 4 port valves:

.1 To be supplied transflow pattern, to allow reduced flow through ports during rotation of plug from one position to another.

.2 Limit stops: to be provided.

.7 Accessories: lubricant gun.

3 Execution

3.1 INSTALLATION OF LUBRICATED PLUG VALVES

.1 Install with line pressure acting to hold plug against body ports which are to be cut-off from higher pressure.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Butterfly Valves.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
  .1 ANSI/ASME B1.20.1-1983 (R2001), Pipe Threads, General Purpose (Inch).
  .2 ANSI/ASME B16.1-1998, Cast Iron Pipe Flanges and Flanged Fittings.
  .3 ANSI/ASME B16.5-03, Pipe Flanges and Flanged Fittings.
  .4 ANSI/ASME B16.11-01, Forged Fittings, Socket-Welding and Threaded.
  .5 ANSI/ASME B16.25-1997, Buttwelding Ends.
  .6 ANSI/ASME B16.34-1996, Valves - Flanged, Threaded and Welding Ends.

.2 American National Standards Institute (ANSI)/American Petroleum Institute (API).
  .1 ANSI/API 609-1997, Lug- and Water-Type Butterfly Valves.

.3 American Society for Testing and Materials International, (ASTM).
  .1 ASTM A126-95 (01), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  .2 ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
  .3 ASTM B209M-04, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  .1 MSS SP-67-02, Butterfly Valves.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Specifications.
  .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
  .3 Submit data for valves specified this section.

.3 Closeout Submittals:
  .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

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

2 Products

2.1 BUTTERFLY VALVES - RESILIENT SEAT - 300 PSIG

.1 Sizes: Lug type: NPS 2 to 48.

.2 Pressure rating: 300 psig at 135 degrees C.

.3 Lug body: 300 ANSI bolt pattern.

.4 Full lug body (threaded).

.5 Application: for on-off service.

.6 Operators:
- .1 NPS 2 - 6: Handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel.
- .2 Install parallel or perpendicular to pipeline.

.7 Designed to comply with MSS SP-67 and API 609.

.8 Compatible with ANSI B16.1 Class 250 (iron) and ANSI B16.5 Class 300 (steel) flanges.

.9 Construction:
- .1 Body: ductile iron.
- .2 Disc: aluminum bronze.
- .3 Seat: EPDM.
- .4 Shaft: NPS 2 - 12: 416 stainless steel.
- .5 Taper pin: 316 SS.
- .6 Blowout proof stem.
- .7 O-Ring: Buna-N.
- .8 Bushings: teflon.
- .9 Disc shall not be pinned to shaft.
- .10 Bubble tight shutoff with downstream flanges removed, class 6 shutoff.

2.2 MOUNTING FLANGES

.1 Class 300 steel to B16.5 pipe flanges.

2.3 ELECTRIC ACTUATORS

.1 Operation: designed to provide precise quarter turn electric operation.
- .1 Torque range: up to 1.130 N-m and speed ranges from 10 seconds to 30 seconds to move from fully open to fully closed.
- .2 Gear train within actuator to provide smooth continuous rotary power stroke for accurate automatic valve positioning. Factory-set, field adjustable cam-actuated travel limit switches to provide precise control of shaft rotation.

.2 Construction:
- .1 Castings: heavy duty industrial grade for rugged use.
- .2 Actuators: continuous duty with high efficiency single phase reversing capacitor motor with thermal overload protection.
- .3 Gears and pinions constructed from hardened steel.
- .4 Gear train to be permanently lubricated.
- .5 Mechanical brake to ensure that gear is locked in precise position.

.3 Electrical:
- .1 Standard voltage: 120 VAC. 60 Hz.
- .2 Control options: 4-20 Ma DC or 0-10 V DC.

.3 CSA approved.
.4 Electrical rating: NEMA IV.

3 Execution

3.1 PREPARATION

.1 Valve and mating flange preparation.
  .1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.
  .2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.
  .3 Install butterfly valves with disc in almost closed position.
  .4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

3.2 INSTALLATION OF VALVES

.1 Install in accordance with manufacturer's instructions.

.2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.

.3 Verify suitability of valve for application by inspection of identification tag.

.4 Mount actuator on to valve prior to installation.

.5 Handle valve with care so as to prevent damage to disc and seat faces.

.6 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.

.7 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

3.3 ACTUATOR INSTALLATION

.1 Electrical connections to be made by actuator manufacturer.

.2 Cycle valve operation from fully closed to fully open then back to fully closed.

.3 At same time, check travel stop settings for proper disc alignment.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 hangers and supports for mechanical piping, ducting and equipment.

.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
- .1 ANSI/ASME B31.1-04, Power Piping.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A125-1996 (R2001), Specification for Steel Springs, Helical, Heat-Treated.
- .2 ASTM A307-04, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .3 ASTM A563-04a, Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
- .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
- .2 ANSI/MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
- .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.6 Underwriter's Laboratories of Canada (ULC)

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:
- .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
- .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
- .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment and prevent vibration.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

.6 Pipe supports shall meet the requirements of ASME B31.1 Power Piping and ASME B31.9 Building Services Piping.
.7 Automatic sprinkler pipe supports shall meet the requirements of NFPA No. 13, Standard for Installation of Sprinkler Systems.
.8 Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.
.9 Select hangers and supports for the service and in accordance with the manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.
.10 Fasten hangers and supports to building steel or structural wood in accordance with the requirements of Structural. Equipment, piping and ductwork shall be supported from the top chords of trusses/beams, supporting off bottom is not permitted, except where specifically noted.
.11 Provide and set sleeves required for equipment, including openings required for placing equipment.
.12 Obtain approval prior to drilling for inserts and supports for piping systems.
.13 Obtain approval prior to using percussion type fastenings.
.14 Use of other piping or equipment for hanger supports is not permitted.
.15 Use of perforated band iron, wire or chain as hangers is not permitted.

1.4 QUALITY ASSURANCE

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

2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ASME B31.1, ASME B31.9 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

.3 Design hangers so they cannot become disengaged by movements of supported pipe.

2.2 PIPE HANGERS

.1 Finishes:
.1 Pipe hangers and supports: galvanized after manufacture.
.2 Use electro-plating galvanizing process or hot dipped galvanizing process.
.3 Ensure steel hangers in contact with copper piping are copper plated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:
.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
.1 Rod: to be UL listed.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:
- .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed to MSS SP69.
- .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.

.4 Upper attachment to concrete:
- .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
- .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed to MSS SP69.

.5 Upper attachment to Modular Structure, wood:
- .1 Ceiling: electro galvanized ceiling flange for threaded rod, Underwriters Laboratories Listed in Canada (cUL). Ensure eye 6 mm minimum greater than rod diameter.
- .2 Side beam/wall: Threaded side beam angle bracket, Underwriters Laboratories Listed in Canada (cUL). Ensure eye 6 mm minimum greater than rod diameter.
- .3 Attachments to suit modular builders requirements.

.6 Shop and field-fabricated assemblies:
- .1 Trapeze hanger assemblies: Steel channels with welded spacers and hanger rods.
- .2 Steel brackets: Welded and wrought steel clamp.

.7 Hanger rods: threaded rod material to MSS SP58:
- .1 Ensure that hanger rods are subject to tensile loading only.
- .2 Provide linkages where lateral or axial movement of pipework is anticipated.
- .3 Threaded both ends, one end or continuous.

.8 Pipe attachments: material to MSS SP58:
- .1 Attachments for steel piping: carbon steel black.
- .2 Attachments for copper piping: copper plated black steel.
- .3 Use insulation shields for hot pipework.
- .4 Oversize pipe hangers and supports.

.9 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
- .1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.10 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.11 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
- .1 Finishes for steel pipework: black.
- .2 Finishes for copper, glass, brass or aluminum pipework: black, with formed portion plastic coated.

.12 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

.13 Wall Support:
- .1 Up to 75 mm: Cast iron hook.
- .2 100 mm and over: Welded steel bracket and wrought steel clamp.

.14 Floor Support:
- .1 Pipe sizes up to 100 mm and all cold pipe sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier to steel support.

.14 Insulation:
- .1 Supports shall be coordinated with requirements of insulation. Oversized hangars are required for all pipe systems that require insulation with a vapour barrier to maintain integrity of vapour barrier.
- .2 Oversized hangars shall also be required for steam pipe systems.

.15 PEX pipe mains and branches running in service spaces (crawlspace, ceiling plenum, etc.) shall be installed in a suitable channel to ensure pipes remain plumb. Channel shall be large enough to house pipe and insulation. Pipe shall be secured to channel.

2.3 WIRE ROPE PIPE AND DUCT HANGERS

.1 Wire Rope Suspension Systems:
- .1 Wire rope suspension systems shall be ULC, CSA and SMACNA approved and tested.
- .2 Wire suspensions systems shall consist of a pre-formed wire rope sling with either a ferruled loop, permanently fixed threaded ¼" (or 3/8") stud, or permanently fixed nipple end with toggle, at one end or hook or eyelet. The end fixings and the wire must be of the same manufacturer. The system is secured and tensioned with a hanger self-locking grip at the other end. System shall incorporate pipe hangars. Pipe hangars shall not penetrate vapour barrier of chilled water pipe insulation.
- .3 Only wire and or supports supplied and or approved, shall be used with the system installed.
- .4 The Contractor shall select the correct specification of wire hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum Safe Working Load Limit (which incorporates a 5:1 safety factor). The correct specification of wire hanger required is determined using the following formula:

  Weight per metre of object suspended (kg) x Distance between suspension points (m) = Weight loading per hanger suspension point (kg)

  Table 1 Wire Hanger Safe Working Loads

Size	Working Load Limit (kg)	Working Load Limit (lbs)
No. 1	0 - 10 kg	0 - 22 lbs
No. 2	10.5 - 45.5 kg	23 - 100 lbs
No. 3	46 - 91 kg	101 - 200 lbs
No. 4	95.5 - 225 kg	210 - 495 lbs
No. 5	225.5 - 325 kg	496 - 715 lbs

- .5 Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the recommendations given in the manufacturer's handbook.
- .6 The Contractor shall select and use the correct length of wire rope required to support the service.
- .7 No in-line joins shall be permitted in the rope.

.8 Solid trapeze hangars may be used to suspend piping routed together, where wire support can be coordinated with ceiling and still ensure pipes are routed at highest point possible (tight to beams).

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: black carbon steel to MSS SP58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:
- .1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:
- .1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.6 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 50 00 - Metal Fabrications.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.10 HOUSEKEEPING PADS

.1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

.2 Concrete: to Section 03 30 00 - Cast-in-place Concrete.

2.11 SLEEVES

.1 Pipes through floors: Form with 18 gauge galvanized steel.

.2 Pipes through beams, walls, fire proofing, footings, potentially wet floor: Form with steel pipe or 18 gauge galvanized steel.

.3 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

2.12 OTHER EQUIPMENT SUPPORTS

.1 Fabricate equipment supports from structural grade steel meeting requirements of Section 05 50 00 - Metal Fabrications.

.2 Submit structural calculations with shop drawings.

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 in accordance with:
  .1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:
- .1 Install on piping systems at pumps, at all vibration isolated equipment and as indicated.

.3 Clamps on riser piping:
- .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
- .2 Bolt-tightening torques to industry standards.
- .3 Steel pipes: install below coupling or shear lugs welded to pipe.
- .4 Cast iron pipes: install below joint.

.4 Clevis plates:
- .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:
- .1 Vertical movement of pipework is 13 mm or more,
- .2 Transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:
- .1 Transfer of load to adjacent piping or to connected equipment is not critical.
- .2 Variation in supporting effect does not exceed 25% of total load.

.8 Installation of Exposed Pipe and Duct Hangers:
- .1 Exposed pipe and duct shall be any pipe/duct visible to the occupants. This does not include piping and ductwork routing above dropped ceilings.
- .2 Exposed Pipe and Duct hangers shall be a Wire Rope Suspension System.

3.3 INSERTS

.1 Use inserts for suspending hangers for reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying pipe over 100 mm.

.3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square steel plate and nut above slab.

3.4 HANGER SPACING

.1 Plumbing piping: to Canadian Plumbing Code, Provincial Code, authority having jurisdiction.

.2 Fire protection: to applicable Fire Code.

.3 Copper piping: up to NPS 1/2: every 1.5 m.

.4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.5 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper	Rod Diameter
up to 32 mm	1.8 m	1.8 m	9.5 mm
38 mm	1.8 m	1.8 m	9.5 mm
50 mm and 63 mm	3.0 m	3.0 m	9.5 mm
75 mm - 100 mm	3.6 m	3.0 m	15.8 mm
150 mm - 200 mm	4.3 m	4.3 m	22.2 mm

.6 Install hangers to provide a minimum 12 mm clear space between finished covering and adjacent work.

3.5 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Use hangers which are vertically adjustable 38 mm minimum after piping is erected.

.5 Support horizontal soil pipe near each hub, with 1.5 m maximum spacing between hangers.

.6 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.

.7 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.8 Where practical, support riser piping independently of connected horizontal piping.

.9 Hangers: Pipe sizes 12 mm to 38 mm: Adjustable wrought steel ring.

.10 Hangers: Pipe sizes 50 mm to 100 mm and Cold Pipe Sizes: Adjustable wrought steel clevis.

3.6 SLEEVES

.1 Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

.2 Extend sleeves through potentially wet floors 25 mm above finished floor level. Caulk sleeves full depth and provide floor plate.

.3 Where piping passes through floor, ceiling or wall close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

.4 Install chrome plated escutcheons where piping passes through finished surfaces.

.5 All penetrations through fire rated walls, floors or partition assemblies shall be sealed/fire stopped with fire stop materials that will remain in place and prevent the passage of smoke, toxic gases, flame, etc., when subjected to the standard test method Can 4-S115, "Standard Method of Fire Tests for Firestop Systems" for a period of time equal to fire protection rating required for the grade of fire separation of the penetrated wall or floor.

.6 Acceptable Product: According to instructions provided, all penetrations in fire rated walls, floors, or partition assemblies shall be sealed/fire stopped with:
- .1 3M Brand Intumescent, "Fire Barrier" Caulk CP-25, Putty 303, Penetration Sealing Systems 7902 or 7904 Series, Composite Sheet CS-195, or Wrap Strip FS-195.
- .2 Tremco Firestop Systems: Fyresil, Fyreshield for penetrations and perimeters. Dymeric ULC, THC 900 ULC

3.7 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.8 FINAL ADJUSTMENT

.1 Adjust hangers and supports:
- .1 Ensure that rod is vertical under operating conditions.
- .2 Equalize loads.

.2 Adjustable clevis:
- .1 Tighten hanger load nut securely to ensure proper hanger performance.
- .2 Tighten upper nut after adjustment.

.3 C-clamps:
- .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:
- .1 Hammer jaw firmly against underside of beam.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Vibration isolation.

1.2 PERFORMANCE REQUIREMENTS

.1 Provide vibration isolation on all mechanical motor driven equipment plus connected piping and ductwork.

.2 Supply vibration isolation equipment and materials by one supplier. Consider side loading of equipment and inertia bases when calculating maximum loads on isolators.

.3 Ensure equipment is sufficiently rigid for isolator point loading.

.4 Provide and install mechanical equipment so that Average Noise Criteria Curves, as outlined in ASHRAE Guide, are not exceeded.

.5 Consider upper floor locations critical unless otherwise indicated.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each.

.3 Product Data: Provide schedule of vibration isolator type with location and load on each.

.4 Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.

.5 Manufacturer's Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements.

1.4 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of isolation including attachment points.

2 Products

2.1 VIBRATION ISOLATORS

.1 Open Spring Isolators:
- .1 Spring Isolators:
  - .1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
  - .2 Code: Colour code springs for load carrying capacity.
- .2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

.3 Spring Mounts: Provide with levelling devices, minimum 6 mm thick neoprene sound pads, and zinc chromate plated hardware.

.4 Sound Pads: Size for minimum deflection of 1.2 mm; meet requirements for neoprene pad isolators.

.2 Restrained Spring Isolators:

.1 Spring Isolators:

.1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.

.2 Code: Colour code springs for load carrying capacity.

.2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

.3 Spring Mounts: Provide with levelling devices, minimum 6 mm thick neoprene sound pads, and zinc chromate plated hardware.

.4 Sound Pads: Size for minimum deflection of 1.2 mm; meet requirements for neoprene pad isolators.

.5 Restraint: Provide heavy mounting frame and limit stops.

.3 Closed Spring Isolators:

.1 Spring Isolators:

.1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.

.2 Code: Colour code springs for load carrying capacity.

.2 Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.

.3 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

.4 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 7 mm clearance.

.4 Restrained Closed Spring Isolators:

.1 Spring Isolators:

.1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.

.2 Code: Colour code springs for load carrying capacity.

.2 Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.

.3 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

.4 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 7 mm clearance and limit stops.

.5 Spring Hanger:

.1 Spring Isolators:

.1 For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.

.2 Code: Colour code springs for load carrying capacity.

.2 Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.

.3 Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators.

.4 Misalignment: Capable of 20 degree hanger rod misalignment.

.6 Neoprene Pad Isolators:
- .1 Rubber or neoprene waffle pads.
  - .1 30 durometer.
  - .2 Minimum 13 mm thick.
  - .3 Maximum loading 275 kPa.
  - .4 Height of ribs: maximum 0.7 times width.
- .2 Configuration: Single layer.

.7 Rubber Mount or Hanger: Moulded rubber designed for 13 mm deflection with threaded insert.

.8 Glass Fibre Pads: Neoprene jacketed pre-compressed moulded glass fibre.

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Install isolation for mechanical motor driven equipment throughout, unless specifically noted otherwise

.3 Install spring hangers without binding.

.4 On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

.5 Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

.6 Provide pairs of horizontal limit springs on fans with more than 1.5 kPa static pressure, and on hanger supported, horizontally mounted axial fans.

.7 Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 1.5 mm maximum clearance. Provide other snubbers with clearance between 4 mm and 7 mm.

.8 Support piping connections to isolated equipment resiliently for scheduled distance.
- .1 Up to 100 mm Diameter: First three points of support.
- .2 125 to 200 mm Diameter: First four points of support.
- .3 250 mm Diameter and Over: First six points of support.
- .4 Static deflection of first point shall be twice deflection of equipment. The next two hangers closest to vibration source shall have the greater deflection of 25 mm static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 25 mm static deflection or 1/2 static deflection of isolated equipment.

.9 Connect wiring to isolated equipment with flexible hanging loop.

3.2 MANUFACTURER'S FIELD SERVICES

.1 Examine systems to Section 01 45 00.

.2 Inspect isolated equipment after installation and submit report. Include static deflections.

3.3 EQUIPMENT ISOLATION SCHEDULE

	ISOLATED EQUIPMENT	BASE Thickness	ISOLATOR Type	Deflection
.1	Outdoor Condensing Units	On concrete pad	Rubber	
.2	Fans	Suspended	Spring	2"

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems

1.2 REFERENCES

.1 ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Submit list of wording, symbols, letter size, and colour coding for mechanical identification.

.3 Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

.4 Product Data: Provide manufacturers catalogue literature for each product required.

1.4 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of tagged valves.

2 Products

2.1 LANGUAGE

.1 Identification in English.

2.2 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification of Natural gas: to CSA/CGA B149.1 and authority having jurisdiction.

.2 Identification of Sprinkler System: to NFPA 13

2.3 NAMEPLATES

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.2 Colours:
- .1 Hazardous: red letters, white background
- .2 Elsewhere: black letters, white background (except where required otherwise by applicable Codes)

.3 Sizes: Conform to following table using a maximum of 25 characters per line.

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

Description: Laminated three-layer plastic with engraved black letters on light contrasting background colour.

2.4 TAGS

.1 Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background colour. Tag size minimum 40 mm diameter.

.2 Control Tag: Laminated plastic card with black letters on light contrasting background colour in multiple lines. Tag size minimum 85mm x 55mm. Inscriptions to include function and (where appropriate) fail-safe position

.3 Metal Tags: Brass with stamped letters; tag size minimum 40 mm diameter with smooth edges.

.4 Chart: Typewritten letter size list in anodized aluminum frame.

2.5 STENCILS

.1 Stencils: With clean cut symbols and letters of following size:

.1 20-30 mm Outside Diameter of Insulation or Pipe: 200 mm long colour field, 15 mm high letters.

.2 40-50 mm Outside Diameter of Insulation or Pipe: 200 mm long colour field, 20 mm high letters.

.3 65-150 mm Outside Diameter of Insulation or Pipe: 300 mm long colour field, 30 mm high letters.

.4 200-250 mm Outside Diameter of Insulation or Pipe: 600 mm long colour field, 65 mm high letters.

.5 Over 250 mm Outside Diameter of Insulation or Pipe: 800 mm long colour field, 90 mm high letters.

.6 Ductwork and Equipment: 65 mm high letters.

.2 Stencil Paint: As specified in Section 09 91 23.

2.6 PIPE MARKERS

.1 Colour: Conform to ASME A13.1.

.2 Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

.3 Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

.4 Underground Plastic Pipe Markers: Bright coloured continuously printed plastic ribbon tape, minimum 150 mm wide by 0.10 mm thick, manufactured for direct burial service.

2.7 CEILING TACKS

.1 Description: Steel with 20 mm diameter colour coded head.

.2 Colour code as follows:
- .1 Yellow - HVAC equipment
- .2 Red - Fire dampers/smoke dampers
- .3 Green - Plumbing valves
- .4 Blue - Heating/cooling valves

2.8 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms: where required to Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend: Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:
- .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
- .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
- .3 Use double-headed arrows where flow is reversible

.5 Extent of background colour marking.
- .1 To full circumference of pipe or insulation.
- .2 Length to accommodate pictogram, full length of legend and arrows.

.6 Extent of background colour marking.

.7 Materials for background colour marking, legend, arrows:
- .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
- .2 Other pipes: pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C

.8 Colours and Legends:
- .1 Where not listed, obtain direction from Departmental Representative.

.2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
City water	Green	CITY WATER
Domestic hot hard water	Green	DOM. HHW
Dom. Hot water recirculation	Green	DOM. HW CIRC
Domestic cold hard water supply	Green	DOM. CHW
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

2.9 IDENTIFICATION OF DUCTING SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast

2.10 VALVES AND CONTROLLERS

.1 Valves to be complete with brass tags with 12 mm stamped identification data filled with black paint coordinated with Valve Tag List.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

.3 Controllers to be complete with controls laminated identification tag.

.4 Identify all control systems components including but not limited to equipment, components, controls, sensors with control tags specified in this section.

2.11 FIRE DAMPERS

.1 All new fire dampers shall be tagged with unique tag (FD-1, FD-2 etc.), 12 mm stamped identification data filled with black paint. Contractor shall compile a Fire Damper Tag List and include in O&M. List to identify fire damper tag and location in building.

2.12 EQUIPMENT WITHIN CEILING SPACE

.1 Provide identification (equipment labels and colour coded dots) on the ceiling for all equipment concealed within a ceiling space in addition to identification on equipment.

.2 Equipment Labels:

.1 Colours: Black lettering on transparent background.

.2 Height of letter: 5 mm.

.3 T-bar ceilings: Label shall be located on the metal ceiling grid beside the ceiling tile that provides service access to the equipment. The label shall include the equipment tag and an arrow indicating the ceiling tile to remove for servicing and access to the equipment.

.4 Solid ceilings: Label shall be located on the trim of the access panel used for servicing the equipment and include the equipment tag.

.3 Colour Coded Dots:

.1 Confirm site standard colour coding with the Departmental Representative prior to commencing work. Coordinate with all trades.

.2 Provide a Legend in the operating and maintenance manual identifying the colour coding utilized on site.

.3 T-bar ceilings: Dot shall be located on the metal ceiling grid beside the ceiling tile that provides service access to the equipment.

.4 Solid ceilings: Dot shall be located on the trim of the access panel used for servicing the equipment.

3 Execution

3.1 PREPARATION

.1 Degrease and clean surfaces to receive adhesive for identification materials.

.2 Prepare surfaces to Section 09 91 23 for stencil painting.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

.3 Install tags with corrosion resistant chain.

.4 Apply stencil painting to Section 09 91 23.

.5 Install plastic pipe markers to manufacturer's written instructions.

.6 Install plastic tape pipe markers complete around pipe to manufacturer's written instructions.

.7 Install underground plastic pipe markers 150 to 200 mm below finished grade, directly above buried pipe.

.8 Identify equipment including air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as small in-line pumps, may be identified with tags.

.9 Identify control panels and major control components outside panels with control tags.

.10 Identify thermostats relating to equipment with nameplates.

.11 Identify valves in main and branch piping with tags.

.12 Identify air terminal units with numbered tags.

.13 Tag automatic controls, instruments, and relays. Key to control schematic.

.14 Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Location of identification not to exceed 6 m on straight runs including risers and drops, adjacent to each valve and Tee, adjacent to each change in direction, at each side of penetration of structure or enclosure, and at each obstruction. Provide additional identification at point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side

.15 Identify ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

.16 Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

.17 Identify electric starting switches and remote push button stations with nametags.

.18 Provide identification on the ceiling for all equipment concealed within a ceiling space in addition to identification on the equipment.

.19 Tag fire dampers sequentially and record on Fire Damper Tag List. Provide copy of list in O&M Manual.

3.3 VALVE, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Owner. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Testing, adjustment and balance of air systems.
.2 Testing, adjustment and balance of water systems.

1.2 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.3 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Consultant within 90 days of award of contract.

.2 Personnel performing TAB shall be qualified to standards of AABC and/or NEBB

.3 Provide documentation confirming qualifications, successful experience.

.4 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
  .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
  .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
  .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.

.5 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.6 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.7 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.8 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.9 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
  .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
  .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.4 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.7 PRE-TAB REVIEW

.1 Review contract documents before project construction is started confirm in writing to Consultant adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Consultant in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.8 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.9 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

1.10 START OF TAB

.1 Notify Consultant 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
- .1 Proper thermal overload protection in place for electrical equipment.
- .2 Air systems:
  - .1 Filters in place, clean.
  - .2 Duct systems clean.
  - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
  - .4 Correct fan rotation.
  - .5 Fire, smoke, volume control dampers installed and open.
  - .6 Coil fins combed, clean.
  - .7 Access doors, installed, closed.
  - .8 Outlets installed, volume control dampers open.
- .3 Liquid systems:
  - .1 Flushed, filled, vented.
  - .2 Correct pump rotation.
  - .3 Strainers in place, baskets clean.
  - .4 Isolating and balancing valves installed, open.
  - .5 Calibrated balancing valves installed, at factory settings.
  - .6 Chemical treatment systems complete, operational.

1.11 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:
- .1 HVAC systems: plus 5 %, minus 5 %.

1.12 ACCURACY TOLERANCES

.1 Measured values accurate to within plus or minus 2 % of actual values.

1.13 INSTRUMENTS

.1 Use accurate instruments for measurements. Prior to TAB, submit to Consultant list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

.4 Provide calibration histories for each instrument. Re-calibration or use of other instruments may be requested when accuracy of readings is questionable.

1.14 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Submit proposed methodology and procedures for performing TAB if different from referenced standard.

1.15 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
- .1 Details of instruments used.
- .2 Details of TAB procedures employed.
- .3 Calculations procedures.
- .4 Summaries.

1.16 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:
- .1 Project record drawings.
- .2 System schematics.

.3 Submit 4 copies of TAB Report to Consultant for verification and approval, in English in D-ring binders, complete with index tabs.

1.17 VERIFICATION

.1 Reported results subject to verification by Consultant.

.2 Provide personnel and instrumentation to verify up to 30 % of reported results.

.3 Number and location of verified results as directed by Consultant.

.4 Pay costs to repeat TAB as required to satisfaction of Consultant.

1.18 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.19 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Consultant.

1.20 AIR SYSTEMS

.1 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.2 Locations of equipment measurements: to include as appropriate:
- .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
- .2 At controllers, controlled device.

.3 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.21 OTHER TAB REQUIREMENTS

.1 Measurement of noise from equipment specified in Division 23.
- .1 As specified elsewhere or as required to prove Noise Performance when operating performance is questioned.

1.22 CLOSEOUT SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Provide copies of complete final TAB report for Operation and Maintenance manual

1.23 BALANCE REPORTS

.1 Balance reports to include the following at minimum (data shall always include design and actual measured data):
- .1 Title Page: Company Name, Address, and Telephone Number; Project Name, Location, Architect, Engineer, and Project Contractor.
- .2 Include types, serial number and dates of calibration of instruments used.
- .3 Air Handling Units (including Roof Top Units): Location, Local Identification, Manufacturer, Model, Size, Arrangement, discharge and class, Supply Air Flow, Return/Exhaust Air Flow, Outside Air Flow, Static Pressures, Fan RPM, inlet and outlet dry bulb and wet bulb temperatures.
- .4 Duct air quantities: Mains, Branches, Outside Air and Exhausts (Maximum and Minimum), Duct sizes; Number of pressure readings; Sum of velocity measurements; Average velocity; duct air flow rate.
- .5 Exhaust Fan Data: Location, Manufacturer, Model, Specified and Actual Air Flow, Static Pressure, and Fan RPM.
- .6 Electric Motors: Manufacturer, HP/BHP, Phase, Voltage, Amperage (maximum operating and full load), RPM, Service Factor, Starter Heater Elements.
- .7 V-Belt Drive: Identification/Location, Driven Sheave Diameter and RPM belt Size and Quantity, Motor Sheave Diameter and RPM.
- .8 Air Inlets and Outlets: Outlet identification location and Designation; Manufacturer's catalogue identification and type; Application factors; air velocities; air flow rates; Deflector vane or diffuser cone settings.
- .9 Pump Data: Location, Identification/Number, Manufacturer, Size/Model, Drive type, Motor type, Flow Rate, Head, BHP, Discharge and Suction Pressure (full flow and no flow).
- .10 Coil Data: Location, Identification/Number, Service, Manufacturer, Element type, Air Flow Rate, Entering Air and Leaving Air Temperatures (dry bulb and wet bulb), Electrical Current at coil, energy transfer at load..
- .11 Terminal Heating/Cooling Equipment with fans (unit heaters, force flows, unit ventilators, fan coils etc.): Location, Identification/Number, Manufacturer, Model, Heat transfer rate, Electrical heating load and air flow.

2 Products

2.1 NOT USED

3 Execution

3.1 PREPARATION

.1 Before adjusting and balancing, verify that systems are complete and operable. Ensure temperature control systems are complete and operable, thermal overload protection is in place, final filters installed, hydronic systems, flushed, filled, and vented.

.2 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.

.3 Recorded data shall represent actually measured, or observed condition.

3.2 GENERAL PROCEDURES

.1 Balance to maximum measured flow, allowable deviation as specified.

.2 Permanently mark settings on valves, splitters, dampers, and other adjustment devices.

.3 Subsequent to correctional work, take measurements to verify balance has not been disrupted or that any such disruption has been rectified.

.4 At final inspection, re-check random selections of data recorded in report. Re-check points of areas as selected and witnessed by the Owner.

.5 Check and adjust systems approximately six (6) months after final acceptance and submit report.

.6 The Balancing Contractor shall include the cost of sheave changes necessary to achieve specified air flow within limits specified.

3.3 AIR SYSTEM PROCEDURES

.1 Adjust air handling and distribution systems to provide required or design supply, return and exhaust air quantities. Permanently mark settings of damper and other adjustment devices allowing settings to be restored.

.2 Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of duct.

.3 Measure air quantities at each air inlet and outlet. Use volume control devices to regulate air quantities.

.4 Vary total system air quantities by adjustment of fan speeds. Where Variable Frequency Drives (VFDs) are installed, utilize VFDs to adjust fan speed. Provide drive changes where required.

.5 Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate - full cooling, and at minimum air flow rate - full heating.

.6 Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

.7 Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

3.4 WATER SYSTEM PROCEDURE

.1 Adjust water systems to provide required or design quantities. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops.

.2 Use calibrated venturi tubes, orifices, or other metered fittings and pressure gauges in conjunction with permanent and portable type flow meters to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

.3 Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

.4 Effect adjustment of water distribution systems by means of balancing cocks, valves and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

.5 Where pump capacity available is less than total flow requirements or individual system parts, full flow in any part may be simulated by temporary restriction of flow to other parts.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and methods for pressure testing ducts over 5 m in length, forming part of a supply, return or exhaust ductwork system directly or indirectly connected to air handling equipment.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
- .1 SMACNA HVAC Air Duct Leakage Test Manual, 1985.

1.3 SUBMITTALS

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

.2 Test Reports: submit test reports indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:
- .1 Submit proposed report form and test report format to Departmental Representative for approval at least three months before proposed date of first series of tests. Do not start tests until approval received in writing from Departmental Representative.
- .2 Prepare report of results and submit to Departmental Representative within 7 days of completion of tests. Include:
  - .1 Schematic of entire system.
  - .2 Schematic of section under test showing test site.
  - .3 Required and achieved static pressures.
  - .4 Orifice differential pressure at test sites.
  - .5 Permissible and actual leakage flow rate (L/s) for test sites.
  - .6 Witnessed certification of results.
- .3 Include test reports in final TAB report.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Manufacturer's field reports specified.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meetings:
- .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) Chart.
  - .1 Verify project requirements.
  - .2 Review installation conditions.
  - .3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 TEST INSTRUMENTS

.1 Test apparatus to include:

.1 Fan capable of producing required static pressure.

.2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.

.3 Flow measuring instrument compatible with the orifice plate.

.4 Calibration curves for orifice plates used.

.5 Flexible duct for connecting to ductwork under test.

.6 Smoke bombs for visual inspections.

.2 Test apparatus: accurate to within +/- 3 % of flow rate and pressure.

.3 Submit details of test instruments to be used to Departmental Representative at least one month before anticipated start date.

.4 Test instruments: calibrated and certificate of calibration deposited with Departmental Representative no more than 28 days before start of tests.

.5 Re-calibrated every six months thereafter.

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 PREPARATION

.1 Do not conceal or cover ductwork or equipment until inspected by consultant and tested.

.2 Provide equipment, materials and labour for tests and pay expenses. Use test instruments by approved laboratory or manufacturer and furnish certificate showing degree of accuracy.

.3 Test instruments shall have been calibrated within one year.

.4 Install permanent gauges and thermometers just prior to tests to avoid changes in calibration.

.5 Before adjusting and balancing, verify that systems are complete and operable. Ensure temperature control systems are complete and operable, thermal overload protection is in place, final filters installed, hydronic systems, flushed, filled, and vented.

.6 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.

.7 Recorded data shall represent actually measured, or observed condition. And shall be included in O&M Manual

3.3 TEST PROCEDURES

.1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.

.2 Section of duct to be tested to include:
.1 Fittings, branch ducts, tap-ins, fire dampers.

.3 Repeat tests until specified leakage at test pressures are attained. Bear costs for repairs and repetition to tests.

.4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.

.5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.4 SITE TOLERANCES

.1 Allowable system leakage tolerances are to follow SMACNA Leakage standards as specified under ductwork.

.2 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.5 TESTING

.1 Test ducts before installation of insulation or other forms of concealment.

.2 Test after seals have cured.

.3 Test when ambient temperature will not affect effectiveness of seals and gaskets.

.4 Low Pressure Ducts: Test for tightness such that leakage is inaudible and not detectable by feel. Check for audible leaks at 250 Pa above duct design operating pressure.

.5 Medium and High Pressure Ductwork: Check for audible leaks. Test for tightness as specified by the SMACNA Manuals at a duct leakage classification of 3 with a static pressure equal to 2 times the external static pressure of the associated air system.

3.6 FIELD QUALITY CONTROL

.1 Performance Verification:
.1 Departmental Representative to witness tests and to verify reported results.
.2 To be certified by same TAB agency approved by Departmental Representative to undertake TAB on this project.

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .1 ANSI/ASHRAE/IESNA 90.1-01, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 American Society for Testing and Materials International, (ASTM)
- .1 ASTM B209M, Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
- .2 ASTM C335, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411, Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C547, Specification for Mineral Fiber Pipe Insulation.
- .6 ASTM C553, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- .7 ASTM C612, Specification for Mineral Fiber Block and Board Thermal Insulation.
- .8 ASTM C795, Specification for Thermal Insulation for Use with Austenitic Stainless Steel.
- .9 ASTM C921-(1998)e1, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

.3 Canadian General Standards Board (CGSB)
- .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).

.5 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701, Thermal Insulation Polyotrene, Boards and Pipe Covering.

1.2 DEFINITIONS

.1 For purposes of this section:
- .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 "EXPOSED" - will mean "not concealed" as defined herein.
- .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.

.2 TIAC Codes:
- .1 CRD: Code Round Ductwork,
- .2 CRF: Code Rectangular Finish.

1.3 SHOP DRAWINGS

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

.2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

1.4 MANUFACTURERS' INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures.

.2 Installation instructions to include procedures used, and installation standards achieved.

1.5 QUALITY ASSURANCE

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

.2 Materials: UL listed; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

.3 Do work to TIAC standards.

.4 Deliver material to job site in original non-broken factory packaging, labelled with manufacturer's density and thickness.

.5 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 deg.C mean temperature when tested in accordance with ASTM C335. Maximum “K” factor to be 0.035 W/m. deg.K (0.24 BTU in/hr/sq.ft. Deg.K) to ASTM C5553.

.3 TIAC Class C-1: Rigid mineral fibre board to ASTM C612, unfaced or faced with vapour retarder jacket; ksi value of 0.035 at 24 degrees C.

.4 TIAC Code C-2: mineral fibre blanket to ASTM C553 with or without factory applied vapour retarder jacket; ksi value of 0.035 at 24 degrees C

.5 Flexible Duct Liner: Flexible non-combustible mineral fiber blanket to ASTM C 1071 Type 1; ksi value of 0.035 at 24 degrees C, 24 kg/cu m minimum density; coated air side for maximum 20.3 m/s air velocity. Minimum NRC value of 0.65 at 25mm to ASTM 423.

.6 Rigid Duct Liner: semi-rigid non-combustible mineral fiber to ASTM C 1071 Type 2; ksi value of 0.035 at 24 degrees C, 48 kg/cu m minimum density; coated air side for maximum 20.3 m/s air velocity. Minimum NRC value of 0.7 at 25mm to ASTM 423.

2.3 JACKETS

.1 Interior Applications:
- .1 Vapour Barrier Jackets: to CGSB 51-GP-52Ma.
- .2 PVC Jackets: One piece, high-gloss pre-moulded type, 0.8 mm (30mls) thick. Jackets exposed to outdoor use or flourescent lighting shall be ultra-violet ray resistant.
- .3 Canvas Jackets: ULC listed treated cotton fabric, 220 g/sq.m. to ASTM C 921
- .4 Aluminum Jackets: 0.51 mm thick; stucco embossed.

.2 Exterior Applications:
- .1 Aluminum Jackets: 0.51 mm thick; stucco embossed.
- .2 Stainless Steel Jackets: Type 304 stainless steel; 0.25 mm thick, stucco embossed
- .3 Outdoor Jacket: Coated glass fibre sheet, 16 kg/sq m.

2.4 ACCESSORIES

.1 Bands: 20 mm wide; 0.38 mm thick stainless steel.

.2 Insulating Cement: Hydraulic setting on mineral wool.

.3 Fibrous Glass Cloth: Untreated; 305 g/sq m weight.

.4 Adhesives: Compatible with insulation, waterproof, fire-retardant type.

.5 Impale Anchors: Galvanized steel, 2 mm diameter with 35mm diameter head, length as required for insulation.

.6 Joint Tape: self adhesive reinforced aluminum, minimum 50mm wide

.7 Tie Wire: stainless steel, 1.5 mm.

.8 Outdoor vapour retarder mastic:
- .1 Vinyl emulsion type acrylic, compatible with insulation
- .2 Fibrous glass cloth

3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards

.2 Apply materials in accordance with manufacturer's instructions and as indicated.

.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
- .1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

.6 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.7 Locate insulation or cover seams in least visible location.

.8 Provide recovering jackets on exposed insulation throughout, including equipment room. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.

.9 External Duct Insulation:
- .1 Secure insulation with vapour barrier with wires and seal jacket joints with vapour barrier adhesive or tape to match jacket.
- .2 Secure insulation without vapour barrier with staples, tape, or wires.
- .3 Install without sag on underside of duct work. Use adhesive or mechanical fasteners to prevent sagging. Seal vapour barrier penetrations with vapour barrier adhesive. Stop and point insulation around access doors and damper operators.

.10 Exposed Rectangular: Secure rigid insulation with 50% coverage of adhesive and 12 gauge galvanized impale anchor tabs on 400 mm (16") centres. Seal joints and breaks with 250 mm (10") wide strips of open mesh glass cloth or tape imbedded between 2 coats of vapour barrier sealant. Point up other joints and breaks with hydraulic setting cement.

.11 Round Duct and Concealed Rectangular Duct: Adhere flexible insulation to ductwork with adhesive applied in 150 mm (6") wide strips on 400 mm (16") centres. Provide 16 gauge annealed tie wire tied, spiral wound or half hitched at 200 mm (8") centres for securing duct insulation until adhesive sets. Butt insulation and seal joints and breaks with 50 mm (2") lap of foil adhered over joint.

.12 Acoustic lining: Apply to interior of ducts where shown.
- .1 Adhere insulation with adhesive for 100 percent coverage. Secure insulation with mechanical fasteners on 375 mm centres maximum on top and side of duct work with dimension exceeding 500 mm. Seal and smooth joints. Seal vapour barrier penetrations with vapour barrier adhesive. Cut off excess fastener length and cover with brush coat of mastic.
- .2 Use 25 mm (1") thick insulation unless otherwise noted.

.3 Provide vapour barrier located on the warm side for outside air intakes.
.4 Ducts with acoustic insulation do not require external thermal insulation
.5 Ductwork dimensions indicated on drawings include insulation thickness.

3.3 INSTALLATION – JACKETS

.1 Install in accordance with TIAC standards and manufacturers written requirements.

.2 Provide recovering jackets on exposed insulation throughout, including equipment room. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

System	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	yes	50
Round cold and dual temperature supply air ducts	C-2	yes	50
Supply, return and exhaust ducts exposed in space being served	none, unless indicated otherwise on drawings		
Mixing plenums	C-1	yes	50
Exhaust duct between fan and louvre/discharge	C-1	Yes	50
Ducts outside building	C-1	Yes	special as required to achieve RSI 4.76 (R-20) to match walls in accordance with NECB requirements.
Acoustically lining	none		25
Domestic Kitchen Range Hood Exhaust	C-1	yes	50

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:
.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.
.1 Finishes: conform to following TIAC codes noted in table:

	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Thermal insulation for piping and piping accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- .1 ASHRAE Standard 90.1-01, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM B209M-04, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
- .2 ASTM C335-04, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411-04, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449/C449M-00, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C533-2004, Calcium Silicate Block and Pipe Thermal Insulation.
- .6 ASTM C547-2003, Mineral Fiber Pipe Insulation.
- .7 ASTM C795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .8 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)
- .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

.4 Department of Justice Canada (Jus)
- .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
- .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.6 Manufacturer's Trade Associations
- .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).

.7 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .3 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings
- .4 CAN/ULC-S702.2-03, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For purposes of this section:
- .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:
- .1 CRF: Code Rectangular Finish.
- .2 CPF: Code Piping Finish.

1.4 QUALITY ASSURANCE

.1 Applicator: Company specializing in mechanical insulation application with three years minimum experience.

.2 Materials: UL listed; flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

.3 Do work to TIAC standards.

.4 Deliver material to job site in original non-broken factory packaging, labelled with manufacturer's density and thickness.

.5 Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre and rock wool.
- .1 TIAC Code A-1; rigid pre-moulded mineral fibre to ASTM C 547 with or without factory applied vapour retarder jacket; ksi value of 0.035 at 24 degrees.

.2 TIAC Code A-2: rigid moulded calcium silicate to ASTM C533 in sections and blocks, and with special shapes to suit project requirements, asbestos free; ksi value of 0.060 at 147 deg.C.
.3 TIAC Code A-3: rigid pre-moulded mineral fibre to ASTM C 547 with or without factory applied vapour retarder jacket for high temperature applications; ksi value of 0.072 at 260 degrees C
.4 TIAC Code A-6: flexible unicellular tubular elastomer to ASTM C534; ksi value of 0.04 at 24 degrees C
.5 TIAC Class C-1: Rigid mineral fibre board to ASTM C612, unfaced or faced with CGSB 51-GP-52Ma vapour retarder jacket; ksi value of 0.035 at 24 deg.C.
.6 TIAC Code C-2: mineral fibre blanket to ASTM C553 with or without factory applied vapour retarder jacket. Thermal conductivity; ksi value of 0.04 at 24 deg.C

2.3 ACCESSORIES

.1 Bands: 20 mm wide; 0.38 mm thick stainless steel.

.2 Insulating Cement: Hydraulic setting on mineral wool.

.3 Fibrous Glass Cloth: Untreated; 305 g/sq m weight.

.4 Adhesives: Compatible with insulation, waterproof, fire-retardant type.

.5 Impale Anchors: Galvanized steel, 2 mm diameter with 35mm diameter head, length as required for insulation.

.6 Joint Tape: self adhesive reinforced aluminum, minimum 50mm wide

.7 Tie Wire: stainless steel, 1.5 mm.

.8 Outdoor vapour retarder mastic:
.1 Vinyl emulsion type acrylic, compatible with insulation
.2 Fibrous glass cloth

2.4 JACKETS

.1 Interior Applications:
.1 Vapour Barrier Jackets: to CGSB 51-GP-52Ma.
.2 PVC Jackets: One piece, high-gloss pre-moulded type, 0.8 mm (30mls) thick. Jackets exposed to outdoor use or flourescent lighting shall be ultra-violet ray resistant.
.3 Canvas Jackets: ULC listed treated cotton fabric, 220 g/sq.m. to ASTM C 921
.4 Aluminum Jackets: 0.51 mm thick; stucco embossed.

.2 Exterior Applications:
.1 Aluminum Jackets: 0.51 mm thick; stucco embossed.
.2 Stainless Steel Jackets: Type 304 stainless steel; 0.25 mm thick, stucco embossed
.3 Outdoor Jacket: Coated glass fibre sheet, 16 kg/sq m.

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 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION ON PIPING

.1 Install materials in accordance with manufacturer's instructions and TIAC National standards.

.2 Continue insulation with vapour barrier through penetrations. pack around pipes with fire proof self-supporting insulation material, properly sealed.

.3 In exposed piping, locate insulation and cover seams in least visible locations.

.4 Provide insulation with vapour barrier when medium conveyed may be below ambient temperature and as noted on schedules.

.5 Insulate fittings and valves on pipe systems.

.6 On insulated piping with vapour barrier, insulate fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints. Cover with open mesh glass cloth sealed with vapour barrier sealant.

.7 On insulated piping without vapour barrier and piping conveying fluids 60 degrees C or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation at such locations.

.8 Provide an insert of cork or other heavy density material not less than 150 mm long, of same thickness and contour as adjoining insulation, between support shield and piping, but under the finish jacket, on piping 50 mm diameter or larger.

.9 Neatly finish insulation at supports, protrusions, and interruptions.

.10 Handicap Plumbing Fixtures: Insulate trap and drain with 25 mm (1") fibreglass insulation complete with high gloss white PVC jacket. Refer to Plumbing specifications.

3.4 INSTALLATION - JACKETS

.1 Install in accordance with TIAC standards and manufacturers written requirements.

.2 Indoor, Concealed Pipes: Apply pipe insulation with an integral all-service jacket complete with vapour barrier if specified. Secure jacketing using appropriate fastenings on approximately 100mm centres. Cover longitudinal and circumferential joints with jacket finishing tape neatly applied. Alternately secure jacketing using integral self-sealing lap and self-sealing circumferential joint strips. Fittings, (valves and strainers if specified) not finished with PVC covers shall be covered with a hard coat cement and finish with treated fitting fabric applied with fabric adhesive. Finish jackets as scheduled.

.3 Indoor, Exposed Applications: Insulate as for concealed applications. Finish jacket to be as indicated in schedule. Where indicated by Architect to be painted, finish insulation with canvas jacket; size for finish painting.

.4 Exterior Applications: Vapour barrier jacket, covered with aluminum jacket with seams located on bottom side of horizontal piping. insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapour barrier cement. Lap joints 75 mm (3") minimum and seal with compatible waterproof lap cement.

.5 Provide recovering jackets on exposed insulation throughout, including equipment room. Insulation located in crawl spaces, shafts and suspended ceiling spaces is not considered exposed. Use pre-sized paper under recovering at uneven insulated surfaces.

.6 Metal Jackets: Over the pipe insulation apply metal jacketing using necessary fastenings on approximately 150mm centres. Over insulated fittings, (valve bodies, valve bonnets, strainers and flanges etc. as specified) apply metal jacket or preformed metal fitting covers to provide a complete jacket system. Secure with necessary fastenings.

.7 PVC Jackets: Over the pipe insulation apply PVC jacketing using necessary fastenings on approximately 100mm centres. Cover longitudinal and circumferential joints with finishing tape neatly applied. Over insulated fittings, valve bodies, valve bonnets, strainers and flanges if specified) apply PVC jacket or preformed PVC fitting covers to provide a complete jacket system. Secure with appropriate fastenings and jacket finishing tape.

3.5 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges, fittings and all associated equipment unless otherwise specified.

.2 TIAC Code: A-1.
- .1 Seals: lap seal adhesive, lagging adhesive.
- .2 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-3.
- .1 Seals: VR lap seal adhesive, VR lagging adhesive.
- .2 Installation: TIAC Code: 1501-C.

.4 TIAC Code: A-6.
- .1 Seals: lap seal adhesive, lagging adhesive.
- .2 Installation: to TIAC standards.

.5 TIAC Code: C-2 vapour retarder jacket.
.1 Seals: lap seal adhesive, lagging adhesive.
.2 Installation: TIAC Code: 1501-C.

.6 TIAC Code: A-2.
.1 Seals: lap seal adhesive, lagging adhesive.
.2 Installation: TIAC Code: 1501-H.

.7 Thickness of insulation as listed in following table.
.1 Run-outs to individual units and equipment not exceeding 4000 mm long.
.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.
.3 Chilled water insulation thicknesses are listed such that a minimum of 25mm is maintained over all fittings, valves and accessories.
.4 Note that in accordance with the National Energy Code of Canada for Buildings HVAC piping located outside the building envelope shall be insulated to the thickness specified for steam over 175 Deg.C. This requirement does not alter the TIAC Code defining the type of insulation to be used.

Application (mm)	Temp deg.C.	TIAC code	Pipe sizes (NPS) & insulation thickness					
		Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over	
Hot Water	60 - 94	A-1	25	38	38	38	38	38
Hot Water	up to 59	A-1	25	25	25	25	38	38
Cold Water		A-3	25	25	25	25	25	25
Refrigerant	4 - 13	A-6	25	25	25	25	25	25
Refrigerant	below 4	A-6	25	25	38	38	38	38
Cooling Coil cond. drain and pan		C-2	25	25	25	25	25	25

.8 Finishes:
.1 Exposed indoors: canvas or PVC
.2 Exposed in mechanical rooms: PVC jacket.
.3 Concealed, indoors: canvas on valves, fittings. No further finish.
.4 Use vapour retarder jacket on TIAC code A-3, A-6 and C-2 insulation compatible with insulation.
.5 Outdoors: water-proof aluminum jacket.
.6 Finish attachments: SS screws, at 150 mm on centre. Seals: wing.
.7 Installation: to appropriate TIAC code CRF/1 through CPF

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

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

END OF SECTION

1 General

1.1 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM E202-04, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.2 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

2 Products

2.1 NOT USED

.1 Not Used.

3 Execution

3.1 PREPARATION

.1 Do not conceal or cover piping, fixtures or equipment until inspected by consultant and tested.

.2 Provide equipment, materials and labour for tests and pay expenses. Use test instruments by approved laboratory or manufacturer and furnish certificate showing degree of accuracy.

.3 Test instruments shall have been calibrated within one year

.4 Install permanent gauges and thermometers just prior to tests to avoid changes in calibration.

.5 Carry out hydraulic tests for 8 hours and maintain pressure. Where leakage occurs, repair and re-test.

.6 Before adjusting and balancing, verify that systems are complete and operable. Ensure temperature control systems are complete and operable, thermal overload protection is in place, final filters installed, hydronic systems, flushed, filled, and vented.

.7 Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Consultant to facilitate spot checks during testing.

.8 Recorded data shall represent actually measured, or observed condition.

3.2 PRESSURE TESTS

.1 Domestic Water Piping: Test to 1-1/2 times maximum working pressure or 1034 kPa (150 psi) water pressure measured at system low point.

.2 Drainage Systems: Test by filling with water to produce water pressure of 30 kPa (10') minimum and 75 kPa (25') maximum. Check for proper grade and obstruction by ball test.

.3 Standpipe System: Test to 2070 kPa water pressure at the valve.

.4 Sprinkler System: Test as required by authorities having jurisdiction.

.5 Control Air Piping: Test to 345 kPa air pressure. Maintain pressure 1 hour with maximum 7 kPa pressure drop.

.6 Refrigerant Piping: Test with nitrogen to 2070 kPa on high pressure side and 1035 kPa on low side and refrigerant halide torch test.

.7 Check system during application of test pressure including visual check for leakage of water test medium, soap bubble test for air or nitrogen test medium and halide torch for refrigerant medium.

.8 During piping system tests, check linear expansion at elbows, U bends, expansion joints, and offsets for proper clearance.

.9 When using water as test medium for system not using water or steam, evacuate and dehydrate the piping and certify the lines are dry. Use agency specializing in this type of work.

.10 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by remaking joints in screwed fittings, cutting out and rewelding welded joints, remaking joints in copper lines. Do not caulk.

.11 Sprinkler system: Test as required by authorities having jurisdiction.

3.3 PERFORMANCE TESTS

.1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required as tests may indicate prior to operating tests.

.2 Lubricate bearings, adjust and/or replace and set direct and "V" belt drives for proper alignment and tension.

.3 Calibrate and adjust thermostats, thermometers, gauges, linkage and dampers. Control valves shall operate freely.

.4 Operate and test motors and speed switches for correct wiring and sequences. Check overload heaters in motor starters.

.5 Replace disposable filters with new testing filters and remove, clean and reinstall washable filters prior to conducting testing.

.6 Clean fan wheel and coils prior to conducting tests.

.7 Remove, clean, and reinstall strainers prior to conducting tests.

.8 Fasten loose and rattling pieces of equipment. Unit heaters, pumps and other equipment shall operate quietly.

.9 Make operating tests for minimum of 5 days during heating season and cooling season of first year of operation and at times when directed, for proper setting of controls under peak load conditions.

.10 Provide services of mechanics and manufacturer's representatives, ladders, tools and associated equipment required to assist the Owner in final tests.

.11 Conduct final operating tests in presence of the Owner. Vary loads to illustrate start-up and shut-down sequence and simulate emergency Conditions for safety shut-downs, with automatic and manual reset. Repair and test defects until satisfactory. Make final adjustments to suit exact building conditions.

.12 Provide manufacturer’s start-ups and reports as specified under specific equipment. Provide copies reports in the Operation and Maintenance Manuals.

.13 Subject gas fired appliances rated in excess of 117 kW to an operational test established by the authority having jurisdiction and to pass this test before being approved for operation.

3.4 POTABLE WATER SYSTEMS

.1 When cleaning is completed and system filled:
- .1 Verify performance of equipment and systems as specified elsewhere in Division 22, 23 or 25.
- .2 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or recharge air chambers. Repeat for each outlet and flush valve.
- .3 Confirm water quality consistent with supply standards, verifying that no residuals remain resulting from flushing and/or cleaning.

3.5 WET AND DRY PIPE SPRINKLER SYSTEM, STANDPIPE AND HOSE SYSTEMS

.1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in Division 23.

.2 Verification of controls, detection devices, alarm devices is specified Division 26.

.3 Demonstrate that fire hose will reach to most remote location regardless of partitions, and obstructions.

.4 Verify operation of interlocks between HVAC systems and fire alarm systems as required by Code or specified.

3.6 SANITARY AND STORM DRAINAGE SYSTEMS

.1 Ensure that traps are fully and permanently primed.

.2 Ensure that fixtures are properly anchored, connected to system.

.3 Operate flush valves and operate each fixture to verify drainage and no leakage.

.4 Cleanouts: refer to Section 22 42 03 - Commercial Washroom Fixtures.

.5 Roof drains:
- .1 Refer to Section 22 42 03 - Commercial Washroom Fixtures.
- .2 Remove caps as required.

3.7 REPORTS

.1 Include record of all tests in Operation and Maintenance Manuals.

3.8 TRAINING

.1 In accordance with Section 21 05 01 - Common Work Results Mechanical.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation procedures for electric heating and cooling controls.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  .2 Instructions: submit manufacturer's installation instructions.
    .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.4 QUALITY ASSURANCE

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

1.5 COORDINATION

.1 All electrical low-voltage control wiring, including interlock wiring, required for the equipment supplied by Mechanical, except where otherwise noted, shall be supplied and installed by Mechanical or their subtrades.

.2 All mechanical control wiring 50 volts or more shall be a minimum of #14 gauge wire. All mechanical control wiring less than 50 volts shall be minimum #18 gauge wire.

.3 All mechanical control wiring installed by mechanical shall conform with the requirements of the local electrical authority and the Division 26 Electrical specifications.

.4 Electrical Contractor: Electrical shall provide the following:
  .1 All power wiring to equipment.
  .2 Wiring of inline control devices on 120 Vac as indicated on drawings (remote solid state speed controllers for fan operation).

2 Products

2.1 THERMOSTAT (LOW VOLTAGE)

.1 Low voltage wall thermostat:
- .1 For use on 24 V circuit at 1.5 A capacity.
- .2 With heat anticipator adjustable 0.1 to 1.2 A.
- .3 Temperature setting range: 10 degrees C to 25 degrees C.
- .4 Without sub-base.

2.2 THERMOSTAT GUARDS

.1 Thermostat guards: Lockable. Slots for air circulation to thermostat.

2.3 LOW LIMIT TEMPERATURE ALARM

.1 Low limit temperature alarm with:
- .1 Rating: 10.2 A at 120 V.
- .2 Sensing bulb and 1.5 m long capillary tube.
- .3 Switching action: manual.
- .4 Temperature setting range: 0 degrees C to 15 degrees C.

2.4 HIGH LIMIT TEMPERATURE ALARM

.1 High limit temperature alarm with:
- .1 Rating 10 A at 120 V.
- .2 Positive lock-out.
- .3 Manual reset only after 14 degrees C drop-in temperature.
- .4 Cutout setting: 50 degrees C.

2.5 ROOF TOP UNIT THERMOSTAT

.1 Programmable low-voltage thermostat/interface to be supplied with RTU, refer to RTU specifications.

2.6 ELECTRIC DUCT COIL CONTROL

.1 Heating coil controller to be supplied with heating coil complete with matched low voltage duct temperature sensor.

2.7 ELECTRIC HEATER LOW VOLTAGE THERMOSTAT

.1 Low voltage adjustable thermostat to be supplied with electric heaters (baseboard, unit heaters, convectors etc.)

.2 Thermostat to be complete with heat anticipator.

.3 Thermostat to be in Celsius.

2.8 MOTORIZED DAMPER ACTUATOR – OUTDOOR AIR INTAKE, CO SENSORS

.1 Mechanical to provide line voltage (120V/1ph) actuator matched to damper.

.2 Actuator to be normally closed.

2.9 DEDICATED ROOM AIR CONDITIONING

.1 Low voltage thermostat to be supplied with Air Conditioner.

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 control devices and wire to equipment.

.2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

.3 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

.4 Install and wire thermostats supplied with mechanical equipment, refer to respective equipment sections.

3.3 ROOF TOP UNIT THERMOSTATS

.1 Thermostats supplied with RTUs to be installed at locations shown on drawings.

.2 Wire from thermostat to roof top unit.

.3 Commission RTU operation and establish programmed schedule for each RTU.

3.4 ELECTRIC DUCT COIL CONTROL

.1 Install duct mounted temperature sensor supplied with heating coil and wire to coil controller.
- .1 Sensor to be installed in accordance with manufacturers requirements
- .2 Wire from thermostat to controller on coil.
- .3 Commission coil operation to maintain discharge temperature of 15 Deg.C.

3.5 EXHAUST FAN CONTROL

.1 Local Switch – Line Voltage
- .1 Local line voltage timed switch to be supplied by mechanical and wired by Electrical.
- .2 Light switch line voltage control to be supplied and wired by electrical.

.2 CO Monitor – Line Voltage
- .1 CO Monitor to be supplied by mechanical and wired by electrical.
- .2 Wire relay from monitor to purge exhaust fan.
- .3 Commission with standard trip points: CO = 25 / 100 ppm, NO2 – 1 / 3 ppm.
- .4 Commission operating delay to be 1 minute.
- .5 Commission high level alarm delay to be 10 minutes.

.6 Commission minimum run time to be 30 minutes.

.3 24/7 Control
.1 Fan to operate 24/7, no control required.

3.6 ELECTRIC HEATER LOW VOLTAGE THERMOSTATS

.1 Install wall mounted adjustable low voltage thermostat supplied with electric heater in locations shown on drawings.
.1 Sensor to be installed in accordance with manufacturers requirements
.2 Wire from thermostat to transformer on heater.
.3 Commission thermostat and ensure heat anticipator is set to electric heat.

3.7 MOTORIZED DAMPER ACTUATOR – EF-05 and EF-06

.1 Mechanical to supply and install damper in ductwork complete with actuator.

.2 Electrical to wire actuator from exhaust circuit (s).

.3 Damper to open when either or both EF-05 and EF-06 is on.

.4 Damper to be closed when both EF-05 and EF-06 are off.

3.8 MOTORIZED DAMPER ACTUATOR – EF-07

.1 Mechanical to supply and install damper in ductwork complete with actuator.

.2 Electrical to wire actuator from exhaust circuit (s).

.3 Damper to open when EF-07 is on.

.4 Damper to be closed when EF-07 is off.

3.9 DEDICATED ROOM AIR CONDITIONER

.1 Install wall mounted adjustable low voltage thermostat supplied with room air conditioner in locations shown on drawings.
.1 Sensor to be installed in accordance with manufacturers requirements
.2 Wire from thermostat to AC unit.
.3 Commission air conditioning system.

3.10 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

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

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Materials and installation for copper tubing and fittings for refrigerant.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
- .1 ASME B16.22-01, Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings.
- .2 ASME B16.24-02, Cast Copper Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
- .3 ASME B16.26-88, Cast Copper Alloy Fittings for Flared Copper Tubes.
- .4 ASME B31.5-01, Refrigeration Piping and Heat Transfer Components.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM A307-04, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 ASTM B280-03, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

.3 Canadian Standards Association (CSA International)
- .1 CSA B52-99, Mechanical Refrigeration Code.

.4 Environment Canada (EC)
- .1 EPS 1/RA/1-96, Environmental Code of Practice for the Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

.5 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.6 Canadian Environmental Protection Act, 1999 with reference to the following Regulations;
- .1 Federal Halocarbon Regulations, 2003 (SOR/2003-289)

1.3 SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
- .2 Submit WHMIS MSDS in accordance with Specifications. Indicate VOC's for adhesive and solvents during application and curing.

.3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

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

.5 Instructions: submit manufacturer's installation instructions.

.6 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Comply with Provincial Regulations and Mechanical Refrigeration Codes.

.2 Qualifications of installer:
- .1 Installing contractor shall have Certificate of Qualification as a Refrigeration Mechanic.
- .2 Contractor must provide list of all installers that will work on refrigeration systems with shop drawings for equipment. List must include photocopy of the refrigeration tech's certificate of registration, along with name and certification number.
- .3 Following installation, the certified refrigeration mechanic(s) will provide verification that they installed the refrigeration system components.

.3 The contractor shall provide the Departmental Representative with a completed Halocarbon Service Record for each piece of Halocarbon containing equipment which requires commissioning and/or decommissioning. All equipment which requires a Leak Test throughout the project will also require the placement of a Leak Test Tag placed on the unit itself. If the equipment is located in an area not protected from the weather, a weatherproof container shall be provided to contain the Leak Test Tag. The Halocarbon Service Record and Leak Test Tag are included in Commissioning Section 01 91 33..

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

1.5 START-UP AND TESTING

.1 Supply initial charge of refrigerant and oil for each refrigeration system. Losses of oil or refrigerant prior to acceptance of equipment or due to defects covered under guarantee shall be replaced. Supply to the Owner, one complete charge of lubricating oil in addition to that placed in the system.

.2 Charge the system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

.3 Shut-down system if initial start-up testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

.4 Provide cooling season start-up, winter season shut-down for first year of operation.

2 Products

2.1 TUBING

.1 Processed for refrigeration installations, deoxidized, dehydrated and sealed.
- .1 Hard copper: to ASTM B280, type ACR.
- .2 Annealed copper: to ASTM B280, with minimum wall thickness as per CSA B52 and ASME B31.5.

2.2 FITTINGS

.1 Service: design pressure 2070 kPa and temperature 121 degrees C.

.2 Brazed:
- .1 Fittings: wrought copper to ASME B16.22.
- .2 Joints: silver solder or copper-phosphorous, 95% Cu-5%P and non-corrosive flux.

.3 Flanged:
- .1 Bronze or brass, to ASME B16.24, Class 150 and Class 300.
- .2 Gaskets: suitable for service.
- .3 Bolts, nuts and washers: to ASTM A307, heavy series.

.4 Flared:
- .1 Bronze or brass, for refrigeration, to ASME B16.26.

2.3 PIPE SLEEVES

.1 Hard copper or steel, sized to provide 6 mm clearance around between sleeve and uninsulated pipe or between sleeve and insulation.

2.4 VALVES

.1 22 mm and under: Class 500, 3.5 Mpa, globe or angle non-directional type, diaphragm, packless type, with forged brass body and bonnet, moisture proof seal for below freezing applications, brazed connections.

.2 Over 22 mm: Class 375, 2.5 Mpa, globe or angle type, diaphragm, packless type, back-seating, cap seal, with cast bronze body and bonnet, moisture proof seal for below freezing applications, brazed connections.

2.5 LIQUID INDICATORS

.1 Liquid indicators shall be double port type with copper or brass body, and flared or solder ends.

.2 Provide removable seal caps on each port to inspect refrigerant condition.

2.6 STRAINERS

.1 Refrigerant strainers shall be angle replaceable cartridge type with brass shell.

.2 Cartridge material and screen size shall be suitable for refrigerant and pipe material utilized in the system.

2.7 FILTER DRIERS

.1 Combination filter driers shall be angle type, with brass shell and incorporate a combined straining and drying material.

.2 Desiccant material shall be replaceable.

2.8 SOLENOID VALVES

.1 Solenoid valves shall have copper or brass body with flared or screwed ends.

.2 Coil assembly shall be replaceable.

.3 Valves shall incorporate a manually operated stem to serve as a bypass in case of coil failure.

2.9 EXPANSION VALVES

.1 Provide angle type or straight through expansion valves suitable for the refrigerant utilized in the system.

.2 Valves shall have brass body, internal or external equalizer, adjustable super-heat setting and be complete with capillary tube and remote sensing bulb.

2.10 CHARGING VALVES

.1 Provide general purpose type refrigerant charging valves with brass body, flared or solder ends and with removable valve core.

.2 Provide valve inlet with quick coupling connection for ease of charging.

2.11 FLEXIBLE CONNECTORS

.1 Flexible connectors shall consist of close pitch corrugated bronze hose with single layer of exterior braiding to provide additional strength and prevent elongation of corrugated section.

.2 Connectors shall be minimum 9" long and provided with bronze fittings to facilitate connection to equipment.

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 GENERAL

.1 Install in accordance with CSA B52, EPS1/RA/1 and ASME B31.5, Section 23 05 01 - Installation of Pipework.

3.3 BRAZING PROCEDURES

.1 Bleed inert gas into pipe during brazing.

.2 Remove valve internal parts, solenoid valve coils, sight glass.

.3 Do not apply heat near expansion valve and bulb.

3.4 PIPING INSTALLATION

.1 General:
- .1 Soft annealed copper tubing: bend without crimping or constriction. Hard drawn copper tubing: do not bend. Minimize use of fittings.

.2 Hot gas lines:
- .1 Pitch at least 1:240 down in direction of flow to prevent oil return to compressor during operation.
- .2 Provide trap at base of risers greater than 2400 mm high and at each 7600 mm thereafter.
- .3 Provide inverted deep trap at top of risers.

.4 Provide double risers for compressors having capacity modulation.
- .1 Large riser: install traps as specified.
- .2 Small riser: size for 5.1 m/s at minimum load. Connect upstream of traps on large riser.

3.5 PRESSURE AND LEAK TESTING

.1 Close valves on factory charged equipment and other equipment not designed for test pressures.

.2 Leak test to CSA B52 before evacuation to 2MPa and 1MPa on high and low sides respectively.

.3 Test Procedure: build pressure up to 35 kPa with refrigerant gas on high and low sides. Supplement with nitrogen to required test pressure. Test for leaks with electronic or halide detector. Repair leaks and repeat tests.

3.6 DX EQUIPMENT START-UP AND TESTING

.1 Refrigeration equipment: Prepare system for start-up by having manufacturer's factory trained representative supervise testing, dehydration and charging of machine. Do start-up including co-ordination on start-up of condensers.

.2 Testing:
- .1 Provide sufficient refrigerant, dry nitrogen and refrigeration oil for pressure and operational testing under manufacturer's supervision.
- .2 Prior to testing ensure that system is complete. Protect relief valves during test procedure. After completion of test, reconnect and make good piping connections and leak test entire system.

3.7 AIR COOLED CONDENSING UNIT

.1 Check unit for damage before and after placement:
- .1 Protect and cover exposed units to the elements during construction.
- .2 Conform to installation drawings. Mount units on roof mounting frame.

3.8 LIQUID INDICATORS

.1 Provide full size liquid indicators in main liquid line leaving condenser. If receiver is used install in liquid line leaving receiver.

3.9 STRAINERS

.1 Provide full size strainer ahead of each automatic valve. Where multiple expansion valves with integral strainers are used, install single main liquid line strainer.

.2 On steel piping systems provide adequate strainer in suction line to remove scale and rust inherent in steel pipe.

.3 Provide shut-off valve on each side of strainer to facilitate maintenance.

3.10 FILTER-DRIERS

.1 Filter-driers may be used in systems instead of separate strainers and driers.

.2 Install with three valve bypass assembly to permit isolation for servicing.

3.11 SOLENOID VALVES

.1 Provide solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

.2 Provide solenoid valves with manually operated stems.

3.12 EXPANSION VALVES

.1 Size expansion valves properly to avoid penalty of being undersized at full load and of being excessively oversized at partial load.

.2 Properly evaluate refrigerant pressure drop through system to determine the available pressure drop across the valve.

.3 Select valves for maximum load at design operating pressure and minimum 7.2 deg.C of superheat.

.4 Locate remote expansion valve sensing bulb immediately after evaporator outlet on suction line.

3.13 CHARGING VALVES

.1 Provide refrigerant charging connections in liquid line between receiver shut-off valve and expansion valve.

3.14 FLEXIBLE CONNECTORS

.1 In general install suction and hot gas piping connections to compressors with three directional changes for distance of minimum six pipe diameters before reaching point of support.

.2 Flexible connectors shall only be utilized at or near compressors where it is not physically possible to absorb vibration within piping configuration.

3.15 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:
- .1 Close service valves on factory charged equipment.

.2 Ambient temperatures to be at least 13 degrees C for at least 12 hours before and during dehydration.

.3 Use copper lines of largest practical size to reduce evacuation time.

.4 Use two-stage vacuum pump with gas ballast on 2nd stage capable of pulling 5Pa absolute and filled with dehydrated oil.

.5 Measure system pressure with vacuum gauge. Take readings with valve between vacuum pump and system closed.

.6 Triple evacuate system components containing gases other than correct refrigerant or having lost holding charge as follows:
- .1 Twice to 14 Pa absolute and hold for 4 h.
- .2 Break vacuum with refrigerant to 14 kPa.
- .3 Final to 5 Pa absolute and hold for at least 12 h.

.4 Isolate pump from system, record vacuum and time readings until stabilization of vacuum.

.5 Submit test results to Departmental Representative.

.7 Charging:

.1 Charge system through filter-drier and charging valve on high side. Low side charging not permitted.

.2 With compressors off, charge only amount necessary for proper operation of system. If system pressures equalize before system is fully charged, close charging valve and start up. With unit operating, add remainder of charge to system.

.3 Re-purge charging line if refrigerant container is changed during charging process.

.8 Checks:

.1 Make checks and measurements as per manufacturer's operation and maintenance instructions.

.2 Record and report measurements Departmental Representative.

.9 Manufacturer's Field Services:

.1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.

.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, at stages listed:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within 3 days of review, and submit, immediately to Departmental Representative.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Metal duct work.
.2 Nonmetal duct work.
.3 Casing and plenums.
.4 Buried duct work.
.5 Kitchen hood duct work.
.6 Duct cleaning.

1.2 REFERENCES

.1 ASTM A36/A36M - Carbon Structural Steel.
.2 ASTM A90/A90M - Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
.3 ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
.4 ASTM A480/A480M - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
.5 ASTM A568/A568M - General Requirements for Steel Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
.6 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.7 ASTM A1008/A1008M - Steel, Sheet, Cold-Rolled Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Formability.
.8 ASTM A1011/A1011M - Standard Specification for Steel, Sheet, and Strip Hot-Rolled, Carbon, Structural, High-Strength, Low-Alloy with Improved Formability.
.9 ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
.10 ASTM C14/C14M - Concrete Sewer, Storm Drain, and Culvert Pipe.
.11 ASTM C443 - Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
.12 AWS D9.1 - Sheet Metal Welding Code.
.13 NBS PS 15 - Voluntary Product Standard for Custom Contact-Moulded Reinforced-Polyestor Chemical Resistant Process Equipment.
.14 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
.15 NFPA 90B - Installation of Warm Air Heating and Air-Conditioning Systems.
.16 NFPA 91 - Exhaust Systems for Air Conveying of Vapours, Gases, Mists, and Noncombustible Particulate Solids.
.17 NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations.
.18 SMACNA - HVAC Air Duct Leakage Test Manual.
.19 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
.20 SMACNA - Fibrous Glass Duct Construction Standards.
.21 UL 181 - Factory-Made Air Ducts and Connectors.

1.3 DEFINITIONS

.1 Low pressure/low velocity: Static pressure in duct less than 498 Pa (2" w.g.) and velocities less than 10 meters/second (2000 fpm).

.2 Medium pressure/high velocity: Static pressure in duct less than 996 Pa (4" w.g.) and velocities between 10 meters/second (2000 fpm) and 20 meters/second (4000 fpm).

.3 High pressure/high velocity: Static pressure in ducts more than 996 Pa (4" w.g.) And velocities greater than 4000 fpm.

.4 Duct sizes: as shown on drawings are outside dimensions. For acoustically lined or internally insulated ducts, sizes shown are actual duct sizes and the insulation thickness has been accounted for.

1.4 PERFORMANCE REQUIREMENTS

.1 No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts to ASHRAE table of equivalent rectangular and round ducts.

1.5 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for 1000 kPa pressure class and higher systems.

.3 Product Data: Provide data for duct materials.

.4 Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

1.6 QUALITY ASSURANCE

.1 Perform Work to SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

.2 Ductwork shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems, and NFPA No. 96, Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapours from Commercial Cooking Equipment

1.7 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Installer: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

.2 Maintain temperatures during and after installation of duct sealants.

2 Products

2.1 DUCT MATERIALS

.1 Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G60 zinc coating to ASTM A90 on both sides.

.2 Steel Ducts: ASTM A1008.

.3 Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061- T6 or of equivalent strength.

.4 Stainless Steel Ducts: ASTM A167, Type 304.

.5 Concrete Ducts: ASTM C14; hub and spigot concrete sewer pipe with ASTM C443 joints, rubber gaskets.

.6 Fasteners: use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

2.2 SEALANT

.1 Oil resistant, water based or solvent based, anti-microbial, anti-bacterial, ultra violet resistant, polymer type, flame resistant duct sealant.

.2 VOC content to be less than VOC limits of the State of California's South Coast Air Quality District Rule #1168. VOC content less than 30 g/L (less water and less exempt compounds) for sealing metal to metal contact.

.3 Sealant shall be cured for a minimum of 48 hours.

.4 Flame Spread Rating: 0 (zero).

.5 Smoke Spread Raring: 0 (zero).

2.3 TAPE

.1 Polyvinyl treated, open weave fibre glass, 50 mm wide.

2.4 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
up to 500	B
Over 500	A

.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.

.3 Class C: transverse joints and connections made air tight with gaskets. Longitudinal seams unsealed.

.4 Unsealed seams and joints.

2.5 DUCT WORK FABRICATION

.1 Fabricate and support to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

.2 Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centreline. Where not possible and where rectangular elbows are used, provide air foil turning vanes.

.3 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 450 mm, cross break for rigidity. Open corners are not acceptable.

.4 Lap metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.5 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

.6 Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints: minimum 100 mm cemented slip joint, brazed or electric welded. Prime coat welded joints.

.7 Provide standard 45 degree lateral wye takeoffs unless duct manufacturer can show 90 degree and tap has less static pressure loss.

.8 Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breath, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.

.9 Provide easements where low pressure ductwork conflicts with piping and structure where easements exceed 10% duct area, split into two ducts maintaining original duct area.

.10 Exposed ductwork to be fabricated from Aluminum for aesthetics.

2.6 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows.
- .1 Rectangular: standard radius with single thickness turning vanes. Centreline radius: 1.5 times width of duct.
- .2 Round: smooth radius. Centreline radius: 1.5 times diameter.
- .3 Oval: 7 gore 90’s, 5 gore 45’s.

.3 Mitred elbows, rectangular:
- .1 To 400 mm: with single thickness Airfoil turning vanes.
- .2 Over 400 mm: with double thickness Airfoil turning vanes.

.4 Branches:
- .1 Rectangular main and branch: with radius on branch 1.5 times width of duct.
- .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: 15 degrees maximum included angle when increasing duct sizes.
- .2 Converging: 45 degrees maximum included angle downstream of equipment.
- .3 Diverging: 30 degrees maximum included angle upstream of equipment.

.6 Offsets:
.1 Full radiused elbows, as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.
.1 Maximum included angles: as for transitions.

2.7 MANUFACTURED DUCT WORK AND FITTINGS

.1 Manufacture to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

.2 Flat Oval Ducts:
.1 Machine made from round spiral lockseam duct with light reinforcing corrugations; fittings manufactured of at least two gauges heavier metal than duct.

.3 Double Wall Insulated Flat Oval Ducts:
.1 Machine made from round spiral lockseam duct with light reinforcing corrugations, galvanized steel outer wall, 25 mm thick fibreglass insulation, perforated galvanized steel inner wall; fittings manufactured with solid inner wall.

.4 PVC Coated Steel Ducts:
.1 UL 181, Class 1, galvanized steel duct coated with polyvinyl chloride plastic, 0.1 mm thick on outside and 0.05 mm thick on inside.

.5 Transverse Duct Connection System:
.1 SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

2.8 CASINGS

.1 Fabricate casings to SMACNA HVAC Duct Construction Standards - Metal and Flexible and construct for operating pressures indicated.

.2 Mount floor mounted casings on 100 mm high concrete curbs. At floor, rivet panels on 200 mm centres to angles. Where floors are acoustically insulated, provide liner of 1.20 mm galvanized expanded metal mesh supported at 300 mm centres, turned up 300 mm at sides with sheet metal shields.

.3 Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection. Provide clear wire glass observation ports, minimum 150 X 150 mm size.

.4 Fabricate acoustic casings with reinforcing turned inward. Provide 1.50 mm back facing and 0.80 mm perforated front facing with 2.4 mm diameter holes on 4 mm centres. Construct panels 75 mm thick packed with 72 kg/cu m minimum glass fibre media, on inverted channels of 1.50 mm.

2.9 FIRESTOPPING

.1 Retaining angles around duct, on both sides of fire separation

.2 Fire stopping material and installation must not distort duct.

2.10 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping Equipment.

.1 Band hangers: use on round and oval ducts up to 500 mm diameter, of same material as duct but next sheet metal thickness heavier than duct.

.2 Trapeze hangers: ducts over 500 mm diameter or longest side, to SMACNA.

.3 Hangers: steel angle with black steel rods to following table.

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 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 clamp or steel plate washer.

.1 Mount to top cord.

.3 For steel beams: manufactured beam clamps:

2.11 WIRE ROPE SUSPENSION SYSTEMS

.1 Wire rope suspension systems shall be ULC, CSA and SMACNA approved and tested.

.2 Wire suspensions systems consist of a pre-formed wire rope sling with either a ferruled loop, permanently fixed threaded 1/4ins (or 3/8ins) stud, or permanently fixed nipple end with toggle, at one end or hook or eyelet. The end fixings and the wire must be of the same manufacturer. The system is secured and tensioned with a hanger self-locking grip at the other end.

.3 Only wire and or supports supplied and or approved, shall be used with the system.

.4 The contractor shall select the correct specification of wire hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum Safe Working Load Limit (which incorporates a 5:1 safety factor). The correct specification of wire hanger required is determined using the following formula:

Weight per metre of object suspended (kg) x Distance between suspension points (m) = Weight loading per hanger suspension point (kg).

Table 1 Wire Hanger Safe Working Loads

Size	**Working Load Limit (kg)** **Working Load Limit (lbs)**
No. 1	0 - 10 kg 0 - 22 lbs
No. 2	10.5 - 45.5 kg 23 - 100 lbs

No. 3	46 - 91 kg 101 - 200 lbs
No. 4	95.5 - 225 kg 210 - 495 lbs
No. 5	225.5 - 325 kg 496 - 715 lbs

(i) Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the recommendations given in the manufacturer's handbook.

.5 The Contractor shall select and use the correct length of wire rope required to support the service.

.6 No in-line joins shall be permitted in the rope.

3 Execution

3.1 GENERAL REQUIREMENTS

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.
.1 Ensure diffuser is fully seated.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints and manufactured equipment in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

.7 At each point where ducts pass through partitions, the joints around the duct shall be sealed with non-combustible material.

3.2 INSTALLATION

.1 Install and seal ducts to SMACNA HVAC Duct Construction Standards - Metal and Flexible according to seal classification specified.

.2 Provide openings in duct work where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated duct work, install insulation material inside a metal ring.

.3 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.4 Use double nuts and lock washers on threaded rod supports.

.5 Provide access doors for inspection.

.6 Tape joints of PVC coated metal duct work with PVC tape.

.7 Connect terminal units to supply ducts directly or with 300 mm maximum length of flexible duct. Do not use flexible duct to change direction.

.8 Connect diffusers to low pressure ducts directly. To decouple diffuser from duct system, use 1.5 m maximum length of flexible duct held in place with caulking compound and strap or clamp. Do not use flexible duct to change direction.

.9 Connect flexible ducts to metal ducts with adhesive and strap or clamp.

.10 Set plenum doors 150 to 300 mm above floor. Arrange door swings so that fan static pressure holds door in closed position.

.11 During construction provide temporary closures of metal or taped polyethylene on open duct work to prevent construction dust from entering duct work system.

.12 Provide floor drains in fresh air coil, and humidifier sections with deep seal traps.

3.3 CLEANING

.1 Clean work to requirements of Division 1 and as detailed herein.

.2 Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

.3 Provide adequate access into duct work for cleaning purposes.

.4 Prior to occupancy and during initial occupancy, building shall be flushed at maximum outdoor air volume. Supply a total of 4,300 cu.m of outdoor air per sq.m of floor area or approximately 30,564,400cu.m of outdoor air or approximately 54 days of flushing. Note that a minimum of 3 weeks of flushing will be required prior to occupancy.

3.4 WATER TIGHT DUCTS

.1 Provide watertight duct for:
- .1 Fresh air intake.
- .2 As indicated.

.2 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 horizontal branch ductwork down towards hoods served.
- .1 Slope header ducts down toward risers.

.4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and discharging to open funnel drain.

3.5 WIRE ROPE SUSPENSION SYSTEMS

.1 The wire hangers shall be fixed to the building structure in accordance with the standard practice and structural limitations.

.2 Loop end can be wrapped around purlins, beams, roof trusses and other accessible building features.

.3 Stud end can be fixed with suitable anchors into concrete ceilings and structures, metal decking and pressed metal brackets (using nuts).

.4 Toggle end can be fixed into profile roof cladding, light fittings and luminaries.

.5 Other wire rope systems can be fixed to an approved structure, as determined by the Departmental Representative.

.6 The wire hangers shall not be fixed to any other services, without the approval of the Departmental Representative.

.7 The free end of the wire rope should be threaded through one channel of the self-locking grip before being either passed around the object being suspended or connected to it, using a suitable fixing. The wire rope is then threaded back through the second channel in the grip until the required level is achieved.

.8 Adjust duct elevations as required to remain level and plumb, the weight of the suspended object must be independently supported while making adjustments.

.9 The wire rope must not be damaged, twisted or deformed in any way prior to, or during, installation. Any such ropes must be discarded and replaced.

.10 When installing wire hangers the angle between the ropes when exiting the grip must never exceed the manufacturer's recommendations and/or 60 degrees.

.11 Lubricants, paint or any other coating shall not be applied to the wire hanger as it may impair its performance.

.12 Wire hangers must be installed in accordance with the manufacturer's loading and installation instructions and all the manufacturer's recommendations.

3.6 LEAKAGE TESTS

.1 Refer to Section 23 05 94.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Do leakage tests in sections.

.4 Make trial leakage tests as instructed to demonstrate workmanship.

.5 Do not install additional ductwork until trial test has been passed.

.6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.

.7 Complete tests before performance insulation or concealment Work.

3.7 SEALANT APPLICATION

.1 Contractor shall apply sealant on exposed ductwork in a 50mm band centered on joint.

.2 Sealant shall be applied evenly with a clean edge finish perpendicular to duct and plumb.

.3 Tape shall be utilized to provide clean edge finish to sealant application.

3.8 SOUND ATTENUATING TRANSFER DUCTS

.1 Sound attenuating transfer air ducts shall be installed where indicated on drawings complete with internal acoustic insulation in accordance with Section 23 07 13.

.2 Elbows on sound attenuating transfer air ducts shall not utilize turning vanes.

.3 Geometry of all sound attenuating transfer air ducts shall ensure that sound contacts a minimum of two duct surfaces.

.4 Provide single elbow configurations or double elbow configurations as indicated on drawings. It is permissible to utilize double elbow configurations in lieu of single elbow but not vice versa.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation of high-pressure metallic ductwork, joints and accessories.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
.2 American Society for Testing and Materials (ASTM).
  .1 ASTM A653/A653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process. (Metric).
.3 Department of Justice Canada (Jus).
  .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  .2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).
.5 Sheet Metal Air Conditioning Contractors' National Association (SMACNA).
  .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible, 95 (Addendum No. 1, (1997).
  .2 SMACNA HVAC Air Duct Leakage Test Manual, 1st Edition 1985.
  .3 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition 1995.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS - Section 02 61 33 - Hazardous Materials for the following:
  .1 Sealants.
  .2 Tape.
  .3 Proprietary joints.
  .4 Fittings.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:
  .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to Codes and Standards.

.2 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

1.5 DEFINITIONS

.1 Low pressure/low velocity: static pressure in duct less than 498 Pa and velocities less than 10 meters/second.

.2 Medium pressure/high velocity: Static pressure in duct less than 996 Pa and velocities between 10 meters/second and 20 meters/second.

.3 High pressure/high velocity: Static pressure in ducts more than 996 Pa and velocities greater than 4000 fpm.

.4 Duct sizes: as shown on drawings are outside dimensions. For acoustically lined or internally insulated ducts, sizes shown are actual duct sizes and the insulation thickness has been accounted for

1.6 QUALITY ASSURANCE

.1 Ductwork shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems, and NFPA No. 96, Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapours from Commercial Cooking Equipment.

.2 Fabricate in accordance with SMACNA duct manuals and ASHRAE handbooks.

1.7 INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

.1 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

2 Products

2.1 GENERAL

.1 Fasteners: Use rivets and bolts throughout; sheet metal screws accepted on low pressure ducts.

.2 Complete metal ducts within themselves with no single partition between ducts. Where width of duct exceeds 450 mm, cross break for rigidity. Open corners are not acceptable.

.3 Lop metal ducts in direction of air flow. Hammer down edges and slips to leave smooth duct interior.

.4 Where 1.5 time radius elbows are not possible and where rectangular elbows possible, use rectangular elbows and provide approved type air foil turning vanes. Where acoustical lining is provided, provide turning vanes of perforated metal type with fibre glass inside.

.5 Rigidly constructed metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so as not to breath, rattle, vibrate or sag. Caulk duct joints and connections with sealant as ducts are being assembled.

2.2 DUCTWORK

.1 Material:
- .1 Galvanized steel with Z90 designation zinc coating lock forming quality: to ASTM A653/A653M.
- .2 Thickness: to SMACNA.

.2 Construction - round and oval.
- .1 Ducts: factory fabricated, spiral wound, with matching fittings and specials to SMACNA.
- .2 Transverse joints up to 900 mm: slip type with tape and sealants.
- .3 Transverse joints over 900 mm: Vanstone.
- .4 Fittings:
  - .1 Elbows: smooth radius or seven-piece (for 90 degrees), five-piece (for 45 degrees). Centreline radius: 1.5 x diameter.
  - .2 Branches: conical transition with conical branch at 45 degrees and 45 degrees elbow.

.3 Construction - rectangular:
- .1 Ducts: to SMACNA.
- .2 Transverse joints: welded or proprietary duct joints to SMACNA seal Class A.
- .3 Fittings:
  - .1 Elbows: smooth radius; centreline radius 1.5 x width of duct. No vanes.
  - .2 Branches: with conical branch at 45 degrees and 45 degrees elbow except where duct manufacturer can show 90 degree and tap has less static pressure loss.

.4 Firestopping:
- .1 50 x 50 x 3 mm retaining angles around duct, on both sides of fire separation.
- .2 Firestopping material must not distort duct.

2.3 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
2500	A
1500	A
1000	A
750	A

.2 Seal classification:
- .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant, gaskets, tape or combination thereof.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with gaskets, sealant, tape or combination thereof.

2.4 SEALANT

.1 Oil resistant, water based, anti-microbial, anti-bacterial, ultra violet resistant, polymer type, flame resistant duct sealant.

.2 VOC content to be less than VOC limits of the State of California's South Coast Air Quality District Rule #1168. VOC content less than 30 g/L (less water and less exempt compounds) for sealing metal to metal contact.

.3 Sealant shall be cured for at minimum of 48 hours.

.4 Flame spread Rating: 0 (zero).

.5 Smoke Spread Rating: 0 (zero).

2.5 TAPE

.1 Polyvinyl treated, open weave fibre glass, 50 mm wide.

2.6 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC air duct leakage test manual.

2.7 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping Equipment.
- .1 Band hangers: use on round and oval ducts up to 500 mm diameter, of same material as duct but next sheet metal thickness heavier than duct.
- .2 Trapeze hangers: ducts over 500 mm diameter or longest side, to SMACNA.
- .3 Hangers: steel angle with black steel rods to following table.

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 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 clamp or steel plate washer.
    - .1 Mount to top cord.
  - .3 For steel beams: manufactured beam clamps:

2.8 WIRE ROPE SUSPENSION SYSTEMS

.1 Wire rope suspension systems shall be ULC, CSA and SMACNA approved and tested.

.2 Wire suspensions systems consist of a pre-formed wire rope sling with either a ferruled loop, permanently fixed threaded 1/4ins (or 3/8ins) stud, or permanently fixed nipple end with toggle, at one end or hook or eyelet. The end fixings and the wire must be of the same manufacturer. The system is secured and tensioned with a hanger self-locking grip at the other end.

.3 Only wire and or supports supplied and or approved, shall be used with the system.

.4 The contractor shall select the correct specification of wire hanger to use for supporting each particular service from table 1 below. Each size is designated with a maximum Safe Working Load Limit (which incorporates a 5:1 safety factor). The correct specification of wire hanger required is determined using the following formula:

Weight per metre of object suspended (kg) x Distance between suspension points (m) = Weight loading per hanger suspension point (kg).

Table 1 Wire Hanger Safe Working Loads

Size	**Working Load Limit (kg)** **Working Load Limit (lbs)**
No. 1	0 - 10 kg 0 - 22 lbs
No. 2	10.5 - 45.5 kg 23 - 100 lbs
No. 3	46 - 91 kg 101 - 200 lbs
No. 4	95.5 - 225 kg 210 - 495 lbs
No. 5	225.5 - 325 kg 496 - 715 lbs

(i) Where the installed wire rope is not vertical then the working load limit shall be reduced in accordance with the recommendations given in the manufacturer's handbook.

.5 The contractor shall select and use the correct length of wire rope required to support the service.

.6 No in-line joins shall be permitted in the rope.

3 Execution

3.1 GENERAL

.1 Do work in accordance with SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.
- .1 Insulate band hangers 100 mm beyond insulated duct.
- .2 Ensure diffuser is fully seated.

.3 Support risers in accordance with SMACNA.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Ensure installation of firestopping does not distort duct.

.6 Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal cam with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

.7 Clean duct systems and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning.

.8 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

.9 Connect terminal units to medium pressure ducts with 300 mm maximum length of flexible duct. Do not use flexible duct to change directions.

.10 At each point where ducts pass through partitions, the joints around the duct shall be sealed with non-combustible material.

3.2 HANGERS

.1 Band hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

.1 Apply sealant in accordance with SMACNA and to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturer's recommendations.

3.4 WIRE ROPE SUSPENSION SYSTEMS

.1 The wire hangers shall be fixed to the building structure in accordance with the standard practice and structural limitations.

.2 Loop end can be wrapped around purlins, beams, roof trusses and other accessible building features.

.3 Stud end can be fixed with suitable anchors into concrete ceilings and structures, metal decking and pressed metal brackets (using nuts).

.4 Toggle end can be fixed into profile roof cladding, light fittings and luminaries.

.5 Other wire rope systems can be fixed to an approved structure, as determined by the Departmental Representative.

.6 The wire hangers shall not be fixed to any other services, without the approval of the Departmental Representative.

.7 The free end of the wire rope should be threaded through one channel of the self-locking grip before being either passed around the object being suspended or connected to it, using a suitable fixing. The wire rope is then threaded back through the second channel in the grip until the required level is achieved.

.8 Adjust duct elevations as required to remain level and plumb, the weight of the suspended object must be independently supported while making adjustments.

.9 The wire rope must not be damaged, twisted or deformed in any way prior to, or during, installation. Any such ropes must be discarded and replaced.

.10 When installing wire hangers the angle between the ropes when exiting the grip must never exceed the manufacturer's recommendations and/or 60 degrees.

.11 Lubricants, paint or any other coating shall not be applied to the wire hanger as it may impair its performance.

.12 Wire hangers must be installed in accordance with the manufacturer's loading and installation instructions and all the manufacturer's recommendations.

3.5 LEAKAGE TESTS

.1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.

.2 In accordance with SMACNA HVAC Duct Leakage Test Manual.

.3 Perform leakage tests in sections.

.4 Perform trial leakage tests, as instructed to demonstrate workmanship.

.5 Do not install additional ductwork until trial tests have been achieved.

.6 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.

.7 Complete tests before performing insulation or concealment Work.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Silencers.

1.2 REFERENCES

.1 AABC - National Standards for Total System Balance.
.2 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
.3 AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
.4 AMCA 302 - Application of Sone Ratings for Non-Ducted Air Moving Devices.
.5 AMCA 303 - Application of Sound Power Level Ratings for Fans.
.6 ANSI S1.1 - Acoustical Terminology.
.7 ANSI S1.8 - Preferred Reference Quantities for Acoustical Levels.
.8 ANSI S1.13 - Measurement of Sound Pressure Levels in Air.
.9 ARI 270 - Sound Rating of Outdoor Unitary Equipment.
.10 ARI 575 - Measuring Machinery Sound Within an Equipment Space.
.11 ASA 16 (ANSI S1.36) - Survey Methods for Determination of Sound Power Levels of Noise Sources.
.12 ASA 47 (ANSI S1.4) - Specification for Sound Level Meters.
.13 ASA 49 (ANSI S12.1) - Preparation of Standard Procedures to Determine the Noise Emission from Sources.
.14 ASHRAE 68 - Laboratory Method of Testing to Determine the Sound Power in a Duct.
.15 ASHRAE Handbook - Systems Volume, Chapter "Sound and Vibration Control".
.16 ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission loss of Building Partitions and Elements.
.17 ASTM E477 - Method of Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
.18 ASTM E596 - Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures.
.19 NEBB - Procedural Standards for Measuring Sound and Vibration.
.20 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate assembly, materials, thicknesses, dimensional data, pressure losses, acoustical performance, layout, and connection details.

.3 Product Data: Provide catalogue information indicating, materials, dimensional data, pressure losses, and acoustical performance.

.4 Design Data: Provide engineering calculations, referenced to specifications and AMCA 301 standards indicating that maximum room sound levels are not exceeded.

.5 Test Reports: Indicate dynamic insertion loss and noise generation values of silencers.

.6 Manufacturer's Installation Instructions: Indicate installation requirements which maintain integrity of sound isolation.

1.4 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of silencers and sound attenuating devices.

1.5 QUALITY ASSURANCE

.1 Perform Work to AMCA 300 standards and recommendations of ASHRAE 68.

1.6 QUALIFICATIONS

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Design application of duct silencers under direct supervision of a Departmental Representative experienced in design of this work and licensed at the place where the Project is located.

2 Products

2.1 DUCT SILENCERS

.1 Description: Duct section with sheet metal outer casing, sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction. Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 Configuration and performance: as noted on equipment schedule, insertion loss to ASTM E477

.3 Materials:

- .1 Outer Casing: Minimum 0.8 mm (22 gauge) thick galvanized steel stiffened as required, with mastic filled lock formed seams, 50 mm long, 2.9 mm slip joints on both ends.
- .2 Inner Casing and Splitters: Minimum 0.6 mm (26 gauge) thick perforated galvanized steel.
- .3 Fill: Formaldehyde free Glass fibre or mineral wool of minimum 64 kg/cu m density.
- .4 Fill Liner: 0.0254 mm Mylar or Tedlar film.

2.2 CROSS TALK SILENCERS

.1 Description: manufactured dual elbow silencer with sheet metal outer casing, sound absorbing fill material, and inner casing of perforated sheet metal; incorporating interior baffles of similar construction. Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible.

.2 Configuration and performance: as noted on equipment schedule, insertion loss to ASTM E477

.3 Materials:

.1 Outer Casing: Minimum 0.8 mm (22 gauge) thick galvanized steel stiffened as required, with mastic filled lock formed seams, 75 mm long, 2.9 mm slip joints on both ends.

.2 Inner Casing and Splitters: Minimum 0.8 mm (22 gauge) thick perforated galvanized steel.

.3 Fill: Formaldehyde free Glass fibre or mineral wool of minimum 64 kg/cu m density.

.4 Specification Based on VAW Model XTS

3 Execution

3.1 INSTALLATION

.1 Install to manufacturer's written instructions.

.2 Support duct silencers independent of duct work with flexible duct connections, lagged with leaded vinyl sheet on inlet and outlet. Refer to Section 23 33 00.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Air turning devices/extractors.
.2 Backdraft dampers.
.3 Combination fire and smoke dampers.
.4 Duct access doors.
.5 Duct test holes.
.6 Fire dampers.
.7 Flexible duct connections.
.8 Volume control dampers.

1.2 REFERENCES

.1 NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
.2 NFPA 92A - Smoke-Control Systems.
.3 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
.4 UL 33 - Heat Responsive Links for Fire-Protection Service.
.5 UL 555 - Fire Dampers.
.6 UL 555S - Smoke Dampers.

1.3 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Provide for shop fabricated assemblies including volume control dampers.

.3 Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

.4 Manufacturer's Installation Instructions: Indicate for dampers including fire and fire/ smoke dampers.

1.4 PROJECT RECORD DOCUMENTS

.1 Section 01 78 00: Submittals for project closeout.

.2 Record actual locations of access doors.

1.5 QUALITY ASSURANCE

.1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

.2 Accessories shall meet the requirements of NFPA 90A, Air Conditioning and Ventilating Systems.

.3 Fabricate in accordance with ASHRAE handbooks and SMACNA duct manuals.

1.6 REGULATORY REQUIREMENTS

.1 Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Section 01 61 00: Transport, handle, store, and protect products.

.2 Protect dampers from damage to operating linkages and blades.

1.8 EXTRA MATERIALS

.1 Section 01 78 00: Submittals for project closeout.

.2 Provide two of each size and type of fusible link.

2 Products

2.1 TURNING VANES

.1 Factory or shop fabricated single thickness or double thickness, to recommendations of SMACNA and as indicated.

.2 Shall be airfoil type.

.3 Where acoustical lining is provided, provide turning vanes of perforated metal type with fibre glass inside.

2.2 BACKDRAFT DAMPERS.

.1 Gravity Backdraft Dampers, Size 450 x 450 mm or Smaller Provided with Air Moving Equipment: Air moving equipment manufacturers standard construction.

.2 Extruded aluminum 6063T5 backdraft damper frame shall not be less than 1.52 mm in thickness. Frame shall be 63.5 mm deep.

.3 Blades shall be extruded aluminum (6063T5) profiles and shall be less than 1.52 mm in thickness.

.4 Blade and side seals shall be extruded silicone. Seals are to be secured in integral slots within the aluminum extrusions.

.5 Bearing system shall be composed of Celcon bearings rotating on zinc-plated 12.7 mm steel pivot points.

.6 Linkage system shall consist of hard alloy aluminum (6005T6) crank arms fastened to zinc-plated steel pivot rods and shall be doubly secured within channel running along top of blade. Large diameter 8.73 mm hard alloy aluminum (6065-T6C) linkage rod shall connect the crank arms by means of a zinc-plated steel trunnion.

.7 Cup point trunnion set screw shall create a compression hard spot where it secures to the linkage rod for a slip-proof grip.

.8 Trunnions shall be zinc-plated to provide a hard, smooth and long-lasting rotating surface.
- .1 Performance:
- .2 Temperature range: -40 deg.C to 100 deg.C.
- .3 Leakage: 101.2 l/s per square meter at 0.25 kPa.
- .4 Pressure Drop: less than 24.9 Pa.

.9 Backdraft dampers shall be made to size required. Minimum section size shall be 152 mm wide x 152 mm high. Maximum section size shall be 914 mm wide by 3658 mm high. Mullion breaks shall be used when damper height exceeds 1220 mm.

.10 Backdraft dampers with dimensions greater than maximum section size shall be manufactured in multiple sections. Multiple sections are not interlinked or connected. To install, each section must be individually fastened to a structural frame prepared on site.

.11 Fully adjustable device to permit setting for varying differential static pressures less than 2.49 Pa.

2.3 DUCT ACCESS DOORS

.1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.2 Access doors to be ULC labelled.

.3 Fabrication for un-insulated ducts: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices.

.4 Fabrication for insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation with sealing gaskets and quick fastening locking devices.

.5 Gaskets: neoprene.

.6 Hardware:
- .1 Less Than 300 mm Square: Secure with sash locks complete with safety chain.
- .2 Up to 450 mm Square: Provide two hinges and two sash locks.
- .3 451 to 1000 mm: piano hinge and minimum two sash locks.
- .4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
- .5 300 x 300 mm glass viewing panels where indicated.
- .6 Hold open devices.

.7 Access doors with sheet metal screw fasteners are not acceptable.

2.4 DUCT TEST HOLES

.1 Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

.2 Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.5 FLEXIBLE DUCT CONNECTIONS

.1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.2 Connector:
- .1 Fabric: cUL listed fire-retardant self extinguishing neoprene coated woven glass fibre fabric to NFPA 90A, minimum density 1.0 kg/sq m. Approximately 50 mm of fabric clenched by means of double locked seams.

.2 Frame: 75 mm wide, 0.6 mm thick galvanized sheet metal.
.3 Attach edging strip to ducting and equipment by screws or bolts at 150 mm (6") intervals

.3 Leaded Vinyl Sheet: Minimum 14 mm0.55 inch thick, 4.2 kg/sq m0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.6 DRYER VENT

.1 Provide stainless steel side wall commercial dryer vent complete with backdraft damper, wind guard, and rain cap. Vent to be minimum 26 gauge metal.

3 Execution

3.1 INSTALLATION

.1 Install accessories to manufacturer's written instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

.2 Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

3.2 ACCESS DOORS

.1 Provide adequately sized duct access doors for inspection and cleaning.

.2 Sizes:
.1 600 x 600 mm for person size entry.
.2 900 x 900 mm for servicing entry.
.3 300 x 300 mm for viewing.
.4 As indicated.

.3 Locations (before and after):
.1 Fire and smoke dampers (install at fire dampers).
.2 Control dampers.
.3 Devices requiring maintenance.
.4 Required by code.
.5 Reheat coils.
.6 Filters.
.7 To facilitate cleaning of ductwork (minimum
.8 Elsewhere as indicated.

.4 Provide 100 mm x 100 mm (4" x 4") quick opening access doors for inspection at balancing dampers, before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust duct work to NFPA 96. Provide minimum 200 x 200 mm size for hand access, 450 x 450 mm size for shoulder access, and as indicated. Provide 100 x 100 mm for balancing dampers only. Review locations prior to fabrication.

3.3 TEST PORTS

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.2 Provide duct test ports where indicated and required for testing and balancing purposes.

.3 Install insulation port extensions as required.

.4 Locations:
- .1 For traverse readings:
  - .1 Ducted inlets to roof and wall exhausters.
  - .2 Inlets and outlets of other fan systems.
  - .3 Main and sub-main ducts.
  - .4 And as indicated.
- .2 For temperature readings:
  - .1 At outside air intakes.
  - .2 In mixed air applications in locations as approved by Departmental Representative.
  - .3 At inlet and outlet of coils.
  - .4 Downstream of junctions of two converging air streams of different temperatures.
  - .5 And as indicated.

3.4 FLEXIBLE CONNECTORS

.1 Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators, including but not limited to the following:
- .1 Inlets and outlets to supply air units and fans.
- .2 Inlets and outlets of exhaust and return air fans.
- .3 As indicated.

.2 Length of connection: 100 mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:
- .1 Ducting on sides of flexible connection to be in alignment.
- .2 ensure slack material in flexible connection.

.6 For fans developing static pressures of 1250 Pa and over, cover connections with leaded vinyl sheet, held in place with metal straps.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA).
- .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-1985.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures..
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

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

2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 MANUAL VOLUME CONTROL DAMPERS.

.1 Fabricate to SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

.2 Splitter Dampers:
- .1 Fabricate from same material as duct but one sheet metal thickness heavier (minimum 16 gauge), with appropriate stiffening to avoid vibration.
- .2 Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous piano hinge.
- .3 Operator: Minimum 6 mm diameter rod in self aligning, universal joint action, flanged bushing with set screw and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Folded leading edge.
- .6 Size on basis of straight air volume proportioning.

.3 Single Blade Dampers:
- .1 Fabricate for duct sizes up to 150 (in depth) x 760 mm.
- .2 Fabricate from same material as duct, but one sheet metal thickness heavier (minimum 16 gauge). V-groove stiffened.
- .3 Size and configuration to recommendations of SMACNA
- .4 Locking quadrant with shaft extension to accommodate insulation thickness.
- .5 Inside and outside nylon end bearings.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

.4 Multi-Blade Damper:
- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100 mm
- .4 Bearings: self-lubricating oil impregnated nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

.5 End Bearings: Except in round duct work 300 mm and smaller, provide end bearings.

.6 Quadrants:
- .1 Provide locking, indicating quadrant regulators on single and multi-blade dampers.
- .2 On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
- .3 Where rod lengths exceed 750 mm provide regulator at both ends.

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 specified, where required for balancing and where indicated on drawings.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Use splitter dampers only where indicated.

.4 Provide commercial balancing dampers on all low velocity duct take-offs to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly unless specifically noted otherwise.

.5 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts. Where indicated on the drawings, a balancing damper is not required for runouts in non-accessible ceiling spaces provided a damper is specified on the register and diffuser.

.6 Dampers: shall be installed vibration free.

.7 Ensure damper operators are observable and accessible. Provide access doors in ceilings/ walls where required.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Operating dampers for mechanical forced air ventilation and air conditioning systems.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM A653/A653M-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 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals
- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

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

2 Products

2.1 MULTI-LEAF DAMPERS

.1 Opposed airfoil blade type as indicated.

.2 Extruded aluminum (6063T5) damper frame shall not be less than 2.03 mm thickness. Damper frame to be 100 mm deep.

.3 Blades to be extruded aluminum (6063T5) profiles. Aluminum end caps are to be press fitted to blade ends, in order to seal hollow interior and reduce air leakage rate.

.4 Blade and frame seals shall be of extruded silicone. Seals are to be secured in an integral slot within the aluminum extrusions.

.5 Bearings are to be composed of a Celcon inner bearing fixed to a 11.11 mm aluminum hexagon blade pin, rotating within a polycarbonate outer bearing inserted in the frame, resulting in no metal-to-metal or metal-to-plastic contact.

.6 Linkage hardware shall be installed in the frame side and constructed of aluminum and corrosion-resistant, zinc-plated steel, complete with cup-point trunnion screws for a slip-proof grip.

.7 Standard air leakage data to be certified under the AMCA Certified Ratings Program.

.8 Dampers shall be made to size required without blanking off free area.

.9 Intermediate or tubular steel structural support is required to resist applied pressure loads for dampers that consist of two or more sections in both height and width.

.10 Operator: to Division 25.

.11 Insulated aluminum dampers:
- .1 Frames: insulated with extruded polystyrene foam with RSI 0.88.
- .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, RSI 0.88.

.12 Performance:
- .1 Temperature Range: -40 deg.C to 100 deg.C.
- .2 Leakage: 15.2 l/s per sq.meter at 0.25 kPa, 40.5 l/s per sq.meter at 1.0 kPa. Shall meet Class 1A at 0.25 kPa.
- .3 Pressure Drop: less than 4 Pa at 5.08 m/s.

2.2 DISC TYPE DAMPERS

.1 Frame: insulated brake formed, welded, 1.6 mm thick, galvanized steel to ASTM A653/A653M.

.2 Disc: insulated spin formed, 1.6 mm thick, galvanized steel to ASTM A653/A653M.

.3 Gasket: extruded neoprene, field replaceable, with 10 year warranty.

.4 Bearings: roller self lubricated and sealed.

.5 Operator: compatible with damper, linear stroke operator, spring loaded actuator, zinc-aluminum foundry alloy casting cam follower.

.6 Performance:
.1 Leakage: in closed position less than 0.001 % of rated air flow at .25 kPa pressure differential across damper.
.2 Pressure drop: at full open position less than 5 Pa differential across damper at 5.08 m/s.

2.3 BACKDRAFT DAMPERS

.1 Extruded aluminum 6063T5 backdraft damper frame shall not be less than 1.52 mm in thickness. Frame shall be 63.5 mm deep.

.2 Blades shall be extruded aluminum (6063T5) profiles and shall be less than 1.52 mm in thickness.

.3 Blade and side seals shall be extruded silicone. Seals are to be secured in integral slots within the aluminum extrusions.

.4 Bearing system shall be composed of Celcon bearings rotating on zinc-plated 12.7 mm steel pivot points.

.5 Linkage system shall consist of hard alloy aluminum (6005T6) crank arms fastened to zinc-plated steel pivot rods and shall be doubly secured within channel running along top of blade. Large diameter 8.73 mm hard alloy aluminum (6065-T6C) linkage rod shall connect the crank arms by means of a zinc-plated steel trunnion.

.6 Cup point trunnion set screw shall create a compression hard spot where it secures to the linkage rod for a slip–proof grip.

.7 Trunnions shall be zinc-plated to provide a hard, smooth and long-lasting rotating surface.

.8 Performance:
.1 Temperature range: -40 deg.C to 100 deg.C.
.2 Leakage: 101.2 l/s per square meter at 0.25 kPa.
.3 Pressure Drop: less than 24.9 Pa.

.9 Backdraft dampers shall be made to size required. Minimum section size shall be 152 mm wide x 152 mm high. Maximum section size shall be 914 mm wide by 3658 mm high. Mullion breaks shall be used when damper height exceeds 1220 mm.

.10 Backdraft dampers with dimensions greater than maximum section size shall be manufactured in multiple sections. Multiple sections are not interlinked or connected. To install, each section must be individually fastened to a structural frame prepared on site.

.11 Fully adjustable device to permit setting for varying differential static pressures less than 2.49 Pa.

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.

.6 Install insulated dampers at interface with outdoors including outdoor air intakes, exhaust ducts, and relief ducts.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Fire and smoke dampers, and fire stop flaps.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
- .1 ANSI/NFPA 90A-2002, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.3 Underwriters Laboratories of Canada (ULC)
- .1 CAN4-S112-M1990, Fire Test of Fire Damper Assemblies.
- .2 CAN4-S112.2-M84, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
- .3 ULC-S505-1974, Fusible Links for Fire Protection Service.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate the following:
  - .1 Fire dampers.
  - .2 Smoke dampers.
  - .3 Fire stop flaps.
  - .4 Operators.
  - .5 Fusible links.
  - .6 Design details of break-away joints.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

.3 Closeout Submittals:
- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

.2 Provide a Fire Damper Schedule identifying the following: damper tag, duct size, location, access door size, location.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - 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 signifying adherence to codes and standards.

1.5 MAINTENANCE

.1 Extra Materials:
- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide following:
  - .1 Six (6) fusible links of each type.

2 Products

2.1 FIRE DAMPERS

.1 Fabricate to NFPA 90A and as indicated.

.2 Fire dampers: arrangement Type A, B and C, listed and bear label of ULC, UL, Warnock Hersey, meet requirements of authorities having jurisdiction. Fire damper assemblies fire tested in accordance with CAN4-S112. Fusible links on fire dampers shall be constructed to ULC Standard S505.

.3 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation
- .1 Fire dampers: 1-1/2 hour fire rated unless otherwise indicated or required.
- .2 Fire dampers: automatic operating type and have dynamic rating suitable for maximum air velocity and pressure differential to which it will be subjected.

.4 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.

.5 Ceiling Dampers: Galvanized steel, 0.76 mm frame and 1.5 mm flap, two layers 3.2 mm ceramic fibre on top side, and one layer on bottom side for round flaps, with locking clip

.6 Horizontal Dampers: Galvanized steel, 0.76 mm frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

.7 Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 250 Pa pressure class ducts up to 300 mm in height.

.8 Multiple Blade Dampers: 1.5 mm galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 3.2 x 12.7 mm plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

.9 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.10 Fusible Links: separate at 71 degrees C (161 Deg.F.) with adjustable link straps for combination fire/balancing dampers.

.11 Fire dampers in low pressure ductwork may be multi-blade, offset butterfly of curtain type.

.12 Fabricate combination fire and balancing dampers with linkage readily adjustable in open position.

.13 50 x 50 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.14 Equip fire dampers with steel sleeve and frame installed disruption ductwork (breakaway ductwork) to ensure damper operation is not impaired. Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening, except where noted otherwise. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.

.15 Fire dampers mounted on through the ceiling/floor security grilles shall utilize the security grille frame as the sleeve through the rated structure. Fire damper to be mounted on the service side to the security grille frame.

2.2 COMBINATION FIRE AND SMOKE DAMPERS

.1 Fabricate to NFPA 90A, UL 555, UL 555S, and as indicated.

.2 Provide factory sleeve and collar for each damper.

.3 Multiple Blade Dampers: Fabricate with 1.5 mm galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 3.2 x 12.7 mm plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 12.7 mm actuator shaft.

.4 Smoke Rating: Leakage Class III Smoke Damper in accordance with UL555S. A Class lll smoke damper leaks no more than 80 cubic feet per minute (2.27 m^3/min) at 4 in. wg. (1 kPa.) differential pressure

.5 Operators: UL listed and labelled Electric 24V, 60 Hz, two-position, fail close, externally mounted.

.6 Duct Smoke Detector: Factory mounted duct smoke detector with no minimum velocity requirement and complete with single point low voltage electrical connection. Sensor to be photoelectronic type.

.7 Normally Open Smoke Responsive Fire Dampers: opposed blades complete with factory mounted actuator, flexible stainless steel blade edge seals to provide constant sealing pressure.

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 Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

.2 Install fire dampers and combination smoke and fire dampers to ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.3 Maintain integrity of fire separation.

.4 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.5 Install access door adjacent to each damper.

.6 Co-ordinate with installer of firestopping.

.7 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.8 Install break-away joints of approved design on each side of fire separation.

.9 Contractor to individually tag each and every fire damper and provide a fire damper schedule in the Operation and Maintenance manual showing tag, size, type and location.

.10 Contractor shall tag fire damper and access door with fire damper tag.

.11 Demonstrate re-setting of fire dampers to Owner's representative.

.12 Where required by authority, seal dampers against smoke with non-intumescent (non-expanding) fire rated sealant.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and installation of flexible ductwork, joints and accessories.
.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

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

.2 Department of Justice Canada (Jus).
  .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  .2 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  .1 Material Safety Data Sheets (MSDS).

.4 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 Installation of Warm Air Heating and Air-Conditioning Systems.

.5 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).
  .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 95 (Addendum No.1, November 1997).
  .2 SMACNA IAQ Guideline for Occupied Buildings under Construction, 1st Edition 1995.

.6 Underwriters' Laboratories Inc. (UL).
  .1 UL 181-96, Standard for Factory-Made Air Ducts and Air Connectors.

.7 Underwriters' Laboratories of Canada (ULC).
  .1 CAN/ULC-S110-1986 (R2001), Fire Tests for Air Ducts.

1.3 SUBMITTALS

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

.2 Product Data: submit WHMIS MSDS in accordance with Section 02 81 01 - Hazardous Materials for the following:
  .1 Thermal properties.
  .2 Friction loss.
  .3 Acoustical loss.
  .4 Leakage.
  .5 Fire rating.

.3 Samples: submit samples with product data of different types of flexible duct being used in accordance with Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE

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

.2 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

2 Products

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 FLEXIBLE DUCT MATERIALS

.1 Two ply vinyl film supported by helically wound spring steel wire.
- .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
- .2 Maximum Velocity: 20.3 m/sec.
- .3 Temperature Range: -23 to 71 degrees C.

.2 ULC Labeled, black polymer film supported by helically wound spring steel wire.
- .1 Pressure Rating: 1000 Pa positive and 175 Pa negative.
- .2 Maximum Velocity: 20.3 m/sec.
- .3 Temperature Range: -28 to 79 degrees C.

.3 ULC labeled, multiple layers of aluminum laminate supported by helically wound spring steel wire.
- .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
- .2 Maximum Velocity: 20.3 m/sec.
- .3 Temperature Range: -28 to 99 degrees C.

2.3 INSULATED FLEXIBLE DUCT MATERIALS

.1 Two ply vinyl film supported by helically wound spring steel wire; fibreglass insulation; polyethylene vapour barrier film.
- .1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
- .2 Maximum Velocity: 20.3 m/sec.
- .3 Temperature Range: -23 to 71 degrees C.

.2 Black polymer film supported by helically wound spring steel wire; fibreglass insulation; polyethylene vapour barrier film.
- .1 Pressure Rating: 1000 Pa positive and 175 Pa negative.

.2 Maximum Velocity: 20.3 m/sec.
.3 Temperature Range: -28 to 79 degrees C.

.3 Multiple layers of aluminum laminate supported by helically wound spring steel wire; fibreglass insulation; polyethylene vapour barrier film.
.1 Pressure Rating: 2.50 kPa positive and 250 Pa negative.
.2 Maximum Velocity: 20.3 m/sec.
.3 Temperature Range: -28 to 99 degrees C.

Part 3 Execution

3.1 DUCT INSTALLATION

.1 Install in accordance with: SMACNA.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Centrifugal fans.
.2 Roof and Wall Exhausters.
.3 Axial fans.
.4 Propeller fans.
.5 Fan accessories.
.6 Roof curbs.
.7 Motors and Drives.
.8 Cabinet Exhaust Fans

1.2 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

.3 Product Data:
- .1 Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, and electrical characteristics and connection requirements.
- .2 Provide data of filter media, filter performance data, filter assembly, and filter frames.
- .3 Provide fan curves with specified operating point clearly plotted.
- .4 Submit sound power level data for both fan outlet and casing radiation at rated capacity.
- .5 Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1.3 SOURCE QUALITY CONTROL

.1 Fans used shall not decrease motor size, increase noise level, increase tip speed by more than 10 percent or increase inlet air velocity by more than 20 percent, from specified criteria; and capable of accommodating static pressure variations of plus or minus 10 percent.

1.4 OPERATION AND MAINTENANCE

.1 Submit operation and maintenance data to requirements of Section 01 78 00.

.2 Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

2 Products

2.1 CENTRIFUGAL FANS

.1 Wheel and Inlet
- .1 Backward Inclined: Steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded or riveted to flange and back plate, cast hub riveted to back plate and keyed to shaft with set screws.
- .2 Forward Curved: Steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of air flow, mechanically secured to flange and back plate, steel hub swaged to back plate and keyed to shaft with set screw.
- .3 Airfoil Wheel: Steel construction with smooth curved inlet flange, heavy back plate, die formed hollow airfoil shaped blades continuously welded at tip, flanged and back plate, cast hub riveted to back plate and keyed to shaft with set screws.

.2 Housing
- .1 Heavy gage steel, spot welded, designed to minimize turbulence with spun inlet bell and shaped cut-off.
- .2 Factory finish before assembly in prime coated. For fans handling air downstream of humidifiers, provide two additional coats of paint. Prime coating on aluminum parts is not required.
- .3 Provide bolted construction with horizontal flanged split housing.
- .4 Fabricate plug fans without volute housing, with steel cabinet, lined.
- .5 Shafts: Hot rolled steel, ground and polished, with key-away and protectively coated with lubricating oil.
- .6 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed, variable and adjustable pitch sheaves for motors 11.2 kW and under, fixed sheaves for 15 kW and over, matched belts, drive rated minimum 1.5 times nameplate rating of the motor.
- .7 Belt Guards: Fabricate to SMACNA Low Pressure Duct Construction Standards.

.3 Accessories
- .1 Adjustable Inlet Vanes: Steel construction with blades supported at both ends with two permanently lubricated bearings, variable mechanism terminating in single control lever with control shaft for double width fans.
- .2 Discharge Dampers: Opposed blade heavy duty steel dampers assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever.
- .3 Inlet/Outlet Screens: Galvanized steel welded grid.
- .4 Access Doors: Shaped to conform to scroll with quick opening latches and gaskets.
- .5 Scroll Drain: 15 mm steel pipe coupling welded to low point of fan scroll.

2.2 AXIAL FANS

.1 Hub and Impeller
- .1 Airfoil Impeller Blades: Adjustable die cast aluminum alloy or welded steel die formed blades with belt drive.
- .2 Hub: Die cast aluminum alloy or cast iron hub or with belt drive of spun, welded steel, bored and keyed to shaft.

.3 Controllable Pitch Assemblies: Incorporate ball bearing, counterbalanced blade and variable pitch assembly into hub with mechanical link to casing exterior mounted actuator, or pneumatic or electric actuator incorporated within hub.

.2 Casing
- .1 Casing: 6 mm steel for fans 1000 mm in diameter and smaller and 0.9 mm steel for larger fans.
- .2 Fabrication: Continuously weld with inlet and outlet flanges connections, motor or shaft supports. Incorporate flow straightening guide vanes for fans specified for static pressures greater than 250 Pa.
- .3 Finish: One coat enamel.
- .4 Shafts: Hot rolled steel, ground and polished, with key-away and protectively coated with lubricating oil.
- .5 V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed, variable and adjustable pitch sheaves for motors 1.12 kW and under, fixed sheaves for 15 kW and over, matched belts, drive rated minimum 1.5 times nameplate rating of the motor.
- .6 Belt Guards: Fabricate to SMACNA Low Pressure Duct Construction Standards.
- .7 Lubrication: Extend lubrication fittings to outside of casing.

.3 Accessories
- .1 Adjustable Inlet Vanes: Steel construction with blades supported at both ends with two permanently lubricated bearings, variable mechanism terminating in single control lever with control shaft for double width fans.
- .2 Inlet Bell: Bell mouth inlet fabricated of steel with flange.
- .3 Outlet Cones: Fabricated of steel with flanges, outlet area/inlet area ratio of 1.5/1.0.
- .4 Inlet Screens: Galvanized steel welded grid to fit inlet bell.
- .5 Dampers: Welded steel construction, consisting of two semi-circular pivoted vanes in short casing section, finished with one coat enamel. Provide airstream operation closing blades by reversing air flow and gravity.
- .6 Access Doors: Shaped to conform to casing with quick opening latches and gaskets.
- .7 Blade Pitch Actuator: Factory mounted and calibrated, electric actuator requiring single phase power and accepting electric input.

2.3 ROOF AND WALL EXHAUSTERS

.1 Roof Mounted Fans
- .1 Centrifugal or Axial Fan: V-belt or direct driven, with spun aluminum housing, resilient mounted motor, 12 mm mesh bird screen, square base to suit roof curb, continuous curb gaskets, plate bolts and screws.
- .2 Roof Curb: 200 mm high self-flashing curb with continuously welded seams, built in cant strip, factory installed door nailer strip.
- .3 Disconnect Switch: Factory wired non-fusible in housing for thermal overload protected motor and wall mounted.
- .4 Back Draft Damper: Gravity activated, aluminum multiple blade construction, felt edged with nylon bearings.
- .5 V-belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed, variable and adjustable pitch motor sheave selected so requiring rpm is obtained with sheaves set at mid-position, fan shaft with self aligning pre-lubricated ball bearings.

.2 Wall Exhausters
- .1 Centrifugal or Axial Fan: V-belt or direct driven, with spun aluminum housing, motor, 12 mm mesh bird screen, cadmium plated bolts and screws.
- .2 Disconnect Switch: Factory wired non-fusible in housing for thermal overload protected motor and wall mounted.
- .3 Back Draft Damper: Gravity activated, aluminum multiple blade construction, felt edge with nylon bearings.
- .4 V-belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed, variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position, fan shaft with self aligning pre-lubricated ball bearings.

2.4 CABINET EXHAUST FANS

.1 Cabinet and Ceiling Exhaust Fans
- .1 Centrifugal Fan: V-belt or direct driven, with galvanized steel housing lined with 15 mm acoustic insulation, resilient mounted motor, gravity back draft damper in discharge.
- .2 Disconnect Switch: Factory wired non-fusible in housing for thermal overload protected motor and wall mounted.
- .3 Grille for Ceiling Fan: Moulded white plastic grille or aluminum grille with baked white enamel finish.
- .4 V-belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed, variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position, fan shaft with self aligning pre-lubricated ball bearings.
- .5 To be complete with factory mounted solid state speed control for air balancing only. The speed control shall not be utilized as the disconnect switch.

2.5 RANGE HOODS

.1 Fan: Resiliently mounted, multi-blade direct driven fan and motor, with two-speed plug-in type motor with permanently lubricated bearings.

.2 Hood: Stainless steel or baked enamel as indicated on equipment schedule, with rocker type switches for light and fan, and washable aluminum mesh type filter.

3 Execution

3.1 PREPARATION

.1 Verify that electric power is available and of the correct characteristics (voltage and phase) prior to ordering pump.

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Assemble high pressure packaged air units by bolting sections together. Isolate fan section with flexible duct connections.

.3 Install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm flex between ductwork and fan while running.

.4 Install fan restraining snubbers as indicated. Flexible connectors shall not be in tension while running.

.5 Pipe scroll drains to nearest floor drain.

.6 Provide access to adjustable blade axial fan wheels for varying blade angle setting. Adjust blades for varying range of volume and pressure.

.7 Provide floor mounted axial fans with reinforced legs and ceiling suspended units with support brackets bolted to casing flange.

.8 When fan inlet or outlet is exposed, provide safety screen.

.9 Install unit on vibration isolators with static deflection of 50 mm. For smaller fans, vibration isolators to be as recommended by manufacturer.

.10 Set roof mounted fans on metal, self flashing curbs 200 mm minimum above roof. Provide acoustic insulation on duct to below roof line and one fan inlet plenum and drip pan for collecting condensation.

.11 Provide exhaust fans with multi-blade, rattle free, back draft damper with felt lines blades edges, bird screen, disconnect switch and curb caps.

.12 Supply and install sheaves as necessary for final air balancing.

.13 Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.
- .2 Sustainable requirements for construction and verification.

1.2 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.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate following:
  - .1 Capacity.
  - .2 Throw and terminal velocity.
  - .3 Noise criteria.
  - .4 Pressure drop.
  - .5 Neck velocity.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Air flow tests and sound level measurement shall be made in accordance with ANSI/ ASHRAE Standard 70.

.2 Manufacturer shall have published performance data.

.3 Manufacturer shall certify catalogued performance and ensure correct application of air outlet types.

1.5 JOB CONDITIONS

.1 Review requirements of outlets as to size, finish and type of mounting prior to submitting shop drawings and schedules of outlet.

.2 Positions indicated are approximate only. Check location of outlets and make necessary adjustment in position to conform with Architectural features, symmetry, performance, and lighting arrangement.

2 Products

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Base air outlet application on space noise level, either by Noise Criteria (NC) curves or Room Criteria (RC) curves, as listed below:

.1	Meeting Rooms	NC 30
.2	Offices	NC 30
.3	Other Spaces	NC 30

.3 Frames:
- .1 Full perimeter gaskets.
- .2 Plaster frames for diffusers, located in plaster surface.
- .3 Concealed fasteners.

.4 Concealed manual volume control damper operators.

.5 Provide baffles to direct air away from walls, columns or other obstructions within the radius of diffuser operation.

.6 Provide anti-smudge frames or plaques on diffusers located in rough textured surfaces such as acoustical plaster.

.7 Refer to equipment schedule for specification of air outlets.

.8 Colour: as directed by Departmental Representative.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 Sidewall and ceiling exhaust grilles shall have streamlined blades, depth of which exceeds 20 mm spacing. Provide spring tension or other device to set blades. Provide units with horizontal face.

.2 Provide 25 mm narrow margin frame with countersunk screw holes.

.3 Fabricate of steel with 20 gauge minimum frames and 22 gauge minimum blades, steel and aluminum with 20 gauge minimum frame, or heavy aluminum extrusions.

.4 Provide exhaust grilles, with integral, gang-operated opposed blade dampers with removable key operator, operable from face, where indicated.

.5 Finish in factory baked enamel finish, colour by Departmental Representative.

2.4 GRID CORE RETURN AND EXHAUST GRILLES

.1 Fabricate fixed grilles of 13 mm x 13 mm x 13 mm louvres.

.2 Provide 32 mm margin frame with lay-in frame for suspended grid ceilings.

.3 Fabricate of aluminum.

.4 Provide exhaust grilles, where not individually connected to exhaust fans, with integral, gang-operated opposed blade dampers with removable key operator, operable from face, where indicated.

2.5 LOUVRED SUPPLY GRILLES

.1 Ceiling supply grilles shall have streamlined and individually adjustable curved blades to discharge air along face of grille. Units shall have two-way deflection.

.2 Provide 25 mm narrow margin frame with countersunk screw holes.

.3 Fabricate of heavy aluminum extrusions.

.4 Provide grilles with integral, gang-operated opposed blade dampers with removable key operator, operable from face, and equalizing grid, where indicated.

.5 Finish in factory enamel finish, colour as selected by Departmental Representative.

2.6 SECURITY GRILLE

.1 Perorated faced steel maximum security grilles of size and mountings as indicated on drawings.

.2 Grilles shall be from approved list of security grilles as follows:

- .1 Chubb OP-20V from www.gunnebo.com
- .2 Simpson V-2 from www.simpsoninstall@email.com and (902) 664-6266.
- .3 Eneround security-type ventilating grille from www.dthompson@heatingproducts.nf.net and (709) 754-9100
- .4 Virtucom SCO Security from www.virtucom-inc.com

.3 Grille to be stamped with manufacturer and model number on faceplate of grille.

.4 Grilles to be secured using Chubb or S&C flathead or equivalent flathead steel spanners from grille manufacturer.

.5 Grilles to be complete with a minimum of 2 spanner tools for the installation/removal of flathead steel spanner screws. Spanner tools to be turned over to owner at completion of project.

.6 Finish: as noted on drawings.

2.7 OUTSIDE LOUVRES

.1 Refer to Section 23 37 20 - Louvres, Intakes and Vents.

2.8 LINEAR FLOOR SUPPLY REGISTERS/GRILLES

.1 Type: Streamlined blades with 0 or 15 degree deflection (refer to schedule), 3 x 19 mm on 13 mm centres.

.2 Frame: heavy duty frame with countersunk screw mounting

.3 Fabrication: Steel, welded construction with factory baked enamel finish.

2.9 LINEAR FLOOR SUPPLY REGISTERS/GRILLES (secure areas)

.1 Type: Streamlined blades with 0 or 15 degree deflection (refer to schedule), 3 x 19 mm on 13 mm centres.

.2 Frame: extra heavy duty frame with countersunk screw mounting

.3 Fabrication: Steel, welded construction with factory baked enamel finish.

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 in accordance with manufacturer’s instructions.

.2 Install with oval head, stainless steel screws in countersunk holes where fastenings are visible.

.3 Bolt grilles, registers and diffusers, in place, where indicated.

.4 With security grilles, contractor shall use high yield grout to fill any space between back of the face plate and the mounting surface.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

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

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.
- .2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)
- .1 ANSI/NFPA 96-04, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 American Society for Testing and Materials International (ASTM)
- .1 ASTM E90-04, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

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

.5 Society of Automotive Engineers (SAE)

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.

1.4 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
  - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate following:
  - .1 Pressure drop.
  - .2 Face area.
  - .3 Free area.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.3 Test Reports:
.1 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.5 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

2 Products

2.1 FIXED LOUVRES - ALUMINUM

.1 Construction: welded with exposed joints ground flush and smooth. Blade and frame fillet welds concealed from view.

.2 Material: extruded aluminum alloy 6063-T5; blades and frames minimum 2.7 mm thick.

.3 Blade: stationary with drainable gutters, reinforcing bosses and maximum blade length of 1500 mm or manufacturer’s recommendations.

.4 Frame, head, sill and jamb: 100 or 150 mm deep one piece extruded aluminum, minimum 2 mm thick with approved caulking slot, integral to unit. Depth as indicated. Frames shall be jointed at each corner with full length weld.

.5 Mullions: at 1500 mm maximum centres, visible vertical mullions.

.6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.

.7 Screen: 12 mm exhaust, 19 mm intake mesh, 2 mm diameter wire aluminum birdscreen on inside face of louvres in formed U-frame.

.8 Finish: factory applied enamel. Colour: as selected by Departmental Representative.

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 In accordance with manufacturer's and SMACNA recommendations.

.2 Reinforce and brace as indicated.

.3 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

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

END OF SECTION

1 General

1.1 REFERENCES

.1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
- .1 ANSI/NFPA 96- 1994, Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
- .1 ASHRAE 52.1- 1992, Gravimetric And Dust Spot for Testing Air-cleaning Devices Used in General Ventilation for Removing Particulate Matter.

.3 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-115.10- M90, Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.
- .2 CAN/CGSB-115.11- M85, Filters, Air, High Efficiency, Disposable, Bag Type (Reaffirmed April 1985).
- .3 CAN/CGSB-115.12- M85, Filters, Air, Medium Efficiency, Disposable, Bag Type (Reaffirmed April 1985).
- .4 CAN/CGSB-115.13- 85, Filter Media, Automatic Roll (Reaffirmed April 1985).
- .5 CAN/CGSB-115.14- M91, High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.
- .6 CAN/CGSB-115.15- M91, High Efficiency Rigid Type Air Filters for Removal of Particulate Matter from Ventilating Systems.
- .7 CAN/CGSB-115.16- M82, Activated Carbon for Odor Removal from Ventilating Systems.
- .8 CAN/CGSB-115.18- M85, Filter, Air, Extended Area Panel Type, Medium Efficiency.
- .9 CAN/CGSB-115.20- 95, Polarized Media Air Filter.

.4 Underwriters' Laboratories of Canada
- .1 ULC -S111- M80, "Fire Tests for Air Filter Units".
- .2 ULC-S649-1993, Grease Filters for Commercial and Institutional Kitchen Exhaust Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawing and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Filters shall be product of and supplied by one manufacturer. Filter components assembled to form filter banks shall be products of same manufacturer.

.2 Filter media shall be UL listed, Class I or Class II, as approved by local authority.

1.5 MAINTENANCE MATERIALS

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

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as frames and filters, addresses of suppliers, list of specialized tools necessary for adjusting, repairing or replacing for inclusion in operating manual.

1.6 ALTERNATIVES

.1 Size, media face area, Merv rating, initial and final resistance of alternative manufacturer’s shall be same as type specified.

1.7 EXTRA MATERIALS

.1 Spare filters: in addition to filters to be installed immediately prior to acceptance by Departmental Representative , supply one complete set of filters for each filter unit or filter bank in accordance with section 01 78 00 - Closeout Submittals. Total number of filters for each and every filter bank as follows:
- .1 One set for testing, balancing and commissioning.
- .2 One set to be installed at acceptance.
- .3 One spare set to be used by Owner during first year of operation.

2 Products

2.1 GENERAL

.1 Media: suitable for air at 100% RH and air temperatures between minus 40 and 50 °C.

.2 Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated.

.3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

.4 Fire rated to: ULC S111

.5 Final filters for all supply air systems shall be MERV 14 to meet LEED requirements.

2.2 ACCESSORIES

.1 Seals: to ensure leakproof operation.

.2 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.3 Access and servicing: through doors/panels on each side and/or from upstream or downstream face of filter bank.

2.3 FIBROUS GLASS PANEL FILTERS

.1 Disposable fibrous glass media: to CAN/CGSB-115.10 with adhesive.

.2 Holding frame: 1.2 mm minimum thick galvanized steel with 3 mm diam hinged wire mesh screen.

.3 Performance: as indicated, to ASHRAE 52.2.

.4 Fire rated: to ULC -S111.

.5 Nominal thickness: as indicated.

2.4 COTTON PANEL FILTERS

.1 Disposable pleated reinforced cotton dry media: to CAN/CGSB 115.18.

.2 Holding frame: galvanized steel, or slide in channel for side access.

.3 Performance: as indicated, to ASHRAE 52.2.

.4 Fire Rated: to ULC -S111.

.5 Nominal thickness: as indicated.

2.5 FILTER GAUGES - MANOMETER TYPE

.1 Direct Reading Dial: 90 mm diameter diaphragm actuated dial in metal case, vent valves, black figures on white background, front recalibration adjustment, range 0 Pa to two times initial pressure, 2 percent of full scale accuracy.

.2 Inclined Manometer: One piece moulded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, range 0 Pa to two times initial pressure, 3 percent of full scale accuracy.

.3 Accessories: Static pressure tips with integral compression fittings, 6 mm aluminum tubing, 2-way or 3-way vent valves.

2.6 RIGID, SUPPORTED BAG TYPE FILTERS

.1 Media: disposable preformed fibrous glass, cartridge with approximately 4.6 sq.m. (50 sq.ft.) of media per 472 l/s capacity (1000 CFM).

.2 Holding frame: galvanized steel with bracing. Provision for front mounted panel pre-filter and front or rear removal of filter media.

.3 Media support: welded wire grid.

.4 High efficiency: to CAN/CGSB-115.11.

.5 Medium efficiency: to CAN/CGSB-115.12

.6 Nominal thickness: as indicated.

2.7 CARTRIDGE FILTERS

.1 Media: deep pleated, disposable, high efficiency, to CAN/CGSB-115.14.

.2 Holding frame: galvanized steel with bracing.

.3 Media support: welded wire grid.

2.8 FILTER FRAMES AND HOUSINGS

.1 General: Fabricate filter frames and supporting structures of 1.50 mm (16 gauge) galvanized steel or extruded aluminum T-section construction with necessary gasketing between frames and walls.

.2 Standard Sizes: Provide for interchangeability of filter media of other manufacturers; for panel filters; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.

.3 Side Servicing Housings: Flanged for insertion into ductwork, of reinforced 1.5 mm galvanized steel; access doors with continuous gasketing and positive locking devices on both sides; extruded aluminum tracks or channels for primary and secondary filters with positive sealing gaskets.

3 Execution

3.1 INSTALLATION GENERAL

.1 Install in accordance with manufacturer’s recommendations and with adequate space for access, maintenance and replacement.

.2 Filter banks shall have removal and access indicated.

.3 Do not operate fan systems without filtration in place.

3.2 REPLACEMENT MEDIA

.1 Replace all media with new upon acceptance.

.2 Filter media to be new and clean, as indicated by pressure gauge, at time of acceptance.

3.3 FILTER GAUGES

.1 Install type as indicated across each filter bank (pre-filter and final filter) in approved and easy readable location.

.2 Mark each filter gauge with value of pressure drop for clean condition and manufacturer's recommended replacement (dirty) value.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Materials and components for electric-resistance furnaces.

.2 Sustainable requirements for construction and verification.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  .1 ASHRAE 52.1-92, Gravimetric and Dust Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter (ANSI approved).

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings:
  .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
    .1 Submit drawings stamped and signed by professional engineer registered or licensed in Provinces of Saskatchewan, Canada.
  .2 Include:
    .1 Physical dimensions.
    .2 Filter accessibility.
    .3 Fan configuration.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  .2 Instructions: submit manufacturer's installation instructions.
    .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with CEPA.

.2 Health and Safety:
  .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Sustainable Requirements:
.1 Construction requirements: in accordance with Section 01 47 15 - Sustainable Requirements: Construction.
.2 Verification: contractor's verification in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

2 Products

2.2 ELECTRIC FORCED AIR FURNACES

.1 Cabinet: die-formed, cold-rolled steel,

.2 Heater elements: nickel chrome, oversized heaters for rapid heat transfer, plug in modules to facilitate servicing.

.3 Blower: centrifugal type permanently lubricated multi-speed, capacity as indicated. Blower to be complete with vibration isolation and balanced.

.4 Motor: electronically commutated motor. Motor and fan accessible for service, mounted on steel frame secured with resilient mountings.

.5 Filters: disposable fibreglass type in removable frame.

.6 Unit to have integral time delay sequencers to prevent power surges and integral breakers to protect from overcurrent.

.7 Cabinet finish: baked epoxy powder paint finish.

.8 Unit shall be CSA certified.

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 furnace.

.2 Locate furnace allowing accessibility for service and filter change.

.3 Check for free rotation of fan.

.4 Ensure alignment of fan and motor pulleys.

.5 Ensure proper belt tension.

.6 Make connections to line, thermostats, humidistat in accordance with manufacturer's instructions.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

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

END OF SECTION

1. General

1.1 WORK INCLUDED

.1 Packaged roof top heating/cooling units.
.2 Operating controls.
.3 Thermostat.
.4 Roof mounting frame.

1.2 REFERENCES

.1 AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
.2 AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
.3 AMCA 99 - Standards Handbook.
.4 AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
.5 AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
.6 AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
.7 AMCA 500 - Method of Testing Louvres for Ratings.
.8 AMCA 5000 - Method of Testing Dampers for Ratings.
.9 ARI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.
.10 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
.11 UL 900 - Air Filter Units.
.12 ASHRAE 90.1 Energy Code.
.13 ARI Standard 1060 - Rating Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment.
.14 NEMA MG1 - Motors and Generators.
.15 NFPA 70 - National Electrical Code.
.16 UL 723 - Test for Surface Burning Characteristics of Building Materials.
.17 UL 1995 - Standard for Heating and Cooling Equipment.
.18 UL 94 - Test for Flammability of Plastic Materials for Parts in Devices and Appliances.
.19 IBC 2000, 2003 - International Building Code.
.20 NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
.21 NFPA 5000 - Building Construction and Safety Code.
.22 ANSI/AHRI Standard 210/240

1.3 QUALITY ASSURANCE

.1 Meet the requirements of CSA, Provincial and Municipal Codes and be CSA listed.

.2 Test and rate cooling systems to ARI Standard 210.

.3 Units shall be products of manufacturers who provide local service personnel from factory representative, franchised dealer or certified maintenance service shop.

.4 Supply service of manufacturer's certified representative to supervise testing and charging of equipment, gas pressure, internal controls, and instruction on operation and maintenance to Owner. Provide written certification that all systems have been verified and tested.

.5 Packaged air-cooled condenser units shall be certified in accordance with ANSI/AHRI Standard 210/240 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.

.6 Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.

.7 Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.

.8 Unit Seasonal Energy Efficiency Ratio (SEER) shall be equal to or greater that prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.

.9 Unit shall be certified by ETL and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label. The nameplate, safety labels and warnings will be in English and French.

.10 Refrigeration systems shall utilize an HFC refrigerant only. Refer to schedule.

1.4 SUBMITTALS

.1 Section 01 33 00: Procedures for submittals.

.2 Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

.3 Product Data:
- .1 Provide literature which indicates dimensions, weights, capacities, ratings, fan performance, gauges and finishes of materials, and electrical characteristics and connection requirements.
- .2 Provide data of filter media, filter performance data, filter assembly, and filter frames.
- .3 Provide fan curves with specified operating point clearly plotted and fan efficiencies.
- .4 Submit sound power level data for both fan outlet and casing radiation at rated capacity.
- .5 Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

.4 Manufacturer's Installation Instructions.

1.5 EXTENDED WARRANTY

.1 Provide 5 year unconditional parts warranty on compressor unit.

.2 Provide 3 year unconditional parts warranty on electric heating coils

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.7 EXTRA MATERIALS

.1 Provide one set of spare fan belts for each fan.

.2 Provide extra filter sets as indicated, refer to Section 23 44 00 - HVAC Air Filtration.

2. Products

2.1 PACKAGED ROOF TOP UNIT WITH 100% FRESH AIR (RTU-1 and RTU-2)

.1 Type:
- .1 Provide roof mounted type units with electric heat and electric refrigeration.
- .2 Packaged rooftop unit shall be self contained and include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, electric heaters, exhaust fans, energy recovery wheels, and unit controls.
- .3 Units shall have at minimum the following features:
  - .1 Variable capacity compressor with 10-100% capacity control
  - .2 Direct drive supply fans
  - .3 Double wall cabinet construction insulated with a minimum R-value of 13
  - .4 Stainless steel drain pans
  - .5 Hinged access doors with lockable handles
  - .6 All other provisions of the specifications must be satisfactorily addressed
- .4 Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
- .5 Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
- .6 Unit components shall be labeled, including refrigeration system components and electrical and controls components.
- .7 Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
- .8 Installation, Operation, and Maintenance manual shall be supplied within the unit.
- .9 Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
- .10 Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

.2 Construction:
- .1 All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
- .2 Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610 deg.F.
- .3 Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
- .4 Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 210/240. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
- .5 Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
- .6 Access to filters, dampers, cooling coils, heaters, exhaust fans, energy recovery wheels, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.

.7 Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
.8 Units with cooling coils shall include double sloped 304 stainless steel drain pans.
.9 Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
.10 Unit shall include lifting lugs on the top of the unit.
.11 Manufacturer shall provide roof curb matched to unit with integral duct transition to facilitate side discharge/intake for both supply and exhaust airflow streams. Refer to drawings.

.3 Electrical:
.1 Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
.2 Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

.4 Supply Fans:
.1 Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
.2 Blowers and motors shall be dynamically balance and mounted on rubber isolators.
.3 Motors shall be standard efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.

.5 Exhaust Fans:
.1 Exhaust dampers shall be sized for 100% relief.
.2 Fans and motors shall be dynamically balanced.
.3 Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
.4 Access to exhaust fans shall be through double wall, hinged access doors with quarter turn lockable handles.
.5 Unit shall include belt driven, unhoused, backward curved, plenum exhaust fans.
.6 Fan motors shall be premium efficiency.

.6 Cooling Coils:
.1 Evaporator Coils
a) Coils shall be designed for use with an HFC refrigerant like R-410A refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
b) Coils shall be standard capacity.
c) Coils shall be hydrogen or helium leak tested.
d) Coils shall be furnished with factory installed expansion valves.

.7 Refrigeration System:
.1 Unit shall be factory charged with R-410A refrigerant.
.2 Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
.3 Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.
.4 Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.

.5 Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.

.6 Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter driers.

.7 Unit shall include a variable capacity scroll compressor on the refrigeration circuit which shall be capable of modulation from 10-100% of its capacity.

.8 First capacity stage shall be provided with on/off condenser fan cycling and adjustable compressor lockout to allow cooling operation down to 35 deg.F.

.8 Condensers:

.1 Air-Cooled Condenser

a) Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
b) Coils shall be designed for use with R-410A refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes or coils shall be constructed of copper tubes with aluminum (copper) fins mechanically bonded to the tubes and aluminum end casings. Fin design of copper tube coils shall be sine wave rippled.
c) Coils shall be designed for a minimum of 10 deg.F of refrigerant sub-cooling.
d) Coils shall be hydrogen or helium leak tested.
e) Condenser fans shall be high efficiency electrically commutated motor driven with multiple speeds which are controlled with a fan cycle switch based on head pressure and allow matching condenser airflow with cooling capacity steps.

.9 Electric Heating:

.1 Unit shall include an electric heater consisting of electric heating coils, fuses and a high temperature limit switch, with capacities as shown on the plans.

.2 Electric heating coils shall be located in the reheat position downstream of the cooling coil.

.3 Electric heater shall have full modulation capacity controlled by an SCR (Silicon Controlled Rectifier). A 0-10 VDC heating control signal shall be field provided to control the amount of heating.

.10 Preheat (RTU-1 only):

.1 Electric Preheat

a) Unit shall include an electric heater consisting of electric heating coils, fuses, and a high temperature limit switch.
b) Electric heating coils shall be located in the outside air preheat position.
c) Electric heater shall have modulation capacity controlled by an SCR (Silicon Controlled Rectifier). A preheat enable signal shall be required from the unit controller.

.11 Filters:

.1 Unit shall include 4 inch thick, pleated panel filters with an ASHRAE efficiency of 95% and a MERV rating of 14, upstream of the cooling coil. Unit shall also include 2 inch thick, pleated panel pre filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the 4 inch standard filters.

.2 Units shall include a Magnehelic gauge mounted in the controls compartment.

.12 Energy Recovery:

.1 Unit shall contain a factory mounted and tested energy recovery wheel. The energy recovery wheel shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings. Frame shall slide out for service and removal from the cabinet.

.2 The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.

.3 Wheel shall be wound continuously with one flat and one structured layer in an ideal parallel plate geometry providing laminar flow and minimum pressure drop-to-efficiency ratios. The layers shall be effectively captured in stainless steel wheel frames or aluminum and stainless steel segment frames that provide a rigid and self-supporting matrix.

.4 Wheel shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.

.5 All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive without the need for external tensioners or adjustment.

.6 The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers and AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.

.7 Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5 year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchange written instructions for Installation, Operation, and Maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.

.8 Unit shall include 2 inch thick, pleated panel outside air filters with an ASHRAE efficiency of 30% and MERV rating of 8, upstream of the wheels.

.9 Hinged service access doors shall allow access to the wheel.

.10 Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

.11 Unit shall include energy recovery wheel rotation detection sensors and a set of normally open and normally closed contracts for field indication of wheel rotation.

.13 Controls:

.1 Factory Installed and Factory Provided Controller

a) Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of standalone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.

b) Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.

c) Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
d) Constant Volume Controller:
   a. Unit shall modulate cooling with constant airflow to meet space temperature cooling loads.
   b. RTU-1: Unit shall modulate heating with constant airflow to meet space temperature heating loads. Modulating heating capacity shall modulate based on supply air temperature.
   c. RTU-5: Unit shall modulate heating with constant airflow to meet discharge air temperature setpoint during heating loads. Modulating heating capacity shall modulate based on supply air temperature.
e) Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network, but shall be commissioned in a standalone fashion at this time.

.14 Curbs:
.1 Curbs shall to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit.
.2 Knockdown curb (with duct support rails) shall be factory furnished for field assembly.
.3 Solid bottom curb shall be factory assembled and fully lined with 1 inch neoprene coated fiberglass insulation and include a wood nailer strip. (Curb shall be adjustable up to 3/4 inch per foot to allow for sloped roof applications.)

2.2 PACKAGED ROOF TOP UNIT WITH RETURN AIR (RTU-2, RTU-3 and RTU-4)

.1 Type:
.1 Provide roof mounted type units with electric heat and electric refrigeration.
.2 Units shall be self-contained, packaged, factory assembled and prewired consisting of a cabinet and frame, supply fan, heating coil, control, air filter, refrigerant cooling coil and compressor condenser coil and fan, and economizer.

.2 Construction:
.1 Cabinet: Heavy gauge steel with baked enamel finish, easily removed access doors or panels with quick fasteners, locking door handle type. Structural members shall be minimum 18 gauge, with removable panels minimum 20 gauge.
.2 Insulation: Foil faced non-hygroscopic glass fibre on surfaces where conditioned air is handled. Protect edges from erosion. Unit base to be fully insulated and insulation shall provide an air seal to the roof curb, eliminating the need to add a seal during installation.
.3 Electric Heat: Helix wound nichrome elements, individual element limit controls, wiring harness. Unit fuse block to be furnished as standard. Coil to have SCR Electric Heat Control to modulate small, precise increments of power to the electric heat load eliminating temperature fluctuations in the supplied air.
.4 Supply Fan: Centrifugal type direct drive, rubber isolated hinge mounted motor, statically and dynamically balanced. Complete fan assembly shall be isolated. Motor shall be variable speed ECM direct drive.

.5 Air Filters: 2" thick glass fibre disposable media in metal frames arranged for easy replacement, minimum MERV 13 rating.
.6 Intake extension kit: factory manufactured extension kit.

.3 Evaporator Coil:
.1 Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection, capillary tubes and expansion valve.
.2 Copper tube construction, enhanced rippled-edge aluminum fins, flared shoulder tubing connections, silver soldered construction for improved heat transfer. Cross row circuiting with rifled tubing to optimize both sensible and latent cooling capacity.
.3 Coil shall be factory leak tested.
.4 Plastic drain pan, sloped to meet drainage requirements of ASHRAE 62.1. Side or bottom drain connections. Reversible to allow connection at back of unit.
.5 Provide factory installed Drain Pan Overflow Switch to monitor condensate level in drain pan and shuts down unit if drain becomes clogged.

.4 Compressor:
.1 Provide hermetic or semi-hermetic two-stage scroll compressors, 3600 RPM maximum resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, service valves and filter drier.
.2 Timed off circuit shall limit number of compressor starts to 12 per hour.
.3 Outdoor thermostat shall energize compressor above 14 deg.C ambient.
.4 Provide step capacity control by cycling the compressors.
.5 Provide high pressure switch to protect compressor from overload conditions such as dirty condenser coils, blocked refrigerant flow, or loss of outdoor fan operation.
.6 Provide low Pressure Switch to protect compressor from low pressure conditions such as low refrigerant charge, or low/no airflow.
.7 Provide freezestat to protect the evaporator coil from damaging ice build-up due to conditions such as low/no airflow, or low refrigerant charge.

.5 Condenser (RTU-2 and RTU-3):
.1 Provide copper tube aluminum fin coil assembly with sub-cooling rows.
.2 Condenser coil shall be lightweight, all aluminum brazed fin construction. Constructed of three components: a flat extrusion tube, fins inbetween the flat extrusion tube and two refrigerant manifolds. Coil shall have face-split design.
.3 Mounting brackets with rubber inserts shall secure coil to unit providing vibration dampening and corrosion protection.
.4 Provide direct drive axial fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.
.5 Motors shall be Variable speed (ECM) for energy efficient multistage air volume operation and quiet operation.
.6 Thermal overload protected, totally enclosed, permanently lubricated ball bearings, shaft up, wire basket mount.
.7 Provide PVC coated fan guard.
.8 Coil to be factory leak tested.

.6 Condenser (RTU-4):
.1 Provide copper tube aluminum fin coil assembly with sub-cooling rows.
.2 Copper tube construction, enhanced rippled-edge aluminum fins, flared shoulder tubing connections, silver soldered construction for improved heat transfer. Cross row circuiting with rifled tubing to optimize both sensible and latent cooling capacity
.3 Mounting brackets with rubber inserts shall secure coil to unit providing vibration dampening and corrosion protection.
.4 Provide direct drive axial fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.

.5 Motors shall be Variable speed (ECM) for energy efficient multistage air volume operation and quiet operation.
.6 Thermal overload protected, totally enclosed, permanently lubricated sleave, shaft up, wire basket mount.
.7 Provide PVC coated fan guard.
.8 Coil to be factory leak tested.

.7 Supply/Return Casing:
.1 Provide outside, return and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper shall fall to closed position. Relief dampers may be gravity balanced.
.2 Provide tight fitting dampers with neoprene or suitable edge gaskets. Dampers shall have nylon bearings.
.3 Damper Operator (return and outside air): gear driven, 24 Volt, fully modulating spring return with motor and gear train sealed in oil.
.4 Mixed Air Controls: Shall use outdoor air and return air sensors that are furnished with the unit. The Unit Controller shall compare outdoor air temperature and return air and using setpoints, enable the economizer when the outdoor air temperature is below the configured setpoint and cooler than return air. Lock out compressor below approximately 14 deg.C ambient. Ensure dampers modulate to provide minimum ventilation when not free cooling.
.5 Provide barometric relief damper and exhaust hood with unit for field installation.

.8 Operating Controls:
.1 Unit Controller shall be microprocessor-based control board that provides flexible control of all unit functions and is supplied by unit manufacturer.
.2 Unit controller shall have the following features:
.1 Scrolling Display - Scrolls full text instead of numerical codes.
.2 Push Buttons - Simplified navigation during setup and diagnostics.
.3 Guided Setup Procedure - Insures proper installation and setup of the rooftop unit.
.4 Profile setup - Copy key setpoints between units with the same configuration greatly reducing setup time.
.5 USB Port - Easily download and transfer unit information via a USB flash drive and also interface with Manufacturer Software.
.6 Self Test Mode - Confirm proper component and system operation.
.7 Time Clock with Run-time Information
.3 Unit controller shall have the following built in functions:
.1 Built-In Functions Include: Adjustable Blower On/Off Delay
.2 Built-in Control Parameter Defaults
.3 Compressor Time-Off Delay
.4 DDC Compatible but shall be commissioned as standalone system.
.5 Dirty Filter Switch Input
.6 Discharge Air Temperature Control
.7 Display/Sensor Readout
.8 Economizer Control – Differential Sensible Control
.9 Fresh Air Tempering
.10 Extensive Unit Diagnostics - minimum 100 diagnostic and status messages in English.
.11 Fresh air damper position control to maintain minimum fresh air.
.12 Permanent Diagnostic Code Storage
.13 Field Changeable Control Setpoints.
.14 Minimum Compressor Run Time
.15 Network Capable - Can be daisy chained to other units or controls.
.16 Return Air Temperature Limit Control
.17 Safety Switch Input - Allows Controller to respond to an external safety switch trip.
.18 Service Relay Output

.19 Staging – as required to meet sequence.
.20 Thermostat Bounce Delay
.21 LED Indicators
.22 PC Interface - For use with PC with optional Unit Controller software.
.23 Zone Sensor Operation - Controls zone temperature.
.24 Factory installed blower proving switch to shut down if blower fails.
.25 Factory installed dirty filter switch to indicate when filters are loaded.
.26 Fresh air tempering, to modulate heating coil to maintain discharge air temperature setpoint in heating mode.

.4 Heating control to include following features:
.1 Zero-Cross (fast cycling) feature to improve electric heater life with less contraction and expansion of the heating elements.
.2 SCR air tempering shall be controlled by a secondary thermostat and remote duct sensor, supplied with unit, field installed.
.3 SCR shall maintain discharge air temperature when there is no call for heat.
.4 A call for heat shall modulate heating to meet space requirements.
.5 A call for cooling (including economizer) shall override the SCR to prevent heating and cooling at same time.

.5 Unit to be complete with low voltage, adjustable thermostat shall control heat, compressor and condenser fan and supply fan to maintain temperature setting. Thermostat shall have the following features:
.1 Two-Stage Heating / Two-Stage Cooling
.2 Intuitive Touchscreen Interface
.3 Seven-Day Programmable
.4 Four Time Periods Per Day
.5 Economizer Output
.6 Backlit Display
.7 Automatic Changeover
.8 20K temperature sensor.

.9 Electrical:
.1 Circuit Breakers: HACR type. For overload and short circuit protection. Factory wired and mounted in the power entry panel. Current sensitive and temperature activated. Manual reset.
.2 Phase/Voltage Detection (3 Phase models only). Phase detection monitors power supply to assure phase is correct at unit start-up. If phase is incorrect, the unit will not start and an alarm code is reported to the unit controller. Protects unit from being started with incorrect phasing. Voltage detection monitors power supply voltage to assure proper voltage. If voltage is not correct (over/under voltage conditions) the unit will not start and an alarm code is reported to the unit controller.
.3 Disconnect Switch: factory installed accessible from outside of unit, spring loaded weatherproof cover furnished.
.4 GFI Service Outlets (2), 115V ground fault circuit interrupter (GFCI) type, non-powered, field wired.
.5 Field Installed: GFI Weatherproof Cover Single-gang cover. Heavy-duty UV-resistant polycarbonate case construction. Hinged base cover with gasket.

3. Execution

3.1 INSTALLATION

.1 Mount units on factory built roof mounting frame providing water-tight enclosure to protect ductwork and utility services.

.2 Installing contractor shall install unit, including field installed components, in accordance with manufacturers' Installation, Operation, and Maintenance manual instructions.

.3 Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit. A factory representative shall start up unit and provide start-up report.

.4 Install to ARI 435.

.5 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

.6 Fabricate to provide smooth air flow through components. Limit air leakage to 1% of rated air flow at 2.5 kPa suction pressure.

.7 Remove all internal hold-down bolts and shipping fasteners and install any parts which were shipped loose. Level spring isolators.

.8 Check and re-align all access doors and dampers to ensure smooth operating through the entire range of travel.

.9 Upon start-up, each fan motor is to be checked for fan rotations, and amp draw for each phase. Amp readings are to be marked on the fan scroll and recorded in the Operation and Maintenance Manual.

.10 All belt drives are to be re-adjusted for tension and alignment.

.11 Provide a drain valve on each coil drain fitting and a vent valve on each coil vent.

.12 All pipe and conduit penetrations to the casing are to be thoroughly sealed and caulked to prevent air leakage.

.13 All floor penetrations are to be thoroughly sealed to ensure the water tightness and integrity of the entire floor.

.14 The Contractor shall provide certified wiring schematics to the electrical division for the equipment and controls.

.15 The Controls Contractor shall provide all necessary field control wiring as recommended by the manufacturer.

.16 The contractor shall provide the Departmental Representative with a completed Halocarbon Service Record for each piece of Halocarbon containing equipment which requires commissioning and/or decommissioning. All equipment which requires a Leak Test throughout the project will also require the placement of a Leak Test Tag placed on the unit itself. If the equipment is located in an area not protected from the weather, a weatherproof container shall be provided to contain the Leak Test Tag. The Halocarbon Service Record and Leak Test Tag are included in Commissioning Section 01 91 33.

3.2 PERFORMANCE

.1 See Equipment Schedule.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
- .1 Mechanical louvers; intakes; vents; and reinforcement and bracing for air vents, intakes and gooseneck hoods.
- .2 Sustainable requirements for construction and verification.

1.2 SECTION INCLUDES

.1 Packaged air conditioning units.

1.3 SUBMITTALS

.1 Submit shop drawings to requirements of Section 01 33 00.
.2 Indicate water, drain, electrical, and duct rough-in connections.
.3 Submit manufacturer's installation instructions to Section 01 33 00.
.4 Provide detailed wiring diagram and complete description of controls.

1.4 SUBMITTALS FOR INFORMATION

.1 Sections 01 33 00 and 01 78 00: Submission procedures.

.2 Manufacturer's Certificate: Certify that specified products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

.1 Section 01 33 00: Submission procedures.

1.6 OPERATION AND MAINTENANCE DATA

.1 Submit operation and maintenance data to requirements of Section 01 78 00.

.2 Include manufacturer’s descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.7 WARRANTY

.1 Provide a 5 year warranty to Section 01 78 00 and CCDC 2 General Conditions.

.2 Warranty: Include coverage of refrigerant compressors.

1.8 QUALITY ASSURANCE

.1 Comply with Provincial Regulations and Mechanical Refrigeration Codes.

.2 Qualifications of installer:
- .1 Installing contractor shall have Certificate of Qualification as a Refrigeration Mechanic.

.2 Contractor must provide list of all installers that will work on refrigeration systems with shop drawings for equipment. List must include photocopy of the refrigeration tech's certificate of registration, along with name and certification number.
.3 Following installation, the certified refrigeration mechanic(s) will provide verification that they installed the refrigeration system components.

.3 The contractor shall provide the Departmental Representative with a completed Halocarbon Service Record for each piece of Halocarbon containing equipment which requires commissioning and/or decommissioning. All equipment which requires a Leak Test throughout the project will also require the placement of a Leak Test Tag placed on the unit itself. If the equipment is located in an area not protected from the weather, a weatherproof container shall be provided to contain the Leak Test Tag. The Halocarbon Service Record and Leak Test Tag are included in Commissioning Section 01 91 33..

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

2 Products

2.1 DEDICATED ROOM AIR CONDITIONING UNITS

.1 Integrated package: to CAN/CSA-C656.

.2 System type:
.1 Air flow arrangement: as noted on equipment schedule
.2 Cooling: direct expansion.
.3 Condensing: air cooled.

.3 Cooling capacity, with fan heat extracted: based on environment of 22 degrees C dry bulb and 50% R.H. (plus or minus 1 degree C and 5% R.H.), with minimum supply air temperature of 14 degrees C.

.4 Unit capacity: as indicated:

.5 Cabinet:
.1 Wall mounted, welded steel, unit construction, corrosion protected, 20 mm thick acoustic insulation, factory baked on external finish aesthetically compatible with typical computer and peripheral cabinets. Colour selected by Department Representative.
.2 Cabinet to house: cooling coil, fans, filters, unit environmental control system, motor starters or contactors and electrical disconnect switch.
.3 Provide adequate access to components for servicing.
.4 Corrosion protected welded structural steel floor stand having adjustable feet and locking device on corners, vibration isolators and compatible with raised floor system.
.5 Fans: DWDI centrifugal, statically and dynamically balanced, direct drive, with self-aligning, permanently lubricated, 100,000 hours minimum life ball or roller bearings.
.6 Fan Motors: Drip-proof permanently lubricated bearings for continuous duty, 40 degrees C maximum rise and variable pitch sheaves on belt driven systems.
.7 Provide hail guards over fins.

.6 Compressors:
- .1 Semi hermetic type, minimum 2 required, with:
  - .1 Vibration isolators.
  - .2 Adjustable high and low pressure switches.
  - .3 Anti-slug device.
  - .4 Motor overload and over temperature protection pump down controls.
  - .5 Crank case heater.
  - .6 Compressor lead/lag switch.
  - .7 Refrigerant service valves.
  - .8 Capacity controls (variable speed compressor)

.7 Condenser:
- .1 Outdoor Air cooled: free standing, welded steel unit construction, corrosion protected.
  - .1 Circuited to provide separate refrigerant circuit for each compressor/evaporator combination.
  - .2 Aluminum fins, mechanically bonded to copper tubes, tested to 3.1 MPa.
  - .3 Propeller or centrifugal type fans. Direct drive.
  - .4 Electrical and control components housed in weather-tight access panels with electrical disconnect switch and control cable for control interconnection and designed for year round operation.
  - .5 Vibration isolation: providing at least 95% isolation efficiency.
  - .6 Capacity: to heat rejection capacity of 35 degrees C.
  - .7 Variable speed compressor for capacity control.

.8 Filters:
- .1 Prefilters: Cleanable.
- .2 Mounting: in corrosion resistant racks with service access.

.9 Refrigerant Piping, Valves, Fittings, and Accessories within unit
- .1 To CSA B52.
- .2 Include for each refrigerant circuit:
  - .1 Thermal expansion valve, external equalizing type.
  - .2 Combination filter-dryer.
  - .3 Solenoid valves.
  - .4 Liquid sight glass with moisture indicator.
  - .5 Suction line insulation: flexible elastomeric unicellar to ASTM C547, 12 mm minimum thickness.
  - .6 Liquid refrigerant receiver.

.10 Environmental Controls
- .1 Solid state electronic control system.
- .2 Front mounted operating panel with visual display.
- .3 Panel to include following:
  - .1 Manual operation and adjustment:
    - .1 On-Off air conditioning system control.
    - .2 Room temperature set point, indicator and sensitivity adjustment controller.
    - .3 Alarm silencing switch for each alarm point.
    - .4 Alarm circuits test switch.

.2 Operational: Visual and Audible Alarm:
- .1 Loss of air flow.
- .2 Loss of liquid flow.
- .3 High room temperature.
- .4 Low room temperature.
- .5 High head pressure.

.11 Refrigerant Charge
- .1 Charge refrigerant system at factory, seal and test.
- .2 Holding charge of refrigerant applied at factory.

.12 Capacity and Line Sizing
- .1 Manufacturer and Mechanical Contractor shall ensure that system will operate at capacities indicated in equipment schedule despite distance from condensing units to indoor units and elevation change.
- .2 Contractor shall ensure refrigerant liquid and suction lines are sized in accordance with manufacturer's requirements for elevation change and distance between indoor and outdoor unit.
- .3 Pipe distance is assumed to be 40m (131 ft) with an elevation change of 13.7m (45 ft). Elevation change is included in pipe distance.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's installation instructions. Refer to Section 23 23 00 for qualifications of installer.

.2 Coordinate installation of units with architectural, mechanical, and electrical work.

.3 Provide initial start-up and shut-down during first year of operation, including routine servicing and check-out.

.4 Mount condensing units at ground level in courtyard. Mount on raised metal stand to ensure minimum of 610mm clearance above ground with stand on concrete pads as indicated by Architect. Mechanical to provide stand.

.5 Supply units fully charged with refrigerant and filled with oil.

.6 Provide shut-off valves in condenser water inlet and outlet piping.

.7 Pipe drain pan condensate to nearest floor drain or mop sink as indicated on drawings.

END OF SECTION

1 General

1.1 SUMMARY

.1 Section Includes:
  .1 Cabinet convector heaters, controls and installation.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
  .1 CSA C22.2 No.46-M1988 (R2001), Electric Air-Heaters.
.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:
  .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
    .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.
  .2 Submit product data sheets for cabinet convector heaters. Include:
    .1 Product characteristics.
    .2 Performance criteria.
    .3 Mounting methods.
    .4 Physical size.
    .5 kW rating, voltage, phase.
    .6 Cabinet material thicknesses.
    .7 Limitations.
    .8 Colour and finish.
    .9 Wiring diagram.
    .10 Matched standalone controls.

.2 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
  .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  .2 Instructions: submit manufacturer's installation instructions.
    .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

.3 Closeout Submittals:
  .1 Submit operation and maintenance data for cabinet convector heaters in accordance with Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

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

2 Products

2.1 ELECTRIC CABINET CONVECTOR HEATERS (BASEBOARD)

.1 Wall mounted cabinet: to CSA C22.2 No. 46, pre-drilled back for securing to wall, slope top design.

.2 Elements: Stainless steel sheath encloses a nickel chromium element compacted in a mineral insulation. Aluminum fins to be brazed to the surface. Element to have floating suspension to eliminate expansion noise.

.3 Voltage – refer to schedule.

.4 Wattage – refer to schedule.

.5 Finish: Painted finish to be hybrid polyester epoxy powder coat process, Color - White

.6 Construction: Front and top constructed of extruded aluminum equivalent in strength to 14 gauge steel, with punched air intake and exhaust vents. Cabinet back and bottom are fabricated from satin coat steel with multiple knockouts for convenient power connection. Endcaps are field removable for continuous heater installation. Unit to have full length wire way for convenient wiring

2.2 CONTROLS

.1 Wall mounted thermostats: type line voltage to Section 23 09 33 - Electric and Electronic Control System for HVAC.

.2 Unit to have built-in low voltage transformer, relay and disconnect matched to remote low voltage thermostat.

.3 Power connection to be possible at either end of the heater

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 cabinet convectors as indicated.

.2 Install wall mounted thermostats in locations indicated.

.3 Make power and control connections.

3.3 FIELD QUALITY CONTROL

.1 Tests:

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

.2 Commission system in accordance with requirements of Performance Verification.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

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

END OF SECTION

1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
  .1 CSA C22.2 No.46-M1988, Electric Air-Heaters.

1.2 PRODUCT DATA

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

.2 Submit product data sheets for unit heaters. Include:
  .1 Product characteristics.
  .2 Performance criteria.
  .3 Mounting methods.
  .4 Physical size.
  .5 kW rating, voltage, phase.
  .6 Cabinet material thicknesses.
  .7 Limitations.
  .8 Colour and finish.

.3 Submit product data sheets for unit heaters.
  .1 Include product characteristics, performance criteria, physical size, limitations and finish.

.4 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures and detailed installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

2 Products

2.1 UNIT HEATERS

.1 Unit heater: to CSA C22.2 No.46, horizontal discharge complete with adjustable louvers finished to match cabinet.

.2 Fan type unit heaters with built-in high-heat limit protection, fan-delay switches.

.3 Motor and Fan:
  .1 Fan size and pitch is matched to the power and speed of the unit to optimize CFM, airflow, temperature rise, and quietness
  .2 Motor is heavy duty, continuous operation, totally enclosed, thermally protected with permanently lubricated ball bearings.

.4 Hangers: as indicated or required by manufacturers installation instructions..

.5 Elements: To include metal tubular sheath fused with spiral steel fins and contain a high quality nickel chromium wire, encased in solidly packed magnesium oxide insulation

.6 Cabinet: Constructed of 18 gauge die formed steel. Units to have individual adjustable 20 gauge convex profile air directing louvers. Louvers shall be friction fastened to a single piece 20 gauge frame to prevent movement, once adjusted to the desired position.

.7 Finish: Polyester/epoxy powder coat, Colour – almond.

.8 Refer to schedule for Voltage and Wattage.

2.2 CABINET UNIT HEATERS

.1 Unit heater: to CSA C22.2 No.46, horizontal discharge complete with louvers finished to match cabinet.

.2 Fan type cabinet unit heaters with built-in high-heat limit protection, fan-delay switches.

.3 Motor and Fan:
- .1 The fan motor to be totally enclosed and factory lubricated complete with a black anodized 5 blade mixed flow aluminum fan.
- .2 Fan delay to be a bi-metallic snap action type

.4 Hangers: as indicated or required by manufacturer's installation instructions. Unit to be recessed in wall, as indicated in drawings.

.5 Elements: nickel chromium resistance wire heating element within a steel sheath. Spiral steel fins to be firmly brazed to the surface.

.6 Cabinet: - Front panel constructed of 20 gauge steel. Recess box to be designed for recessing into either frame or masonry walls or ceilings and shall contain knockouts for wiring connections.

.7 Finish: Polyester/epoxy powder coat, Colour – white.

.8 Refer to schedule for Voltage and Wattage.

.9 Access door to be lockable for tamperproof installation.

2.3 CONTROLS

.1 Wall mounted thermostats: type line voltage to Section 23 09 33 - Electric and Electronic Control System for HVAC.

.2 Units to have built-in low voltage transformer, relay and disconnect matched to remote low voltage thermostat.

3 Execution

3.1 INSTALLATION

.1 Suspend unit heaters from ceiling or mount on wall as indicated.

.2 Install thermostats in locations indicated.

.3 Make power and control connections.

3.2 FIELD QUALITY CONTROL

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

.2 Test cut-out protection when air movement is obstructed.

.3 Test fan delay switch to assure dissipation of heat after element shut down.

.4 Test unit cut-off when fan motor overload protection has operated.

.5 Ensure heaters and controls operate correctly.

.6 Commission system in accordance with requirements of Performance Verification.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section covers items common to Sections of Electrical Contractor. This section supplements requirements of Division 00 – Procurement and Contracting Requirements, Division 01 – General Requirements, Division 02 – Existing Conditions.

.2 Refer to Sections 019141 – Commissioning Training, 019113 – General Commissioning Requirements, 013543 – Environmental Procedures, 017700 – Closeout Procedures, 017800 – Closeout Submittals, 019133(02) – Commissioning Forms as they will form part of this Contractor's requirements.

.3 Provide complete and fully operational electrical systems with facilities and services to meet requirements described herein, as shown on the drawings, and in complete accord with applicable codes and ordinances.

.4 Only those items that are specifically indicated as not in contract (N.I.C.) will be omitted.

.5 Contract documents of Divisions 26, 27, and 28 are diagrammatic and approximately to scale, unless detailed otherwise. They establish scope, material and installation quality, and are not detailed installation instructions.

.6 Follow manufacturers' recommended installation details and procedures for equipment supplemented by details given herein and on plans subject to approval of the Consultant.

.7 Examine all drawings to ensure that work under this Division can be properly installed without interference.

.8 Where discrepancies, ambiguities, obvious omissions or errors have been made in drawings and specifications, it shall be the responsibility of the contractor to clarify same prior to tender closing. No allowance will be made after contract award for any expense incurred by him for having to adjust his work to properly conform.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

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

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

1.3 CODES AND STANDARDS

.1 The electrical installation shall comply with all SaskPower requirements and regulations.

.2 In the event of any inspection authority requesting deviation from the design, notify the Consultant and obtain approval before proceeding with any change.

.3 In no instance, shall the standard established by the drawings and specification be reduced by any code or ordinance. All references to codes and standards shall be to the latest edition.

1.4 CARE, OPERATION AND START-UP

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

.2 Connect to equipment furnished in other Divisions and by Owner including start-up and test.

.3 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.

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

1.5 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83

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

1.6 PERMITS, FEES AND INSPECTION

.1 Submit to SaskPower necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish Certificates of Acceptance from Electrical Inspection Department and authorities having jurisdiction on completion of work to Consultant.

1.7 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 All goods and materials shall be new and carry CSA approval seal. Equipment and material shall be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the Consultant and the Electrical Inspection Department.

.3 All fire alarm equipment shall carry ULC approval seal.

.4 No deviation from specified materials shall be allowed, except where alternative materials have been specifically accepted in writing.

.5 Where materials are not directly specified by catalogue number and manufacturer's name, a high industry specification grade product shall be provided. The Consultant shall be the sole judge of whether this standard is being met.

.6 All references to known standard specifications shall mean and intend the latest edition of such specifications.

.7 Each major component of equipment shall have manufacturer's name, address, catalogue and serial number in a conspicuous place.

.8 Upon request, provide a complete list of all materials and their manufacture. The contractor will be required to use the materials indicated. Changes in manufactures at a future date will not be acceptable.

.9 Factory assemble panels and component assemblies.

1.8 WORKMANSHIP

.1 All work under this Division shall be executed in a workmanlike and substantial manner, neat in its mechanical appearance and arrangement.

.2 A competent representative shall constantly supervise the work of this Division from beginning to completion and final acceptance. So far as possible, the same supervisor and workmen shall be employed throughout the project's duration.

.3 Material and workmanship not meeting the standard intended and required by this specification shall, upon instruction from the Consultant, be properly replaced without further charge or consideration.

1.9 ELECTRICAL DRAWINGS

.1 They indicate the general location and route of conduit and cable to be installed. Conduit shall be installed in coordination with other services. These include both new and existing services. Prior to excavation anywhere on site, arrange to have all existing services marked. Where space is indicated for future equipment or plant use, leave space clear.

.2 Install equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment to the satisfaction of the Consultant at no extra cost.

.3 Ceiling and floor outlet symbols are scaled to centre line of symbol; symbol does not indicate the size or shape. Mounting height shall be measured to the lowest point on ceiling mounted equipments, and above finished surface for wall mounted equipment.

.4 Wall outlets are scaled to the perpendicular centre line of the symbol. Mounting heights for all wall mounted outlets shall be measured to the horizontal centre line.

.5 Where outlets are mounted in masonry walls, outlets should be mounted to the nearest coursing line.

1.10 WORK PROVIDED FOR OTHER DIVISIONS

.1 Provide information as to exact size and location of all required, housekeeping pads and roof curbs required for the installation of equipment of Divisions 26, 27, and 28.

.2 Provide information as to the location and exact size of all openings through floors and walls.

.3 Provide information as to the location and exact size of all equipment supports required within walls, and roof support structure.

.4 Provide electrical connections, circuit protection and disconnect devices for all equipment supplied by other Divisions, including the Owners. Provide motor starters, disconnect switches, thermal switches, etc., for motors supplied by mechanical contractor. Special control equipment being supplied by mechanical contractor shall be installed and wired by that contractor.

1.11 WORK PROVIDED BY OTHER DIVISIONS

.1 All housekeeping pads and curbs required for the installation of equipment of Divisions 26, 27, and 28.

.2 Installation and framing of all openings in walls or floors larger than 150 mm diameter, or rectangular, with one dimension greater than 150 mm.

.3 Openings in millwork for electrical outlets and conduits.

.4 Painting of all panelboard and communication panel trims to match colour scheme where exposed in finished areas.

.5 Firestopping shall be the responsibility of the General Contractor.

1.12 WORK NOT PROVIDED BY THIS DIVISION

.1 Control wiring for Mechanical Contractor equipment beyond terminal section of each motor control centre, unless specifically indicated otherwise.

.2 Other work as noted on drawings or specified herein.

1.13 COORDINATION WITH OTHER DIVISIONS

.1 Cooperate fully with the Consultant and other trades of electrically operated equipment to ensure proper arrangement of and provision for all electrical equipment.

.2 Where outlets or equipment may affect architectural or site treatment desired, contact Consultant and for instructions or detailed drawings.

.3 Refer to other Divisions including mechanical, millwork, kitchen equipment, owner supplied equipment, etc, for electrical work in connection with these drawings and specifications.

.4 Location of lighting outlets and receptacles in mechanical or equipment rooms and similar areas shall be finalized during construction to give optimum arrangement. The Consultant shall approve final location before installation.

.5 Supply and install all motor connections, including starters and overload protection and disconnecting devices at motors where required. All motor driven equipment shall be provided with a lockable disconnecting device within line of site of the motor to be disconnected.

.6 Supply and install complete wiring requirements for full voltage in-line devices on single phase equipment such as thermostats, multi-speed switches for unit heaters, force flows, cabinet heaters, etc.

.7 Cutting of openings for electrical outlets in millwork and other similar types of custom-made equipment shall be done by the supplier of this equipment.

.8 Check other Divisions to ensure that suitable provisions have been provided for all motors. It is possible that some motors may vary in size, numbers and characteristics, depending on the equipment manufacturer's specific requirements. Any variations in this regard will not constitute cause for further consideration. The mechanical coordination schedule supplied on the drawings shall be updated with nameplate specifications.

.9 Assume full responsibility for layout of this work and for any damage caused the Owner or other Divisions by improper location or carrying out of this work.

.10 Before commencing work, examine the work of other Divisions, and report at once any defects or interference affecting the work under this Division, or the guarantee of same.

.11 Location of lighting outlets and receptacles in mechanical or equipment rooms and similar areas shall be finalized during construction to give optimum arrangement. The Consultant shall approve final location before installation.

.12 Allow for all hoisting and setting of material and equipment.

1.14 OWNER SUPPLIED EQUIPMENT

.1 Connect all electrically operated equipment supplied by the Owner, as designated on the drawings.

.2 Reconnect all existing electrical services from new and existing electrical sources modified by the work of this contract.

1.15 INSPECTION, TESTING, AND COMMISSIONING

.1 During construction and up to final acceptance, make accessible any equipment or wiring for inspection purposes.

.2 All electrically operating equipment shall be left as a complete installation in perfect operating condition, and receive final test in the presence of the Consultant.

.3 Ensure that all power circuitry is properly tested and meets the CSA Ground Resistance Requirements. For any 600 volt systems, a 600 volt megger or hi-pot procedures shall be used for all such tests. Provide documentation for each test within maintenance/commissioning manuals.

.4 On the request of the Consultant, a staff supervisor shall be made available to assist in this inspection work.

.5 At the completion of the installation, voltage tests shall be conducted in the presence of the Consultant. Transformer taps shall be adjusted, and any other corrective measures implemented to assure the proper operation of all electrical equipment. Provide documentation for each test within maintenance/commissioning manuals.

.6 Acceptance tests and commissioning shall be conducted for systems and/or equipment where indicated in the specifications and other standards referenced herein. Acceptance tests shall include, but not be limited to, the following Sections.

.1 26 09 24 – Low Voltage Lighting Control Devices
.2 26 32 10 – Diesel Generating Unit
.3 26 36 23 – Automatic Transfer Switches
.4 27 05 14 - Communication Cables Inside Buildings
.5 27 05 28 – Pathways for Communication Systems
.6 27 11 19 - Communications Termination Blocks and Patch Panels
.7 28 31 01 - Fire Alarm System

.7 Acceptance tests shall meet requirements as required by manufacturer, as outlined in ANSI – NETA 2007 and additional requirements described on drawings and specified herein. All tests shall be documented as per ANSI – NETA 2007 standards and shall include testing results, testing date, testing technician and representative present.

.8 Acceptance tests shall be made up of the following:

.1 Shop Drawing Information Sheets
.2 Manufacturer Commissioning and Report
.3 Manufacturer Test Reports, Factory and On Site where required
.4 Test Results not forming part of the Static Review Checks Sheets
.5 Owner / Consultant Demonstration Sheets
.6 Training

.9 Certification of all acceptance tests and commissioning forms shall be submitted to the Consultant for approval. Tests and forms not completed to the satisfaction of the Consultant

shall be repeated, and no further costs will be considered. Written documentation bearing name and signature of Contractor, Consultant and Owner's personnel present during acceptance tests and also all commissioning forms shall be included in certification reports. Provide for a minimum of six (6) hours across three (3) separate meetings with Consultant and Owner for review of acceptance test sheets and commissioning forms.

.10 Commissioning is intended to begin upon completion of each system. However, commissioning may proceed prior to the completion of a system, or sub-system, and shall be coordinated with the Consultant. Start of commissioning before system completion will not relieve the Contractor from completing each system on schedule.

.11 In some systems, misadjustments, misapplied equipment and/or deficient performance under varying loads and conditions will result in additional work being required to commission the systems. This work will be completed under the direction of the Consultant, with input from the Contractor, equipment supplier, and Owner. Whereas all participants will have input and the opportunity to discuss the work and resolve problems, the Consultant will have final jurisdiction on the necessary work to be done to achieve the desired performance.

.12 Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process. Experimentation to render system performance will be permitted. If the Consultant deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Consultant will notify the Owner indicating the nature of the problem, expected steps to be taken, and the deadline for completion of activities. If deadlines pass without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner will be the Contractor's responsibility.

1.16 SHOP DRAWINGS

.1 Submit shop drawings, where specifically called for, or as requested. Shop drawings shall show detailed dimensional and technical information, and shall properly describe each piece of equipment. Where applicable, shop drawings shall include complete schematics and wiring diagrams. These shop drawings shall be sufficiently detailed to permit the Owner's technicians to trouble-shoot and repair the equipment. Equipment shall not be ordered and/or fabricated until shop drawings have been reviewed by the Consultant. Shop Drawings shall include, but not be limited to the following Sections on systems and equipment:

.1 26 05 36 - Cable Trays
.2 26 23 00 – Low Voltage Switchboards
.3 26 24 17 - Panelboards Breaker Type
.4 26 27 26 - Wiring Devices
.5 26 28 14 - Fuses - Low Voltage
.6 26 28 21 - Moulded Case Circuit Breakers
.7 26 28 23 - Disconnect Switches - Fused and Non-Fused
.8 26 29 10 - Motor Starters
.1 26 32 10 – Diesel Generating Unit
.2 26 36 23 – Automatic Transfer Switches
.9 26 50 00 – Lighting
.10 26 52 00 - Emergency Lighting

.11 26 53 00 - Exit Signs
.12 27 00 00 - Communication Requirements
.13 27 05 14 - Communications Cables Inside Buildings
.14 27 05 28 - Pathways for Communication Systems
.15 27 11 19 - Communications Termination Blocks and Patch Panels
.16 28 31 01 - Fire Alarm System

.2 Review of shop drawings shall be for general design, arrangement and appearance only. This Division shall check and correct, if necessary, all manufacturer's drawings before submitting, and shall so indicate on each copy, along with a dated approval stamp. All shop drawings must bear an approval stamp and be signed by the Contractor. This review does not relieve this Division from the responsibility for the final installation being correct in all detail, and fully acceptable to the Consultant. Refer to each section for further shop drawing information.

.3 Refer to General Conditions of the Contract.

.4 Provide nine (9) printed copies and one PDF copy for each Section. Each shop drawing shall be complete with a cover page with the following information:

.1 Specification Section and name
.2 Project name, Owner’s name and address
.3 Number of pages in submittal
.4 Contractor and Supplier’s name and contact information
.5 Approval stamps with room for Consultant’s stamp

.5 Shop drawings for complementary systems and/or equipment shall be submitted at the same time. Partial submittals of related equipment will be rejected or held until all other related shop drawing information has been submitted (i.e. submit all shop drawings for power equipment at the same time). Submittals of shop drawings that are incomplete will be rejected.

1.17 CHANGES

.1 Refer to General and Supplemental Conditions.

.2 Submit complete itemized breakdowns of all extras, deletions, and changes to the Consultant. Breakdown shall include quantities, unit costs and extensions. If requested, support claim by certified copies of supplier's invoices.

.3 The right is reserved to move equipment 3000 mm from location shown without further charge or consideration, provided that such re-location is requested prior to finish being applied.

1.18 CONSULTANT PRICES

.1 Electrical progress claims shall be made on Contractor Progress Report #ES110 provided by the Consultant. A copy of this Progress Report is attached for reference. The Electrical contract price shall be broken down into thirteen (13) parts to facilitate assessment of work

done and material supplied. This progress claim shall be submitted simultaneously to the General Contractor and the Consultant, the latter case in duplicate. Refer to General Conditions.

.2 The breakdown shall indicate labour and material to the nearest dollar. Overhead, profit and job expense shall be apportioned to all parts. The breakdown shall be as follows:

.1 Main services
.2 Distribution/Panels
.3 Conduit and boxes
.4 Wire and cable
.5 Motor control
.6 Wiring devices
.7 Lighting fixtures and lamps
.8 Communications systems
.9 Security Systems
.10 Fire Alarm System
.11 Specials
.12 Miscellaneous - 8% maximum
.13 Extras and credits. (Extras in excess of $1,000 shall be broken down into the above points on a separate ES110 sheet)

1.19 OPERATING INSTRUCTIONS AND SERVICE MANUALS

.1 Upon completion of the installation, provide complete and comprehensive identical sets of operating and maintenance manuals.

.2 The Consultant shall review the operating and maintenance manuals and approve same prior to the manuals being sent to the Owner.

.3 The operating and maintenance manuals shall include but not be limited to the following information when applicable in the project:

.1 Certification reports.
.2 Documentation indicating Owner’s receipt of operating instructions.
.3 Complete list of all materials turned over to the Owner c/w receipts for same.
.4 Shop drawings properly indexed and contained in suitably sized binders.
.5 Schematic drawings for all systems indexed and contained in suitably sized envelopes or attached efficiently in the above binders.
.6 Catalogue brochures for light fixtures, panelboards, switches, receptacles, fuses, etc.
.7 All final settings of equipment that has user adjustable settings.
.8 Overcurrent coordination and arc fault study and documentation of associated tests.
.9 Phase rotation confirmation by the Contractor.
.10 Certificate of Owner’s training.
.11 Acceptance Testing and Commissioning reports.
.12 Listing of any spare devices turned over to Owner

The above information shall be bound in binders as noted in specifications. Incomplete or poorly reproduced manuals will be rejected.

.4 Maintain, on a daily basis, a complete set of marked-up prints as as-built drawings that show in complete detail the final arrangement and location of all electrical components and the interconnecting wiring.

.5 All riser conduits (size and routing), panel feeds (size and routing), conduit runs (size and routing) and main communications (size and routing) shall be marked on plans. These are to be maintained in a neat and substantial manner, so as to properly and fully illustrate the way in which the installation has been completed.

.6 All equipment locations such as fire alarm signal boosters, cable termination boxes, signal amplifiers, network switches, door controllers, etc shall be identified on the drawings as to their location and quantity (if more than one exists at that particular location).

.7 The Owner's personnel shall be instructed in the operation and maintenance of the following equipment to the satisfaction of the Owner as per the standards referenced herein.

Section No.	Description	Hours
26 09 24	Low Voltage Lighting Control	2
26 29 10	Motor Starters	1
26 50 00	Lighting	1
26 29 10	Motor Starters	1
26 32 10	Diesel Generating Unit	4
26 36 23	Automatic Transfer Switches	1
52 00 00	Emergency Lighting	1
27 00 00	Communication Requirements	1
27 11 19	Communications Termination Blocks and Patch Panels	1
28 31 01	Fire Alarm System	2

.8 The above instructions shall be given by personnel experienced in the operation of the particular system or equipment. Each item or type of equipment, and all controls, shall be operated in the presence of the Owner's personnel to ensure their understanding of equipment function and individual working parts. The Owner reserves the right to set the period or periods during which the instruction shall be given. The contractor shall submit a program of instruction for approval by the Owner.

.9 Operating and maintenance manuals shall include written documentation bearing name and signature of Owner's personnel who received the above instructions. Contractor shall allow for all training to be completed in a minimum of two sessions. One session at substantial completion, and one session within three months of turning over the system.

.10 Operating and maintenance manuals, as well as all Owner instructions, shall be complete before substantial completion (as outlined by the Builders' Lien Act) will be considered. Also, preliminary maintenance manuals must be submitted prior to 70% completion. No further progress payments will be permitted until these preliminary maintenance manuals have been submitted and approved.

1.20 STORAGE AND PROTECTION

.1 Maintain and protect all work provided under this Division. Store all materials within a protected enclosure to prevent exposure to weather or construction dirt.

.2 Protect all finished and unfinished work of this and other divisions from damage during the course of construction. Cover floors and other surfaces, if necessary. Any damaged work or finishes shall be repaired or replaced without further charge to the Owner.

1.21 WARRANTY

.1 All materials and workmanship shall be guaranteed for a period of one year from date of substantial completion.

.2 Properly repair and replace all defective work and other work which becomes defective during the term of warranty.

.3 Service on equipment or systems critical to the Owner's operation shall be provided on an emergency basis which may necessitate overtime and service outside of normal working hours. The contractor shall ensure that all suppliers comply with this requirement.

1.22 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is provided by the Electrical Contractor except for conduit, wiring and connections below 50 V which are related to control systems specified in Mechanical Division and shown on mechanical drawings.

1.23 FINISHES

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

.1 Paint indoor switchboards and distribution enclosures light grey ASA 61.

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

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

1.24 ABBREVIATIONS

.1 Abbreviations used in this specification are common to and in general use within the related trades.

1.25 EQUIPMENT IDENTIFICATION

.1 Nameplates shall be provided on each new piece of electrical equipment, including, power panels, distribution panels, lighting panels, transformers, disconnect switches, contactors, telephone panels, miscellaneous systems and panels.

.2 Nameplates for each new electrical panel shall indicate panel designation, mains voltage and panel and circuit number from which this panel is fed.

.3 Nameplates for new disconnects and contactors shall indicate equipment being controlled, and voltage.

.4 Nameplates for new terminal cabinets shall indicate system and voltage and load of area served.

.5 Nameplates for Normal Power Equipment shall be made from black-white-black Lamecoid with bevelled edges and white engraved letters. Nameplates shall be fastened with self tapping metal screws to equipment in a conspicuous location. Flush mounted panels shall have nameplate located on front of panel behind hinged door.

.6 Typical identification standards shall be used for new equipment throughout the project as follows:

.1 Lighting, receptacle and power panels shall each be identified with an engraved Lamecoid plate secured to top interior trim as:

Panel 202	10 mm high lettering
120/208 volts	6 mm high lettering
Fed from	6 mm high lettering

.2 Each panel shall be supplied with a directory card holder welded to inside of door, complete with a neatly typewritten list showing information as follows:

Panelboard name	202
Panel voltage	120/208 volts

Circuit Number	Description	Load
1	Lighting Room 200 (Main Area)	1200W
2	Receptacles Room 200 (Main Area)	6-15A
3	Room 220	1/3 H.P. Fan

Spaces and spares shall be left blank so as to facilitate future description. Also, existing panels where adjustments have been made in the circuitry shall be field checked in their entirety and new directory cards shall be provided.

.3 List shall be covered with a 1 mm thick clear plastic sheet to protect it.

.4 Other cabinets and plywood back boards for low voltage systems, such as signals and communications, shall be identified as panelboards with a directory showing circuit

numbers and room locations, plus a blank for "Remarks", as well as a Lamecoid plate designation panel name.

EXAMPLE: if cabinet is for telephone

.....TP - 2nd floor

.5 Equipment not listed above, such as incoming service cables, communicating cables, switchgear, transformers, disconnects, motors, instruments, fire alarm and control panels, shall be identified in a similar manner, showing name and number of the equipment, voltage and load information.

.7 Feeder pull boxes and junction boxes shall be identified with waterproof ink, showing feeder or system concerned. Conduit entering junction boxes for communications systems shall be identified with the room number that each conduit serves.

.8 A small dab of paint shall be applied to inside of each outlet box, pull box and panel as it is installed, using colour code as follows:

Red	-	Fire Alarm System
Yellow	-	Security, Alarm Systems, Card Access
Green	-	Telephone/IT Computer Systems

The outside of the box shall also be identified in this way so as to readily determine the system within the conduit system. The cover of each junction box for branch circuits shall describe the voltage being used by means of a waterproof ink.

.9 No colour code is required for regular lighting and power circuits, but voltage class shall be displayed on all pull boxes and panels.

.10 Junction boxes in furred ceilings shall be colour identified on both inside and outside.

.11 Connections in equipment shall be made Phase 'A', 'B', 'C', from left to right when viewing wiring from front or accessible direction.

.12 Colour coding shall be carried through from incoming utility supply down to and including panels, and shall be as follows:

.1 Incoming utility service lines shall be identified by Red - Phase 'A'; Black - Phase 'B'; Blue - Phase 'C'; with colour coded PVC tape.

.2 Switchgear buswork in each switchboard and unit substation cubicle shall be banded with 3M tape identified in accordance with service lines colour coding. In addition, where neutral bus is introduced, it shall be banded white. Ground bus shall be banded green.

.3 Feeder and sub-feeder bus or conductors shall be banded as above.

.4 Lighting and power panels shall conform to the Canadian Electrical Code, and shall have main bus banded with tape as follows:

Red	-	Phase 'A'
Black	-	Phase 'B'
Blue	-	Phase 'C'
White	-	Neutral
Green	-	Ground

.13 Each cover plate shall have an engraved label or riveted Lamecoid approximately 8 mm x 30 mm, and contain the panel and circuit number in 4 mm high lettering. The cover plates for all receptacles designated on the drawings for housekeeping purposes shall also contain the wording "Housekeeping". The cover plates for all receptacles fed from the ground fault interrupters shall also contain the wording "G.F.I."

.14 The circuits controlled by all light switches shall be neatly printed with waterproof ink on the side of the switch outlet box so that the panel and circuit number are clearly legible when the coverplate is removed. It shall not be necessary to remove the switch from the outlet box in order to read the panel or circuit number.

1.26 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

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

.5 All data cables and data jumper cables (minimum 23 gauge), jacks and connector boots installed as part of this project used for Security Systems, whether CAT 6A or fibre optic, shall be BRIGHT GREEN in colour.

.6 All patch cables are to be stranded cable with RJ45 connectors. RJ45 connectors shall not be attached to solid conductor cable.

.7 All installed runs of CAT 6A cable are to be solid conductor cable and terminated into patch panels in equipment racks or faceplates in other locations.

.8 An installed cable is any cable that is run through a conduit, run from one area in a building to another area or any cable that travels farther than the adjacent equipment cabinet in a series of cabinets. Note: Equipment cabinets must be abutting without side panels to open connection to be considered adjacent.

1.27 CONDUIT AND CABLE IDENTIFICATION

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

1.28 WIRING TERMINATIONS

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

1.29 MANUFACTURERS AND CSA LABELS

.1 Visible and legible, after equipment is installed.

1.30 WARNING SIGNS

.1 As specified and to meet requirements of Electrical Inspection Department and Owner.

.2 Decal signs, minimum size 175 x 250 mm.

1.31 LOCATION OF OUTLETS

.1 Locate outlets in accordance with drawings and specifications.

.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. Locate disconnect devices in mechanical and electrical on latch side of door.

1.32 MOUNTING HEIGHTS

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

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

.3 Install electrical equipment at following heights unless indicated otherwise or as noted on drawings.

.1 Local switches: 1200 mm.

.2 Wall receptacles:

.1 General: 450 mm.

.2 Above top of counters or counter splash backs: 150 mm.

.3 In mechanical rooms: 1400 mm.

.3 Fire alarm stations: 1200 mm.

.4 Fire alarm horn/strobe: 2100 mm.

1.33 LOAD BALANCE

.1 All lighting panels, distribution centres, motor control centres and main switchboards shall be load balanced such that the maximum variation between the two worst phases does not exceed 5%.

.2 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.

.3 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

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

1.34 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. 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 to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.4 All conduit and tray sealing shall be the responsibility of the Electrical Contractor.

1.35 TEMPORARY AND TRIAL USAGE

.1 Temporary and trial usage by the Owner, or the Contractor, of any of the electrical apparatus or equipment, or any work or materials supplied under this Division before final completion and written acceptance, is not to be construed as evidence of acceptance of same by the Owner.

.2 Temporary and trial usage may be made as soon as this Division deems the work sufficiently advanced for making a complete and thorough test of same, and that no claim may be made for the injury to or the breaking of any part of such work which may be so used, whether caused by weakness or inaccuracy of structural parts, or by defective material or workmanship of any kind.

.3 Lighting shall not be used for temporary or trial usage without prior approval of the owner and consultant sign off. If temporary lighting is required for the duration of the project, only construction lamps marked with a permanent ink on the lamp may be used. Evidence of marking will be requested by the consultant. Any fixtures used for temporary or trail usage shall be relamped and cleaned. Evidence of cleaning and relamping will be required by the consultant.

1.36 EXCAVATION AND BACKFILL

.1 Any excavation and backfilling work that is necessary to accommodate the work under this Division shall be the responsibility of Divisions 26, 27, and 28, in accordance with the requirements of Division 31.

.2 Do not proceed with backfilling operations until completion of following:

- .1 Departmental Representative has inspected and approved installations.
- .2 Departmental Representative has inspected and approved of construction below finish grade.
- .3 Inspection, testing, approval, and recording location of underground utilities.
- .4 Removal of concrete formwork.

.3 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.4 Do not use backfill material which is frozen or contains ice, snow or debris.

1.37 TEMPORARY LIGHT AND POWER

.1 The General Contractor shall be responsible for all temporary light and power provisions. Refer to General Conditions.

1.38 MATERIAL TO BE TURNED OVER TO THE OWNER

.1 All equipment that is being removed or replaced shall be stockpiled as per Owner's request. The owner may deem that the equipment shall be disposed. All disposal and removal is the responsibility of the contractor.

.2 Materials as indicated in various sections of this specification shall be turned over to the Owner. These materials shall include, but not be limited to the following:

.1 Obtain a signed receipt for each item turned over to the Owner. Include receipts in the operating and maintenance manuals.

.2 One set of three fuses for each fuse type and size for each switchboard distribution centre and motor control centre.

.3 One set of contacts and one holding coil for each size and type of FVNR motor starter.

.4 Spare lighting fixtures.

.5 Spare Fire Alarm Devices.

.6 Data patch cables.

1.39 SITE EXAMINATION AND REVIEW OF WORK

.1 It is recommended that the contractor visit the existing site during the tendering period to familiarize himself with the construction conditions and electrical work provided to date. The contractor shall thoroughly satisfy himself that the work contained in these drawings and specifications can be carried out and that all costs have been included in the tender submitted.

.2 The Contractor shall review all sets of tender documents associated with the project to ensure that they have an idea as to the scope of work involved in the other trades and to assist with their coordination of required interface procedures and inter-connection requirements.

1.40 SITE WORK

.1 The electrical contractor shall be responsible for all necessary trenching and backfilling for all exterior work in connection with underground feeders. All trenches shall be a minimum 900 mm deep or to top of bedrock. Care must be exercised to ensure a proper grade line is used, and that suitable drainage has been provided.

.2 All excavated material shall be removed from the site.

.3 Trenches shall be filled with granular fill and compacted to 95% proctor. Prior to backfilling, all trenches must be inspected by the Consultant.

.4 Supply and install all cable and conduit in trenches, as described herein or detailed on the drawings.

.5 Electrical contractor shall be responsible for all concrete and reinforcing in connection with site lighting and car parking pedestals. All concrete and reinforcing on the project shall be in accordance with the quality required for reinforced concrete and reinforcing as specified under Division 3, and as detailed on the drawings.

1.41 CUTTING AND PATCHING

.1 Should any cutting or repairing of either unfinished or finished work be required, the contractor shall employ the particular trade whose work is involved, to do such cutting and patching, and shall pay for any resulting costs.

.2 All holes within buildings shall be fire stopped when penetrating a fire rated structure.

.3 Provide re-usable fire stopping sleeves for all locations where data/voice cables penetrate a fire rated structure.

1.42 PAINTING

.1 All iron or steel structures fabricated and installed by Divisions 26, 27, and 28 for supporting panels, starters, conduit or other equipment, shall be wire brushed and given one coat of lead chromate paint primer before being set into place. After all equipment is installed and piping complete, this iron work shall be given two coats of ASA #61 enamel to match the panel or structure being supported or in the colour specified for the product.

.2 All pull boxes, wireways, gutters, etc., fabricated for Divisions 26, 27, and 28, shall be given a coat of lead chromate primer and two coats of ASA #61 enamel before installation to match equipment finish.

.3 All panels and pull boxes that are set in finished walls or ceilings shall have approved flush covers that shall be prime coated with lead chromate paint, and left for the painting division to paint in with the surrounding wall or ceiling finishes. Panel trims and pull box covers to be painted with the cover removed from the wall so that it can be easily installed or removed without damaging the surrounding paint finish.

.4 All electrical equipment shall be finished with an ASA #61 enamel, the colour of which shall be grey, unless otherwise specified.

.5 When installation is complete, all scratches and defects to the paint finishes shall be properly touched up, and where necessary, entire paint surfaces shall be re-done.

1.43 MATERIAL SAFETY DATA AND HAZARDOUS MATERIALS

.1 The Contractor shall provide material safety data sheets on all materials prior to shipping materials to site. These data sheets shall be submitted in triplicate to the Owner.

.2 The Contractor shall coordinate and provide necessary information for the Owner’s "Work Place Hazardous Material Information System".

1.44 SCHEDULING OF WORK AND DEMOLITION

.1 Refer to Division 1 specifications.

.2 Refer to the overall project schedule for further scheduling requirements.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

CONTRACTOR PROGRESS REPORT ES110

Ritenburg & Associates Ltd.
Consulting Electrical Engineers

#200–2222 ALBERT STREET – REGINA, SASK. S4P 2V2
Phone: (306) 569–7543 Fax: (306) 569–1307

ELECTRICAL PROGRESS CLAIM No. _____
DATE _____ 20____
PROJECT _____
ELECTRICAL CONTRACTOR _____
GENERAL CONTRACTOR _____
PRIME CONSULTANT _____
SUBMITTED BY _____

REVIEWED BY: _____
DATE: _____ 20____

RECOMMENDED PAYMENT AS SHOWN ☐ AS CORRECTED ☐ REJECTED ☐

* Cross out if not applicable	TOTAL CONTRACT		COMPLETE TO DATE		THIS PROGRESS	
	MATERIAL	LABOR	MATERIAL	LABOR	MATERIAL	LABOR
A. MAIN SERVICE *HV, Duct Bank, Transformers, Switchboards						
B. DISTRIBUTION / PANELS *Distribution Centres, Dry Type Transformers, Fuses						
C. CONDUIT AND BOXES *Tray						
D. WIRE AND CABLE *Bus Duct						
E. MOTOR CONTROL						
F. WIRING DEVICES *Dimmers, Pac Poles, Low Voltage Switching, Coverplates						
G. LIGHTING FIXTURES & LAMPS						
H. ALARM SYSTEMS *Fire, Security, Signal, Medical						
I. COMMUNICATIONS SYSTEMS *Intercom, Nurses' Call, Data/Telephones						
J. SPECIALS *Emergency Generator, Lightning Protection CCTV, UPS, Trench Duct						
K. MISCELLANEOUS – 8% Maximium						
L. EXTRAS & CREDITS (List price changes seperately, use separate sheet if necessary)						
TOTAL						

SUMMARY TOTAL	Contract $	To Date $	This Progress
	Contract GST $	To Date GST $	This Prog GST $
	Total Amount	Less Holdback	Less Holdback
		Net Amount	Net Amount

% COMPLETE _____

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to device types, cable types, and special mounting details.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors #10 AWG or less.

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

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

.2 Clamp for round copper conductors.

.3 Stud clamp bolts.

.4 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required.

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 C22.2No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with NEMA.

END OF SECTION

Part 1 General

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.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.3 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 BUILDING WIRES

.1 All conductors shall be copper, minimum No. 12 gauge, unless specifically noted otherwise.

.2 All non-housing building conductors #12 AWG to #8 AWG shall be rated for minimum 600V RW-90 XLPE. Conductors #6 AWG and larger shall be rated for minimum 600V RW-90 XLPE. All conductor for motor feeds from variable frequency drives, shall be rated for minimum 1000V RW-90 XLPE. Wiring in channel back of fluorescent fixtures shall be 600 volt Type GTF or TEW. Size, grade of insulation, voltage and manufacturer's name shall be marked at regular intervals.

.3 All wiring shall be rated at 75 Deg C when connected to equipment rated 75 Deg C.

.4 All cabling for housing units shall be NMD-90 cabling except where noted or specified as otherwise.

.5 Wiring for major feeders may be NUAL aluminum and shall be installed only where specifically noted on the drawings.

.6 Conductor utilized in conduit run under slab on grade or in conduit underground shall be Type 'RWU-90'.

.7 Wire shall be as manufactured by Nexans, Alcan, Pirelli, BICC General Wire or Superior Essex.

.8 NMD90 cables meet or exceed the requirements of all applicable ASTM specifications, CSA C22.2 No. 48 (non-metallic sheathed cable).

.9 The construction is manufactured using annealed (soft) copper conductors—compressed stranding for the stranded conductors; a 90°C rated thermoplastic polyvinyl chloride (PVC) insulation and a nylon jacket for the individual conductors; and a PVC jacket surrounding the overall construction.

2.2 TECK CABLE

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

.2 Conductors:

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

.3 Insulation:

- .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V to 1000V as noted above.

.4 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.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.5 Connectors:

.1 Watertight approved for TECK cable.

.6 Gasoline Dispensing Station:

.1 Watertight and Hazardous Location Rated (HL) approved for TECK cable.

.2 All Teck90 Cable shall be HL rated.

.3 Provide adequate protection and strain relief for cables between stub-up and devices.

.4 All cables shall include grounding conductor.

Part 3 Execution

3.1 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for the Intercom system for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Manufacture description sheet on each cable type

3.2 INSTALLATION OF BUILDING WIRES

.1 Termination for #8 AWG and larger shall be by means of approved solderless connector lug. For parallel conductors, a common lug with separate termination for each conductor shall be employed.

.2 Conductor splices shall be made in accordance with specifications. Provide sufficient length for joint remake, and no less than 200 mm spare length. On through wiring, leave 300 mm loop.

.3 Wiring in cabinets, pull boxes, panels and junction boxes shall be neatly trained and held with nylon cable ties.

.4 Conductors shall be tag identified where passing through junction boxes.

.5 All housing unit wiring shall be installed as per residential wiring methods that comply with applicable Canadian Electrical Code and the local authority having jurisdiction.

.6 The use of BX cabling is required for connections to such equipment as furnace, water heater, etc.

.7 The maximum allowable conductor temperature for NMD-90 is 90°C. The minimum recommended installation temperature for NMD-90 is minus 25°C for two-conductor cables, and minus 10°C for three-conductor cables (with suitable handling procedures)

□

.8 NMD-90 cable should be properly stored above 0°C for 24 hours prior to installation.

.9 The maximum voltage rating for all intended applications is 300 volts.

.10 After installation of all cable, wrap connectors having exposed conductive surfaces with plastic electrical tape, applying enough servings to provide uniform covering not thinner than the insulation of the largest conductor connected and overlapping the insulation of each connected conductor by not less than 12mm.

3.3 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 - 0-1000V.

.3 All cables shall be terminated and spliced with suitable compression type connectors, as recommended by the cable manufacturer. The connectors shall satisfy the bonding and grounding requirements at the supply end.

.4 All cables shall be single conductor and copper, unless otherwise specified.

.5 All cable shall be rated for 600 volts (except for VFD output cable), insulated with cross-linked polyethylene and rated for operation at 90 degrees C. Cable shall have a FT4 rated outer jacket.

.6 All cable shall meet the CSA requirements for cold bend and impact testing at minus 40 degrees C.

.7 All cable shall be protected by a corrugated aluminum sheath or by interlocked aluminum armour.PVC jackets shall be required on all metallic sheathed cables.

.8 The jackets shall meet the FT6 flame spread requirements and be identified on the P.V.C. jacket.

.9 All cables shall be installed in accordance with the manufacturers recommendations, in suitable cable tray as specified within the specifications.

.10 The cables shall be terminated at the supply end on a non-ferrous metallic plate and at the load end on a non-metallic rigid fibre board plate. The cable sheaths shall be bonded at the supply end only.

.11 All cable installed in cable tray shall be installed at one diameter spacing.

.12 When single conductor cables are direct earth buried they shall be spaced 150 mm apart.

.13 Cables shall be manufactured by Nexans, Alcan, Superior Essex, General Wire or Pirelli.

□

3.4 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 Conductors: insulated, copper, size as indicated.

.4 Type: AC90 - Armour: interlocking type fabricated from aluminum strip.

.5 Type: ACWU90 - jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

.6 Connectors: as required.

.7 Multi conductor cables shall be color coded during manufacture. Single conductor cables shall be color coded with adhesive colour coding tape. The tape shall be applied for a minimum of 75 mm at all terminations. Cables shall not be painted under any condition. Color coding shall be as follows:

Phase 'A' - Red	Neutral - White
Phase 'B' - Black	Ground - Green or Bare
Phase 'C' – Blue	

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

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.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to connectors used, specialty ground bars, etc.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 EQUIPMENT

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

.2 Ground rods: 20 mm diameter by 3000 mm long, copper clad.

.3 Plate electrodes: galvanized steel surface area 0.37 m2, minimum 6.35 mm thick, with two (2) ground cable connectors per plate

.4 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.5 Insulated grounding conductors: green

.6 Ground bus: copper, complete with insulated supports, fastenings, connectors.

.7 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.

.8 All ground conductors shall be bare or insulated, stranded, medium hard drawn copper wire. All insulated ground wires shall be green.

.9 Exposed copper shall be cleaned to a bright surface, and shall be finished with two coats of clean, insulating varnish.

.10 Connect ground conductor to copper water pipe at least twice (minimum 40 mm diameter), utilizing a Burndy Type GAR pipe clamp. Provide jumper across water meter.

.11 All connections to the ground bus or risers shall be thermowelded, or shall utilize the Burndy Hy-Ground compression connections. Clamp type connections shall only be allowed to individual pieces of equipment.

.12 Where bonds are covered with soil, the conductors are to be coated with anti-corrosion compound "Kopr-Shield" (Thomas & Betts Co.) before compression connector is applied. All bonding shall be done with 'C' tap and lug compression connectors.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Electrical equipment and wiring shall be grounded in accordance with the Canadian Electrical Code, and local inspection authority's rules and regulations.

□

.2 All metallic raceways and conduits for communications, cable and conductors shall be grounded.

.3 All motors with flexible connections shall have separate ground wire run bridging the flexible connections. This ground wire shall be run from the motor back to the nearest junction box or motor control centre where the termination can be readily inspected. Insulation for this wire shall be green.

.4 Lay-in trays and feeder conduits shall be connected to the ground bus.

.5 All panel feeds (208 volt and 600 Volt) shall include a building network ground conductor.

.6 All grounding conductors outside the electrical rooms and closets shall be insulated and installed in conduits, unless otherwise noted.

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

.8 Protect exposed grounding conductors from mechanical injury.

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

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

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

.12 Structural steel and metal siding to ground by welding copper to steel.

.13 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections unless indicated otherwise.

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

.15 Soldered joints not permitted.

.16 Install separate ground conductor to outdoor lighting standards.

.17 Make grounding connections in radial configuration only. Avoid loop connections.

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

.19 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.2 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of secondary systems.

□

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, duct systems, frames of motors, starters, control panels, structure steel work, and distribution panels.

3.4 MAINTENANCE HOLES

.1 Install conveniently located grounding stud, electrode, size as indicated stranded copper conductor in each manhole.

.2 Install ground rod in each manhole so that top projects through bottom of manhole.

.3 Provide with lug to which grounding connection can be made. Confirm ground resistance meets or exceeds Canadian Electrical Code minimum requirements.

3.5 COMMUNICATION SYSTEMS

.1 Install grounding connections for all communication and security systems as per manufacturer’s recommendations

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Perform tests before energizing electrical system.

.3 All grounding conductors outside the electrical rooms and closets shall be insulated and installed in conduits, unless otherwise noted.

.4 Connections to equipment shall be made with, bronze or copper bolts and connectors.

.5 Equipment grounds shall be connected to the building grounding network. All non-current carrying metallic parts of equipment shall be connected to the ground network.

.6 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

.2 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.3 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.3 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to poured concrete with expandable inserts.

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

.3 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.

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

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

- .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm 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.

.7 For surface mounting of two or more conduits, use channels spaced as required by C22.1.

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

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

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

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

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

□

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for the Intercom system for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
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.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

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.

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 Sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

Part 3 Execution

3.1 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.2 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.

3.3 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 / bix block where indicated in cabinets.

□

.4 Only main junction and pull boxes are indicated. Provide others as required by code. Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

3.4 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, Emergency, or Normal power.

3.5 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

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.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

□

.3 The Bidder must provide a complete list of primary system products offered with their bid.

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 Provide blank cover plates for boxes without wiring devices.

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

.6 Each outlet box installed in steel stud and gyproc walls shall be mounted on Caddy #BHA, series SGB or TSGB screw gun brackets. Wood strapping with steel studs shall not be utilized for supporting outlet boxes

.7 Use condulets where 90° turn required on wall mounted conduit. They shall be of the type where cover screws do not enter the wire chamber and covers are left accessible.

.8 Each outlet box installed in acoustic tile ceilings shall be mounted on double Caddy "Tee Bar Hanger" #512 in such a manner that the outlet box will not twist in any direction.

.9 Where boxes are surface mounted in unfinished areas, such as furnace or boiler rooms, stamped galvanized steel 100 mm square box to accept #8300 series raised covers shall be used.

.10 Where surface wiring methods are allowed and approved in finished areas, use Hubbell or Wiremold boxes as per drawings c/w suitable adapter for wireway entrance.

.11 Outdoors or damp locations, boxes shall be cast Feraloy or aluminum type 'FS', with threaded hubs and vapourproof covers.

.12 Indoors, stamped zinc cadmium plated steel boxes shall be provided and set for each fixture, switch, wall receptacle or other types of outlets, adapted to suit its respective location and designed to accept its particular components.

.13 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.14 Two gang or larger shall be solid type with raised cover for tile, block or gyproc finish.

.15 Wood strapping with steel studs shall not be utilized for supporting outlet boxes.

.16 Set boxes plumb and level within 6 mm of finished surface. Mats not permitted.

.17 Where required, provide voltage separation barriers.

□

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel 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 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

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

.5 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 CONCRETE BOXES

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

2.4 CONDUIT BOXES

.1 Outdoors or damp locations, boxes shall be cast Feraloy or aluminum type 'FS', with threaded hubs and vapourproof covers.

.2 Indoors, stamped zinc cadmium plated steel boxes shall be provided and set for each fixture, switch, wall receptacle or other types of outlets, adapted to suit its respective location and designed to accept its particular components.

.3 Standard octagon boxes shall be 100 mm diameter, 53 mm deep minimum. Increase depth where area fill requires. Equip each box used for fixture hanging with a fixture stud.

.4 Two gang or larger shall be solid type with raised cover for tile, block or gyproc finish.

.5 Wood strapping with steel studs shall not be utilized for supporting outlet boxes.

.6 Set boxes plumb and level within 6 mm of finished surface. Mats not permitted.

.7 Where required, provide voltage separation barriers.

2.5 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.

□

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, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Outlet boxes shall be supported independently of conduit capable of supporting weight of fixture or other device. Conduit entering the back of a box shall not enter the centre knockout.

.6 For recessed fixtures in suspended ceilings, outlet box shall be accessible when fixture is removed.

.7 Flexible conduit to fixture shall be minimum 12 mm diameter, and shall not emanate from outlet box cover. Maximum length of flexible conduit from outlet box to fixture shall be 3000 mm. Outlet box for fixture shall not be located above ducts, pipes, etc. Outlet box shall be within 750 mm (vertically) of the fixture.

.8 Provide and set all special communications type back boxes associated with systems specified under Electrical Divisions.

.9 In placing outlets, allow for overhead pipes, ducts, etc., and for variation in wall and ceiling finishes, door and window trim, panelling, etc.

.10 Location of receptacle outlets in equipment rooms shall be finalized during construction to give optimum arrangement. Consultant to approve locations before installation.

.11 Multigang boxes shall have each gang fully barriered from the next, or multiple single gang boxes may be used, provided they are installed in a neat, orderly fashion. Barriers shall be steel and shall be firmly held in place.

Attention is directed to special outlet box locations for switches requiring wider mount spacing rejection feature.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

□

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

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.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

□

Part 2 Products

2.1 CONDUITS

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

.2 Rigid PVC conduit: to CSA C22.2 No. 211.2.

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

.4 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3

.5 Conduit for use in corrosive atmospheres shall be rigid PVC or rigid steel with extruded PVC jacketed. Refer to drawings for areas requiring PVC.

.6 Condulets shall be of a type wherein cover screws do not enter the wire chamber.

.7 Flexible conduit connections to all mechanical equipment shall be of 'Sealtite' manufacture.

.8 Flexible conduit connectors shall be of the insulated throat type.

.9 Condulets with suitable covers shall be used where condulets are exposed. Each conduit fitting shall be of a type suitable to its particular use, and of a type which will allow installation of future conduits without blocking covers of existing condulets.

.10 Expansion joints shall be installed with ground jumper.

.11 All conduits shall be terminated with a suitable bushing.

.12 Flexible conduit and Rigid conduit entering boxes or enclosures shall be terminated with nylon insulated steel threaded bushings, grounded type.

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 / raceway specified. Coating: same as conduit / raceway.

.2 Factory "ells" where 90º bends are required for 25 mm and larger conduits / raceways.

□

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 Conduits and cables shall be supported, at regular intervals, with corrosion resisting clamps. Lead anchors or expansion bolts shall be used to attach clamps to masonry walls.

.3 Conduit and cables shall be installed to avoid proximity to water and heating pipes. They shall not run within 150 mm of such pipes, except where crossings are unavoidable, in which case they shall be kept at least 25 mm from covering of pipe crossed.

.4 Cap ends of all conduits to prevent entrance of foreign matter during construction. Manufactured caps shall be employed.

.5 Conduit shall be installed as close to building structure as possible so that where concealed, necessary furring can be kept to a minimum.

.6 Empty conduits, installed under this Division but in which wiring will be installed by others, shall be swabbed out with "Jet Line" foam packs, and be c/w Polypropylene pull wire or polytwine.

.7 Conduits shall be installed at right angles or parallel to building lines, accurate in line and level.

.8 Conduit shall not be bent over sharp objects. Improperly formed bends and running threads will not be accepted. Bends and fittings shall not be used together. Proper supports of manufactured channels shall be provided where exposed conduits and cable runs are grouped.

.9 Under no condition will EMT be allowed exposed within 1200 mm of floor, outdoors, or in areas where explosive, corrosive or moist atmosphere exists.

.10 Not more than four (4) 90 degree bends or equivalent offsets will be permitted between pull boxes. When maximum number of bends are used, the total run between pull boxes shall not exceed 18000 mm.

□

.11 PVC conduit shall not pass through a fire partition or floor separation. Where it is necessary for PVC conduits to pass through a fire barrier, a transition to rigid steel conduit shall be provided for 2000 mm on either side of the fire barrier.

.12 Surface mount conduits except where noted otherwise.

.13 Use rigid PVC conduit in corrosive areas or as indicated on plans.

.14 Use flexible metal conduit or Teck90 for connection to motors.

.15 Use liquid tight flexible metal conduit or Teck90 for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.16 Use explosion proof flexible connection for connection to explosion proof motors.

.17 Minimum conduit size for lighting and power circuits: 19 mm.

.18 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter. Mechanically bend steel conduit over 19 mm dia.

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

.20 Install pulltwine in all empty conduits / raceways and conduits / raceways that are less than 40% filled.

.21 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.22 Dry conduits out before installing wire.

.23 Conduits/Cabling/raceways are not to be run within concrete floors/ceilings. Any conduits/cabling/raceways required to be run along the concrete slabs shall be surface run and not recessed into the concrete. Any instances where cabling is required to be run vertically within concrete poured walls, coreline may be used as the raceway but it shall be transitioned to EMT or Rigid Steel (where required) with interfacing connectors or junction boxes being provided as required. This specification contains references to cast in place conduits. This is only applicable where specifically called for in certain locations within the documents.

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 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.

□

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 UNDERGROUND

.1 Slope conduits to provide drainage.

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

3.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.6 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

.3 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES AND CODES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2No.126-M91(R1997), Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA) standards

.1 NEMA FG 1-1993, Fibreglass and Cable Tray Systems.

.2 NEMA VE 1-1998, Metal Cable Tray Systems.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with section 01 33 00 - Submittal Procedures.

.2 Identify types of cabletroughs used.

.3 Show actual cabletrough installation details and suspension system.

Part 2 Products

1.4 CABLETROUGH

.1 Cable trays shall be complete with necessary factory elbows, fittings, joiner plates, radius turns, supports, etc., as necessary for the total installation.

.2 Cable tray shall be provided for communications conductors where shown on the drawings. The cable tray shall be used for the running of data/voice communications cables, coax cable.

.3 The cable tray shall not be used for the running of low-voltage Class 2 control wiring.

.4 Cable tray indicated on the drawings for the purpose of running base building Data / communications conductors shall be a basket tray cable support system, electroplated welded wire-mesh, minimum of 50 x 100mm mesh size, 105mm deep, in standard 3048mm lengths. Tray width shall be 300mm unless otherwise noted on the drawings.

□

.5 Increase try size if necessary to accommodate cables and spacing specified on the drawings AND to meet the maximum fill requirements of 60% (the cable tray fill shall not be more than 60% at project completion).

.6 Where required, provide framed cable or conduit drops.

.7 Provide cable clamps or ties at 1000 mm intervals to maintain alignment of cable in tray.

.8 All hanger rods and supports shall be galvanized.

.9 Cable tray shall be manufactured by Cooper B-Line Systems, Cablofil, Canstrut, Code Manufacturing Ltd., or Thomas and Betts 'Express' Tray.

1.5 SUPPORTS

.1 Provide supports as required.

Part 3 Execution

1.6 INSTALLATION

.1 Install complete cabletrough system. The basket tray shall be run suspended from the LAN room's ceiling around the perimeter of the room in a 'U' or 'J' shape from where the cabling enters the room to directly above the equipment racks.

.2 The trays shall be installed at a minimum height of 2300mm A.F.F and a maximum of 2740mm A.F.F (measured from the bottom of the tray).

.3 Do not run tray within 300 mm of steam or hot water lines. Cable tray shall not be in contact of any sprinkler piping or laboratory gas lines.

.4 Cuts shall be filed smooth and treated with a galvanizing compound where cutting of certain sections is required.

.5 Cable tray shall be supported on 1500 mm centres, and shall be adequately braced to withstand loads due to pulling in of cables.

.6 Check routing and field dimensions to ensure there is absolutely no interference with work and equipment of other divisions.

.7 Cable tray shall be grounded every 15 meters with AWG #1/0 bare copper unless otherwise noted.

.8 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 CSAC22.2No.26, Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

.3 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.4 National Electrical Manufacturers Association (NEMA).

.5 National Building Code 2010 (NBC 2010)

.6 National Fire Protection Association (NFPA)

.7 Institute of Electrical and Electronic Engineers (IEEE).

.8 Audio Engineering Society (AES).

.9 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

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Part 2 Products

2.1 WIREWAYS

.1 Wireways and fittings: to CSA C22No.26.

.2 Sheet steel with hinged cover to give uninterrupted access with baked grey enamel finish

.3 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

Part 3 Execution

3.1 INSTALLATION

.1 Install wireways and auxiliary gutters.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers where required.

.5 Install gutter to full length of equipment.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.2 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts.

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END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 23 00 – Alternates.

.2 Section 26 05 01 - Common Work Results - Electrical.

.3 Section 26 27 26 - Wiring Devices.

.4 Section 26 50 00 - Lighting.

1.2 SYSTEM DESCRIPTION

.1 Provide occupancy sensors and photocell control as shown on the drawings and as described herein.

.2 Stand alone control system designed to provide switching of lighting zones by use of:

- .1 Low voltage power supplies
- .2 Low voltage relays
- .3 Line voltage wall switches (keyed where noted)
- .4 Low voltage occupancy sensors
- .5 Low voltage exterior discrete photocells
- .6 Low voltage interior discrete photocells

.3 The lighting control system shall control the building's exterior lighting as noted on the panel schematics and on drawings.

.4 Any low voltage relays required shall be mounted in surface enclosures adjacent the lighting electrical panels, as located on the floor plans.

.5 Individual rooms lighting shall be controlled only by low voltage sensors and line voltage switches located in that room.

.6 Common areas shall be controlled by local low voltage sensors with a master switch located in the staff office area.

.7 Photocell sensors and occupancy / vacancy sensors shall operate in a "slave" mode unless noted otherwise. Wall switches shall operate in "master" mode unless noted otherwise. That is, sensors shall operate only when the low voltage power supplies are energized. Refer to drawings.

1.3 PRODUCT DATA AND SHOP DRAWINGS

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

.2 Shop drawings shall include a fully detailed description of the system, control schematics, wiring diagrams, component equipment and operating instructions. Component equipment shall include relay or contactor control panel, transformers and power supplies, rectifiers,

override switches, occupancy and photo-sensors, etc. Each component shall be identified as to the manufacturer, type, description and catalogue number.

.3 Provide labeling of system components with shop drawings.

1.4 CLOSEOUT SUBMITTALS

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

Part 2 Products

1.1 MATERIALS

.1 Low voltage class 2 wiring shall be #18 gauge copper with 30 volt insulation, type LVT, installed within conduit systems unless otherwise noted.

.2 All catalogue numbers shown are approximate and are intended to assist in providing the current features. Coordinate all catalogue numbers with the manufacturer to ensure a fully operable system. The catalogue numbers shown shall not reduce or amend the requirements of the specifications.

.3 All equipment shall be manufactured by Hubbell, Douglas Lighting Controls, Watt Stopper, Leviton or Sensor Switch.

1.2 DEVICES

.1 Relays shall be momentary-pulsed mechanically latching contactors with plug in connector. Relays shall have mechanically latching contacts with single moving part design.

.2 Contacts of low voltage relays and power supplies shall be rated at 20 amp tungsten, 120/277 volt rated for ballast loads. Coils shall be mechanically held, momentary coil activation, operate on 24 volt, 60 Hz. Relays shall be equipped with pilot light switch operation. Provide for each relay, a varistor between line and neutral.

.3 Next to each relay mounted in the low voltage panel shall be an individual override button and a bi-colour LED to indicate status.

.4 Power Supply Units: The power supply units shall provide 24 volt DC power to the control devices and have a control feedback from these devices to control its dry contact. Input voltage for the power supply shall be 120 volt or 347 volt AC, depending on the load. The power supplies shall include internal over-current protection, and voltage spike protection. Power supply relay contacts shall be rated at 20A. In cases where multiple loads are fed from a single power supply unit, power supply unit shall have a secondary 120V relay.

.5 Wall Switch/ occupancy / vacancy Sensors: shall be specification grade passive infrared (PIR) or Dual Technology, wall sensor switch, ivory finish. Manual ON/OFF switch with automatic time delay off operation (adjustable from 30 seconds to 30 minutes) set at 5 minutes after momentary occupancy. Adjustable PIR unit sensitivity from 20% to 100%. Coverage limited to 180° field of view, 900 square feet, rated for minimum 800 watt for fluorescent ballast load at 120-volt. Wall occupancy / vacancy sensor switch shall be compatible with all electronic

fluorescent non-dimming ballasts and shall mount in a standard 120-volt single gang switch box.

.6 Occupancy / vacancy Sensors: Provide where indicated and as described on lighting plans. The sensor shall be easy to adjust with a 5-minute time delay setting (adjustable from 30 seconds to 20 minutes), LED status indicator and push button programmable. Occupancy sensors shall be white in finish. Provide two (2) devices not shown on drawings of each type for Owner stockpile. See drawings for type of occupancy sensors required.

- OC – wall switch decorator sensor, line voltage, dual technology.
- OC1 – passive dual technology, 360 degree sensor, standard range, ceiling mounted, low voltage.
- OC2 – passive dual technology, 360 degree sensor, extended range, ceiling mounted, low voltage.

.7 Interior Photocell (Discrete): Provide where indicated on the lighting plans, indoor day-light sensors for applications that harvest daylight by 50/100% control of the designated lighting circuit or designated lighting fixtures. The sensor shall switch the ballast to 100% when natural light is insufficient and step down to 50% when the sufficient. The sensors shall be ceiling mounted and shall measure light reflected upward from the surface below. The sensor shall be easy to adjust with a range setting and a set-point at the device. The day-light sensor shall have an adjustable dead-band and 5-minute time delay setting so that cycling effects can be eliminated, adjustable setpoints 100 – 2000 lux, and adjustable time delay 3 seconds to 5 minutes, LED status indicator. Provide two (1) devices not shown on drawings for Owner stockpile.

.8 Outdoor photocells: Surface exterior wall mounted with weatherproof plate, range between 10 – 160 lux. Photocells may be installed with one exterior fixture to control the remained of that zone.

Part 3 Execution

1.3 INSTALLATION

.1 All low voltage wiring shall be installed in conduit. Confirm with the manufacturer of this system all wiring and cable requirements.

.2 Switches shall be ganged where more than one occurs in the same location.

.3 All relays and switches shall be tested after installation to confirm proper operation, and all connected loads shall be recorded on the relay schedule for each panel.

.4 Refer to manufacturer's literature for typical methods of installation and connection of components. The contractor shall be responsible for coordinating the actual components and equipment utilized so as to provide a fully operational and reliable system.

.5 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

1.4 IDENTIFICATION AND DOCUMENTATION

.1 Provide unique identification for all low voltage control devices and power supplies.

.2 Each low voltage wire shall be labelled clearly indicating which device the cable is connected to. Use only proper colour coded, stranded #18 AWG, or as recommended by the manufacturer.

.3 Labelling shall be applied to ganged switches to identify the areas the switches control.

.4 Include in the Electrical Operating Manuals, the system installation and operating manuals for the lighting control system, including the installation and operation of each unique configuration.

1.5 SYSTEM START-UP AND TRAINING

.1 Provide trained factory authorized technician to confirm proper installation, programming and operation of the system.

.2 Perform tests described herein and in accordance with Section 26 05 01 – Common Work Results – Electrical and Electrical Commissioning Specifications.

.3 Actuate control units in the presence of Engineer to demonstrate lighting circuits are controlled as designated.

.4 The Owner's operating and maintenance personnel shall be instructed in the operation and maintenance of the lighting control system by a trained factory authorized technician. The minimum training period shall be (4) six hours of instruction. Training shall be completed in two parts. The first training shall be four hours and shall be completed prior to substantial completion. The second training session shall be two months following completion to ensure owner understands system and requirements. Written documentation bearing name and signature of Owner's personnel who received the above instruction shall be included in the operating Electrical Operating and Maintenance manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 CAN/CSA-C22.2 No.31-M89(R2000), Switchboard Assemblies.
.3 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.4 National Electrical Manufacturers Association (NEMA).
.5 National Building Code 2010 (NBC 2010)
.6 National Fire Protection Association (NFPA)
.7 Institute of Electrical and Electronic Engineers (IEEE).
.8 Audio Engineering Society (AES).
.9 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to layout, devices installed, withstand ratings, lug and torque tables, Time-current characteristic curves for circuit breakers and fuses, and special mounting details.

.3 Submit shop drawings for review prior to fabrication of equipment. The following drawings of the switchboard shall be provided prior to commencing manufacture:

.1 Channel base plan
.2 Single line diagrams showing necessary details of electrical components and connections.
.3 Elevation plan and section views with dimensions and all component details.
.4 Weight of complete structure, size and weight of each shipping section, and manufacturer's data sheets of all major components.
.5 Complete wiring schematics.

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.4 Include schematic, wiring and interconnection diagrams, which shall include component identification.

.5 Each component shall be identified as to manufacturer, type, description, and catalogue number.

.6 Drawing details show all stations, control modules, cabling and field terminations.

.7 Include a statement of warranty hardware from the manufacturer.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for secondary switchboard for incorporation into manual in accordance with Section 01 78 00 - Closeout Submittals.

.2 3 copies maintenance data for complete switchboard assembly including components.

1.2 STORAGE AND PROTECTION

.1 Store switchboard on site in protected, dry location. Cover with plastic to keep off dust.

1.3 EXTRA MATERIALS

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

.2 Include:

.1 3 sets of Type L fuses for each type above 600 A.

.2 6 sets of Type J fuses for each type up to and including 600 A.

Part 2 Products

2.1 MATERIALS

.1 Switchboard assembly: to CAN/CSA-C22.2 No.31.

.2 Size, arrangement and extent of equipment shall be as shown on the drawings.

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.3 Switchboard construction shall consist of a 3 mm sheet steel enclosure dead front, self-supporting unit.

.4 Phasing shall conform to CSA and CEMA standards. Colour code all three phases on main bus and on the load terminals of all feeders.

.5 Re-arrangement of components will not be permitted. Equipment shall be constructed to fit space allocated and shall be mounted on a concrete pad. Arrangement and space allocation as shown on drawings shall be maintained, unless an alternate method, suggested by the contractor under this Division and the successful manufacturer, is approved in writing by the Consultant.

.6 Equipment shall be designed, factory assembled and tested in accordance with latest applicable CEMA and CSA standards.

.7 Equipment shall be complete with required Arc Flash warning labels as required by CEC and this specification.

.8 All switchboard enclosures including covers and lids shall be made with 3mm. (#12 gauge) steel.

2.2 RATING

.1 Secondary switchboard: indoor, voltage as shown on drawing, ampacity as shown on drawings, 3 phase, 4 wire, 60 hz, minimum short circuit capacity 22 ka (rms symmetrical) for 120/208V.

2.3 ENCLOSURE

.1 Distribution sections to contain:

.2 Fusible disconnects sized as indicated.

.3 Main bus work, extending through every section, shall be tin plated copper rated as shown on the drawings, and shall be full size throughout length of switchboard.

.4 Copper ground bus 6 mm x 50 mm, bolted to the structure and extending the full length of the switchboards. Cable clamps shall be provided at convenient locations for making the station ground connection.

.5 Blanked off spaces for future units.

.6 Switchboard shall be fitted with two permanent channels, minimum 100 mm across the bottom of each section, to permit rolling or jacking of board. A permanent channel or angle shall also be provided across top of each section substantial enough to carry weight of section for hoisting purposes. Two other channels, minimum 150 mm width, shall be provided by switchboard manufacturer along with floor plan, and shall be grouted into floor for levelling purposes. Floor channels shall run full length of board, and shall line up with 100 mm channel on switchboard.

.7 All panelboard enclosures shall be 2300 mm high. All unused panel spaces shall be made available for future switch fuse units.

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.8 Provide sprinkler guards on top of all switchboards. All conduit entering top of switchboards shall be c/w water tight connectors. Seal all conduit connectors with silicone based caulking to provide a degree of water tightness in the event of a sprinkler system failure.

.9 The entire enclosure shall be cleaned and phosphated, then painted with one coat of alkyd type primer, and one coat of low gloss light grey (ASA 61) baked on polyester powder coat.

.10 Before leaving the factory, switchboards shall be touched up to present a smooth, even, clean finish inside and outside. Interiors shall be cleaned of debris and dirt. Before shipment, movable components shall be carefully blocked.

.11 The switchboard shall be completely assembled, wired, adjusted and tested at the factory. After assembly, the complete switchboard will be tested for operation under simulated service conditions to ensure the accuracy of the wiring and the functioning of the equipment.

.12 All switchboards shall be manufactured by General Electric, Eaton, Siemens or Schneider Electric

2.4 BUSBARS

.1 Three phase and full capacity neutral, insulated busbars, continuous current rating as noted on drawing, self-cooled, extending full width of cubicle(s), suitably supported on insulators.

.2 Main connections between bus and major switching components to have continuous current rating to match major switching components.

.3 Busbars and main connections: Tin Plated Copper

.4 Provision for extension of bus on both sides of unit without need for further drilling or preparation in field.

.5 Tin plated joints, secured with non-corrosive bolts and Belleville washers.

.6 Identify phases of busbars by suitable marking.

.7 Busbar connectors, when switchboard shipped in more than one section.

.8 Bus section shall house interconnecting bus, instrument transformers, connections to incoming feeders and control wiring.

.9 Main bus work, extending through every section, shall be rated as shown on drawings, and shall be full size throughout length of switchboard.

.10 Where space has been provided for future switches or air circuit breakers on the drawings, bus and stationary elements shall be provided to facilitate future additions.

2.5 GROUNDING

.1 Lugs at each end for size #3/0 AWG grounding cable.

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.2 Copper ground bus 6 mm x 50 mm shall be provided at bottom, bolted to the structure and extending the full length of the switchboards.

.3 Cable clamps shall be provided at convenient locations for making the station ground connection.

2.6 FUSIBLE DISCONNECTS AND FUSES

.1 As per Specification Section 26 28 23 Disconnect Switches – Fused and Non Fused

2.7 INSTRUMENTS

.1 Refer to Section 26 09 02 – Metering and Switchboard Instruments.

2.8 FINISHES

.1 The entire enclosure shall be cleaned and phosphated, then painted with one coat of alkyd type primer, and one coat of low gloss light grey (ASA 61) baked on polyester powder coat.

2.9 EQUIPMENT IDENTIFICATION

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

.2 Lamecoid nameplates, approximately 75 mm x 25 mm, shall be provided on front doors of each switch for identification, showing the name and rating. Also, a 150 mm x 50 mm nameplate shall be provided on top portion of switchboard for identification.

.3 Lamecoid nameplates shall be Black with white lettering for Normal Power switchboards.

Part 3 Execution

3.1 INSTALLATION

.1 Locate switchboard assembly as indicated and bolt to floor.

.2 Check factory made connections for mechanical security and electrical continuity.

.3 Size and weight of the sections into which the assembly shall be divided for shipment to ensure that they can easily be moved into or out of the electrical room, as shown on the drawings.

.4 The ground bus shall be connected to the ground network. Refer to specifications and the drawings for full grounding requirements.

.5 All switchboards shall carry the required arc flash warning labels.

.6 Service on equipment or systems critical to the Owner's operation shall be provided on an emergency basis which may necessitate overtime and service outside of normal working hours.

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.7 Set on 100 mm high concrete housekeeping pad.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 CSA C22.2No.29-M1989(R2000), Panelboards and enclosed Panelboards.
.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

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

.3 Include time-current characteristic curves for breakers with ampacity of 50 A and over or with interrupting capacity of 18,000 A symmetrical (rms) or greater.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval,

as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 PANELBOARDS

.1 All panels shall be of the dead front, molded case circuit breaker type, as shown, sized and located on the drawings.

.2 Panel trim shall be furnished for flush or surface mounting as indicated on the drawings. Panel trim shall be removed for painting, and allowed to dry before final placement.

.3 Surface mounted panels shall have manufacturer's standard trim, and shall be finished with two coats of grey ASA #61.

.4 Panels shall be equipped with a flush type combination lock-latch. Two keys shall be provided for each panel, and all locks shall be keyed alike.

.5 Panels shall have mains of voltage and capacity and shall be complete with branch breakers, spares and spaces, as shown on the drawings. "Spaces" shall be understood to include necessary bus work such that Owners, at a later date, need buy only breakers.

.6 Panelboards: to CSA C22.2No.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.

.7 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.

.8 Each panel shall be complete with a typed directory, which shall be mounted inside the door in a metal frame with clear plastic cover.

.9 Flush panels shall have concealed hinges and flush type combination lock-latch. Doors shall open minimum 135 degrees. Trims shall have fasteners concealed.

.10 Cabinets shall be fabricated of code gauge steel, with ample wiring gutters for all wiring connections.

.11 All panels shall have main bus bar equipped with solderless lug and be capable of accepting any arrangement of single, two or three pole breakers.

.12 Branch circuit breaker shall have quick-make, quick-break toggle mechanism with single, two or three pole common trip thermal magnetic units in ampere ratings as designated on the drawings. Breaker handles shall have three positions: 'on', 'off' and 'tripped'. All circuit breakers and panel bus shall have an interrupting capacity of 10,000 amps symmetrical.

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.13 Panels for 120/208 volt, 3 phase, 4 wire systems, shall be complete with bolt-in type breakers, with a minimum nominal width of 20 mm per pole, and a bus of sufficient capacity to feed the number of branch circuit breakers indicated.

.14 All panels shall be specification grade and of the same manufacture. Load centres are not acceptable.

.15 All branch circuit spaces shall be fitted with filler plates.

.16 All panels serving bedrooms shall be equipped with arc fault circuit interrupters where shown on the drawings.

.17 Each panel shall be equipped with a ground bus suitable for terminating one ground conductor per load circuit.

.18 Panels shall be General Electric, Siemens, Eaton or Schneider Electric.

.19 Refer to attached breaker panel schematic detail sheets attached at the end of this specification section.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 Lock-on devices for fire alarm circuits.

2.3 EQUIPMENT IDENTIFICATION

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

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

.3 Nameplate for each circuit in distribution panelboards size 2 engraved.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

Part 3 Execution

3.1 INSTALLATION

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

.2 Install surface mounted panelboards on painted plywood backboards. Where practical, group panelboards on common backboard.

.3 Electrical panels shall, where possible, be mounted with top of trim at uniform height of 2000 mm.

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.4 Panels, shown adjacent to other panels, shall have adjacent edges of different panels mounted parallel to each other with a gap of 75 mm.

.5 For panels recessed in a finished wall, provide for every six branch circuit spaces and spares, or fractions thereof, one 20 mm empty conduit up to furred ceiling space, and one (1) 20 mm empty conduit down to ceiling space of floor below, and cap for future wiring.

.6 Connect neutral conductors to common neutral bus.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
.8 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
.9 CSA-C22.2 No.55, Special Use Switches.
.10 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

□

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 SWITCHES

.1 15 A, 120 V, single pole, three-way switches where required on drawings.

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

.1 Terminal holes approved for No. 10 AWG wire.
.2 Silver alloy contacts.
.3 Urea or melamine molding for parts subject to carbon tracking.
.4 Suitable for back and side wiring.
.5 Ivory toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps.

.4 All wiring devices specified shall be of the same manufacture throughout the project.

.5 Switches controlling motors shall be K.W. (H.P.) rated and approved for motor control service.

.6 Set switches flush in all finished areas, or in surface box where conduit or wireway is exposed.

.7 Refer to drawing symbol schedule for further requirements.

.8 Switches and receptacles shall comply with requirements of CSA and NEMA Standards.

.9 Switches shall be specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

2.2 RECEPTACLES

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

.1 White high impact chemical resistant molded nylon or polycarbonate face.
.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.
.6 Specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 White high impact chemical resistant molded nylon or polycarbonate face.
.2 Suitable for No. 10 AWG for back and side wiring.

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.3 Four back wired entrances, 2 side wiring screws.

.4 Specification grade from one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Set receptacles flush in all finished areas, or in surface box where conduit or wireway is exposed

.6 Provide ten (10) 20 amp and ten (10) 15 amp specification grade receptacles c/w installation, 10 meters of wire and required raceway, etc for each of these receptacles so that they may be installed where required during the construction and commissioning stages of this project. .

2.3 SPECIAL WIRING DEVICES

.1 **Ground Fault Circuit Interrupter** - shall have a nylon face and a thermoplastic backbody. They must have a feed-through capability for protecting receptacles downstream on the same circuit. They must be Class A rated with a 5 milliampere ground fault trip level and a 20 ampere feed through rating. GFCI receptacles shall have 'Safe Lock' protection such if critical components are damaged and ground fault protection is lost, power to the receptacle is disconnected. GFCI receptacles shall be equipped with LED trip indicator light, NEMA configuration 5-15R, side wired and one of the following manufacturers: Cooper #XGF15-V, Leviton #8599-I or Pass & Seymour #1594-I, Hubbell 'Autoguard' GFR Series

.2 **Pilot Light Switches** - shall be quiet specification grade and rated 15A, 120 volts, back and side wiring with toggle lit red in the "ON" position, accepting up to #10 copper conductor and of one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.3 **Fractional HP/KW Manual Starters** - to be non-reversing, toggle operated, suitable for mounting in a surface or flush box, single or two pole to suit 120 or 208 volt application, c/w pilot light and thermal overload to adequately protect motor. Flush mount to have stainless steel or ivory cover plates to match other flush mount wiring devices. To be of one of the following manufacturers: Cooper, Leviton, Hubbell or Pass & Seymour.

.4 **Illuminated Switches** - shall be quiet specification grade, 120 volts, back and side wiring with toggle lit in the "OFF" position, accepting up to #10 copper conductor and of one of the following: Cooper, Leviton, Hubbell or Pass & Seymour.

.5 **Wall Occupancy / Vacancy Sensors, 120-Volt:** Wall occupancy / vacancy sensors shall be specification grade passive infrared (PIR) or dual technology (PIR/Microphonics) wall sensor switch, white finish. Manual ON/OFF switch with automatic time delay off operation (adjustable from 30 seconds to 30 minutes) after momentary occupancy and user adjustable switch to convert unit to Vacancy mode. Adjustable PIR unit sensitivity from 20% to 100%. Coverage limited to 180° field of view, 900 square feet, rated for minimum 800 watt for ballast load at 120-volt. Wall occupancy / vacancy sensor switch shall be compatible with all electronic fluorescent non-dimming ballasts and LED fixtures and shall mount in a standard single 120-volt single gang switch box. Set delay off to 5 minutes after momentary occupancy. Wall occupancy / vacancy sensors shall be of one of the following manufacturers:

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Hubbell, Leviton, Sensorswitch, Wattstopper, Cooper

.6 **Ceiling Occupancy / Vacancy Sensors, 120-Volt:** Designated as 'OC3' on drawings - Ceiling occupancy / vacancy sensors for controlling the room lighting shall be multi-technology occupancy / vacancy sensor switch, passive infrared (PIR/Microphonics) and ultrasonic sensor (40kHz ultrasonic frequency), 360° coverage within a 92.9 square meter area. Automatic ON/OFF control, Occupancy / Vacancy mode switch, with delay off set at 5 minutes after momentary occupancy.

Hubbell, Leviton, Sensorswitch, Wattstopper, Cooper

2.4 COVER PLATES

.1 Cover plates for wiring devices.

.2 Cover plates from one manufacturer throughout project.

.3 Wall plates shall be designed and manufactured in accordance with performance and dimensional requirements of the following industry standards:

CSA Standard C22-2 No. 42

U.S. Federal Specification WP455

NEMA Standard WD-1

.4 Wall plates shall be manufactured by one of the following:

Cooper, Arrow Hart, Eagle, Hubbell, Leviton or Pass & Seymour.

.5 Blank cover plates in finished ceiling areas shall be Columbia Electric #9002 baked white enamel for white ceilings, or painted to match colored finishes.

.6 Stainless Steel wall plates shall be provided for all switches, receptacles, blanks, telephone and special purpose outlets. The wall plates shall be of suitable configuration for the device for which it is to cover with colour matched mounting screws. Use ganged plate where more than one device occurs at one location. Any specific locations calling for Metal wall plates shall be stainless steel.

.7 Where surface wiring methods need to be employed in a high finish area because of renovations to existing structure, wall plates shall be used in conjunction with Wiremold surface box to suit the device.

.8 Where outlets occur in an unfinished area such as boiler or furnace room and surface conduit and boxes are specified, stamped galvanized steel wall plates shall be used to suit configuration.

.9 Exterior outlets shall be fitted with weatherproof die cast aluminum cover plates to suit wiring device, c/w rubber gasket to provide positive seal. Duplex cover plates shall have two independent flaps. Weatherproof covers shall provide protection in wet and damp locations.

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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 Switches shall be as located on the drawings, mounted up 1200 mm, and ganged where more than one occurs in the same location.

.2 Receptacles:

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

.2 Convenience outlets shall be as located on the drawings, and mounted up 450 mm, unless otherwise noted.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Outlets over counter tops shall be mounted 150 mm above counter, or immediately above backsplash. Coordinate with architectural drawings for location of all counter tops, millwork and feature walls, to ensure proper location and mounting height.

.5 Coordinate with the location of all mechanical convectors and mount convenience outlets up 100 mm above heating convectors.

.6 All convenience outlets shall meet tension tests as per CSA requirements, and will be subjected to 'on site' tests during final inspection.

.3 All plug-in type receptacles shall be identified by means of a Lamecoid label fixed with self tapping screws on the cover plate or engraved stainless steel cover plates. Each cover plate shall contain the panel and circuit number. Those receptacles fed from ground fault interrupters shall have 'GFI' labeled adjacent to the panel and circuit number. Those receptacles designated for housekeeping purposes shall have ‘HOUSEKEEPING’ labeled adjacent to the panel and circuit number.

.4 The circuits controlled by all switches on all levels, shall be neatly printed with waterproof ink on the side of the switch outlet box so that the panel and circuit number are clearly legible when the cover plate is removed. It shall not be necessary to remove the switch from the outlet box in order to read the panel or circuit number.

.5 Cover plates:

.1 Protect 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.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly

authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

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

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Submit fuse performance data characteristics for each fuse type and size above 40 A. Performance data to include: average melting time-current characteristics.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

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1.5 DELIVERY AND STORAGE

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Provide a typed list of all spare fuses

.4 Provide three (3) spare fuses of each type and size installed.

Part 2 Products

1.2 FUSES GENERAL

.1 Fuses: product of one manufacturer for entire project.

.2 Fuse interrupting rating shall be 200,000 amperes RMS symmetrical, unless otherwise noted.

.3 Time delay fuses shall carry 500% of rated current for a minimum of 10 seconds and shall be labeled "Time Delay" by the manufacturer.

1.3 FUSE TYPES

.1 HRC fuses rated 600 amperes and smaller shall be CSA certified HRC1-J time delay and shall be in accordance with CSA Specification C22-2 No. 106-M92. HRC-1 fuse dimensions and current limiting performance shall be in accordance with the UL Standard 198C

Part 3 Execution

1.4 INSTALLATION

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Application of all fuses shall comply with the Canadian Electrical Code - Part 1 and local inspection authority regulations.

.5 Unless otherwise noted on the drawings, Time Delay fuses for overcurrent protection of motor circuits shall be rated at 150% of full-load current and

.6 Time Delay fuses for overcurrent protection of transformer circuits shall be rated at 125% of full-load current.

.7 All fuses shall be manufactured by Littlefuse, Buss, Ferraz Shawmut**,** or Edison.

1.5 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly

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authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

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

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

.8 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Include time-current characteristic curves for breakers with ampacity of 50 A and over or with interrupting capacity of 18,000 A symmetrical (rms) and over at system voltage.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

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.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 BREAKERS GENERAL

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

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

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating in breaker panelboards.

.6 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers to have adjustable trips.

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 long time, short time, instantaneous, tripping for ground fault short circuit protection.

.2 The main service breaker for the building main service shall have solid state trip unit. All other breakers shown shall be thermal magnetic breakers unless otherwise noted.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's

standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.
.8 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.
.9 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 Shop drawings shall include but not be limited to speakers, riser diagram, cable types, and special mounting details.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

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.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible and non-fusible disconnect switch in CSA Enclosure , size as indicated.

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

.3 Fuses: size as indicated, in accordance with Section 26 28 14 - Fuses - Low Voltage. Switch fuse units shall be available in 30 through 1200 amp standard industry sizes. They shall be readily removable and interchangeable without modification to bus work or mounting rails

.4 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.5 Quick-make, quick-break action.

.6 Fusible switches shall be quick-make, quick-break, visible blades, integral handle mechanism, deionizing arc quenchers, front operation, high pressure fuse clips and recessed live parts.

.7 Operating handles to have provision for padlocking in either 'on' or 'off' position.

.8 Handle to be marked to clearly indicate switch contact positions.

.9 Switch fuse units shall be available in 30 through 1200 amp standard industry sizes.

.10 Shall be readily removable and interchangeable without modification to bus work or mounting rails.

.11 All switches shall be manufactured by General Electric, Eaton, Siemens, or Schneider Electric.

2.2 EQUIPMENT IDENTIFICATION

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

.2 Lamecoid nameplates, approximately 75 mm x 25 mm, shall be provided on front doors of each switch for identification, showing the name and rating.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly

authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

.3 Coordinate all control requirements prior to ordering equipment.

.4 All motor control and ancillary components shall be supplied by one manufacturer in order to assure an integrated system and one point of contact for service with the exception of the VFD requirements. Each manufacturer shall still have a local Saskatchewan service capability. All motor control equipment shall be manufactured by one of the following:

Eaton, Schneider Electric, General Electric, Toshiba

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
.2 Electrical and Electronic Manufacturers Association of Canada (EEMAC).
.3 National Electrical Manufacturers Association (NEMA).
.4 National Building Code 2010 (NBC 2010)
.5 National Fire Protection Association (NFPA)
.6 Institute of Electrical and Electronic Engineers (IEEE).
.7 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures
.2 Section 26 05 01 – Common Work Results

.2 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.

.7 All Fuse types for all starters

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 GENERAL REQUIREMENTS EXTRA MATERIALS

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

.2 Provide listed spare parts for each different size and type of starter:

.1 2 contacts, auxiliary.

.2 1 operating coil.

.3 2 fuses.

Part 2 Products

2.1 MATERIALS

.1 For all motors, provide circuit and thermal protection on all lines except neutral.

.2 For all pumps not controlled by VFD's, provide hour meters for each visible on the motor control centre doors. All magnetic starters located outside of motor control centres shall contain hour meters.

.3 All contactors shall be NEMA rated contactors.

2.2 MANUAL MOTOR STARTERS

.1 Single or Three phase manual motor starters as shown of size, type, rating, and enclosure type as indicated, with components as follows:

.1 Switching mechanism, quick make and break.

.2 Overload heater(s) for each phase, manual reset, trip indicating handle.

.3 Thermal switches for small fractional KW motors shall be single or 2 pole as required.

.4 In all cases, locate within 9000 mm and in sight of motor

.2 Accessories:

.1 Toggle switch: industrial standard type labelled as indicated.

.2 Indicating light: standard neon type and colour as indicated.

.3 Locking tab to permit padlocking in "ON" or "OFF" position.

.4 thermal relay

2.3 FULL VOLTAGE MAGNETIC STARTERS

.1 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.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.

.5 All starters shall be combination starters c/w quick-make, quick-break, switch, fuse and magnetic starter c/w red and green indicator lights

.6 H.O.A. switch operator controls

.7 Provide primary fuse for control transformer.

.8 Starters shall not be equipped with an automatic thermal overload reset.

.9 Tin plated stab on connectors are acceptable.

.2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.4 Fusing shall be Form I, NEMA "J", HRC, 200,000 amps current limiting type.

.3 Accessories:

.1 Pushbuttons and Selector switches: standard labelled as indicated.

.2 Indicating lights: standard type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

.4 The overload relays shall be the ambient temperature compensated type, and the trip rating of a specific heater element shall be field adjustable over a range of approximately 85% + 115% of its respective rating.

2.4 FULL VOLTAGE REVERSING MAGNETIC STARTERS

.1 Full voltage reversing magnetic starters of size, type, rating and enclosure type as indicated with components as follows:

.1 Contactor solenoid operated, rapid action type.

.2 Motor overload protective device in each phase, manually reset from outside enclosure.

.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.

.5 All combination starters shall be quick-make, quick-break, switch, fuse and magnetic starter c/w red and green indicator lights

.6 H.O.A. switch operator controls

.7 Provide primary fuse for control transformer.

.8 Starters shall not be equipped with an automatic thermal overload reset.

.2 Combination type starters to include fused disconnect switch with operating lever on outside of enclosure to control disconnect, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.4 Fusing shall be Form I, NEMA "J", HRC, 200,000 amps current limiting type.

.3 Accessories:

.1 Pushbuttons and Selector switches: standard labelled as indicated.

.2 Indicating lights: standard type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

.4 The overload relays shall be the ambient temperature compensated type, and the trip rating of a specific heater element shall be field adjustable over a range of approximately 85% + 115% of its respective rating.

2.5 VARIABLE FREQUENCY DRIVES

.1 All VFDs shall be remotely mounted outside of motor control centres and shall be located as close as possible to the motor unit being controlled. Unistrut supports shall be provided for mounting the VFD units. All remote controllable parameters shall be wired within the VFD assembly. The VFD assembly shall be rated for Nema 12.

.2 All VFDs shall be provided with a connected bypass mounted to the VFD unit. Space is limited so the bypass may be provided as a separate attached unit or integral to a larger VFD assembly in a common cabinet.

.3 Provide variable frequency drives (VFD) where designated by the motor control schedule and drawings. These drives shall have the following features:

.1 The drives shall be capable of continuously operating any standard squirrel cage induction motor, NEMA design A, B, or C self-ventilated or force ventilated and inverter duty motors without derating within ambient temperatures up to 40°C. Coordinate final type with Mechanical Contractor.

.4 It is required that the variable speed drive models for the fans be the HVAC applicable type drives that have accessories and functions typical for requirements of motors used in HVAC applications.

.5 It is required that the variable speed drive models for the pumps be the Pump applicable type drives that have accessories and functions typical for requirements of motors used in Pumping applications.

.6 The variable speed drive shall be the pulse width modulated (PWM sinusoidal) output type with adjustable carrier frequencies.

.7 Unless otherwise noted, all horsepower/Kilowatt drive ratings are to be based on a variable torque load and FLA of motor being controlled.

.8 The drive shall maintain a minimum line side power factor of 0.95 throughout the entire speed range and the drive shall be capable of an overload of 115% for 1 minute.

.9 Provide surge arrestors (internal or external) with a minimum 250 Joule (line-ground) rating shall be used to protect the drive from AC line transients. Surge arrestors shall not to be part of the bridge circuit.

.10 Provide separate Input line reactors in separate enclosure rated a minimum impedance of 3%. Ensure adequate ventilation is provided for proper heat dissipation.

.11 Ensure drives have EMI and RFI filtering (internal or external). Equipment shall be designed that use of communication equipment adjacent to VFD units is permissible. The VFD shall not be susceptible to interference from communications equipment operated adjacent to it.

.12 The output inverter section shall utilize insulated gate bipolar transistors and diodes to provide a sine coded pulse width modulated output to the motor. The carrier frequency of the pulse width modulation shall be asynchronous to control harmonic distortion in the 3rd to 7th bandwidths to less than 1%. Total voltage harmonic distortion on the input shall be less than 3%.

.13 Control power input terminals shall be separate from the input power terminals to facilitate start-up, trouble-shooting, and diagnostics without power to the DC bus.

.14 The VFD shall not be sensitive to incoming power feeder phase sequence.

.1 Operator controls shall consist of:

.1 “Hand / Off / Auto” selector switch

.1 “Hand” for local control of VFD. VFD is operated by panel mounted keypad pushbuttons, speed controlled by the keypad. LCD Keypad Display. LCD Display to be full English Word.

.2 Motor cannot be started or remain running in Off position through Power Removal Function.

.3 in “AUTO” position, the VFD operates by remote start/stop command, the speed is controlled by a programmable analogue input selectable isolated input signal 0 to 10 Vdc from the BMS.

.2 Input disconnect switches and fuses shall be mounted in the existing motor control centres. In the event that the motor protection such as the overloads or thermistor tripping unit senses a motor fault, the starter shall lock out and the motor shall be de-energized.

.15 Each VFD shall be provided with an integral disconnect switch to minimize area consumed.

.16 All control wiring shall be run in separate raceway away from any line voltage or motor feeder power wiring. Motor cables shall be separated from the supply cables at a minimum distance of 600mm and from signal / control cables at a minimum distance of 400mm. The signal / control cables shall be separated from the motor cables at a minimum distance of 900mm. Where signal / control cables must cross power or motor cables, the crossover angle shall be 90 degrees.

.17 The drive shall be designed and constructed to operate at a maximum altitude of 1000 m without derating and an ambient temperature between 0o C and 40o C. The drive shall operate in an environment with a relative humidity up to 90% with no condensation.

.18 The drives shall operate at 208 Volts or 600 Volts (as noted on mechanical schedule) as applicable plus 10% 60Hz, 3ph. Drives which require isolation transformers or are rated at 200 Volt or 575 Volt are not acceptable.

.19 The drive shall accept an analog signal of 0-10Vdc for use as a fan motor speed reset.

.20 All VFD set-up operations and adjustments shall be digital and stored in nonvolatile memory (EEPROM).

.21 The drive shall also have a fault log that stores several last occurring fault conditions within its internal memory.

.22 The VFD shall have a “momentary Power Loss” ride through capability.

.23 The VFD shall be capable of operating with the VFD output open circuited (no motor connected) with no fault or damage to any part of the drive.

.24 The drive shall have the capability to energize and control a currently ‘spinning’ load regardless of the direction of rotation of the load.

.25 Provide a bump-less speed transfer from remote control to local control or local control to remote control without setting the motor to zero.

.26 Provide a display that shall show, when the drive is running the motor, electronic setspeed, motor current and motor thermal state (if RTD’s or thermistors are installed in motor).

.27 The setting controls shall be accessible from the front of the control board, from a commissioning terminal. The drive shall contain the required communications card to communicate with the BMS.

.1 The following functions shall be independently field adjustable:

- .1 Acceleration rate
- .2 De-acceleration rate
- .3 Adjustable minimum speed of 0 to maximum speed.
- .4 Adjustable maximum speed of minimum speed to max. frequency.
- .5 Automatic restart.
- .6 Catching a spinning load in either direction.

.2 The following conditions shall result in a drive fault and orderly shutdown. The mode of the fault shall be displayed on the electronic display on the front of the drive.
- .1 Phase failure on the input line
- .2 Drive over temperature
- .3 Motor phase failure
- .4 Over current for short-circuit or grounding of the drive output or excessive transient operation.

.3 The drive shall include a self-diagnostic system to test all main functions and identify any failed elements.

.4 Provide an Operations and Maintenance manual with the following:
- .1 Preliminary checks and start up check sheet with list with outline
- .2 Design and Operation
- .3 Technical characteristics
- .4 Installation
- .5 Connections
- .6 Troubleshooting charts for all device faults.
- .7 An instruction manual for programming and hardware provided with the equipment at time of shipment.
- .8 A listing of authorized service depots, spare parts lists and recommended spare parts
- .9 Final settings of all parameters
- .10 Input and output filter type and size
- .11 Specified environmental conditions
- .12 Voltage and current wave form printout taken from the motor terminals

.5 Provide a trouble shooting guide with the following features:
- .1 Observation, fault code
- .2 Possible causes
- .3 Checks to be made
- .4 Result
- .5 Remedial action
- .6 Comments

.6 The starter shall be equipped with an automatic start mode that shall restart the motor after a power failure without operator intervention. This option shall be controlled by the internal parameter settings. Drives that lock out in a fault condition due to power outage or transfer from and to emergency power shall not be accepted. The drive shall resume to the last known frequency.

.7 The starter shall be equipped with a programmable automatic reset/restart after any individual trip condition resulting from either overcurrent, over voltage, under voltage, or an over temperature. This parameter shall initially be set to disabled.

.8 The drives are to be set for two (2) only restarts, set for a 30 second delay following the return of essential power to the drive. Failure of the drive to restart the motor following these two (2) restarts will necessitate a manual acknowledgement of the fault at the actual drive control panel.

.9 Prior to any motor control equipment ordering, the Electrical contractor shall coordinate with successful controls contractor and determine the required control, i.e. '2 wire' or '3 wire' control. Equipment shall be ordered as such upon written confirmation from the controls contractor.

.10 Coordinate all control requirements prior to ordering equipment.

.11 Each VFD shall be provided with a minimum of 2 dry contacts assignable to alarm conditions such as a VFD fault. Both contacts shall be wired to the nearest BMS control panel.

.28 The Contractor shall co-ordinate with the VFD manufacturer regarding all motor sizes, motor types and motor feeder lengths. Provide Load dv/dt filters for all motors equipped with VFD's where the feeder distance exceeds the limits for the pulse rise times shown in the following table:

Pulse Rise Time (Microseconds)	**Critical Lead Length** (Meters)
1 or greater	45
0.5	20
0.1 and less	Always

Coordinate with manufacturer to ensure proper mounting of all output filters (when required). Filters shall be connected to the drive via bus bars. If bus bar connection not available with drive manufacturer, connect filter to drive with 105°C RW90 rated cable. All filters shall be placed in their own enclosure mounted beneath the drive. Ensure enclosure is adequately vented as per manufacturer recommendations. Ensure clearances are made within filter enclosure as per filter manufacturer recommendations. Ensure filters and enclosures are bonded to ground connections of drive.

.29 The manufacturer in co-ordination with the Contractor shall have voltage and current waveforms taken at the time of final commissioning from the motor terminals of each motor controlled to ensure that the waveforms are within the tolerance limit of the motor and drives. The settings of the waveform capture shall be such that the pulse rise time of the waveform shall be visible and easily evaluated for voltage reflection amplification. Any documentation not meeting this requirement shall be rejected and resubmitted until it is satisfactory to the Consultant.

.30 Co-ordinate with the motors supplied to site and ensure the proper filter protection is provided for all motors served by the VFD's. The electrical contractor shall assume full responsibility for ensuring a complete and fully operational system in regards to output and input filtering for the motors and VFD's supplied.

.31 The manufacturer shall provide all necessary assistance, including on-site support, to both mechanical and electrical contractors to determine final drive parameter settings. The VFD manufacturer shall adjust the drive parameter settings to suit on-site conditions prior to commissioning.

.32 Setting of all drive parameters, commissioning, testing and certification of all VFD's shall be completed by the VFD Manufacturer Certified VFD Service Technicians. Third party commissioning agents will not be accepted.

.33 Coordinate all control requirements prior to ordering equipment.

.34 All VFDs and ancillary components shall be supplied by one manufacturer in order to assure an integrated system and one point of contact for service. Each manufacturer shall have a local Saskatchewan service capability. All motor control equipment shall be of the same manufacture, and shall be manufactured by one of the following:

Schneider Electric, Eaton, General Electric, Toshiba, Siemens

2.6 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with secondary fuse, installed in with starter as indicated.

2.7 FINISHES

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

2.8 EQUIPMENT IDENTIFICATION

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

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 The plates shall be attached with two self-tapping metal screws.

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 Each manufacturer shall have a local Saskatchewan service capability.

.4 All motor control equipment shall be of the same manufacture.

.5 Install starters, connect power and control as indicated.

.6 Ensure correct fuses and overload devices elements installed.

.7 The motor starters shall be cleared of all ambient construction dust prior to commissioning or the energizing of the starters.

.8 Provide a disconnect for each motor within the room or area that the motor is located. All disconnects shall be sized in accordance with kilowatt ratings of the motor being isolated and shall be quick-make, quick-break type, equipped with lock-off feature.

.9 Within 900 mm of each motor, provide flexible Sealtite conduit. Provide a separate ground wire bridging the flexible connections.

.10 All conduit / cabling entering top of motor starter shall be c/w water tight connectors with silicone based caulking.

.11 Use shielded twisted pair (STP) wiring for control and signal wiring that connects externally to the VFD.

.12 Provide separate conduits for VFD control wiring from input and output power wiring.

.13 Provide #6 bare copper ground from each VFD grounding point to the building ground grid. DO NOT loop or series connect multiple VFD ground cables.

.14 Control wiring shall be stranded TEW 105°C (220°F) rise.

.15 Terminal blocks for remote interface shall be Weidmueller SAK6N or approved equal.

.16 Provide wire markers at both ends of all control wires, Electrovert Type Z or approved equal

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information for incorporation into manual specified in:

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions
.2 Description of system operation
.3 Description of each subsystem operation
.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.
.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.
.6 Include operation and maintenance data for each type and style of starter.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and manufacturer's instructions.

.2 Provide factory certified copies of production test results to the Consultant prior to shipment of the equipment.

.3 Operate switches, contactors to verify correct functioning.

.4 Perform starting and stopping sequences of contactors and relays.

.5 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

.6 Calibrate VFD display values with Building Management System display output. Verify motor RPM values.

.7 Ensure that voltage waveforms are taken at the motor terminals at a time span that shows the relative rise times of output waveform from drive and that the waveforms are within the tolerance limit of the motor and drives.

3.4 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

3.5 VERIFICATION

.1 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.2 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.6 TRAINING

.1 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Materials and installation for electric generating unit.

1.2 REFERENCES AND CODES

.1 Canadian Standards Association, (CSA International)

.2 The system design and installation shall comply with CSA standards and Canadian Electrical Code Part 1, C22.1-02.

.1 CAN3-Z299.3-85 (R1997)(R2002), Quality Assurance Program - Category 3.

.3 International Organization for Standardization (ISO)

.1 ISO 3046-1-2002, Reciprocating internal combustion engines - Performance - Part I: Declarations of power, fuel and lubricating oil consumptions, and test methods - Additional requirements for engines for general use.

.2 ISO 3046-4-1997, Reciprocating internal combustion engines - Performance - Part 4: Speed governing.

.4 National Electrical Manufacturers Association (NEMA)

.1 NEMA MG 1 (latest edition), Motors and Generators.

.5 The Society of Automotive Engineers (SAE)

1.3 SYSTEM DESCRIPTION

.1 This specification defines the requirement for an emergency standby generating system, consisting of one (1) standby generator set and associated equipment.

.2 All materials, equipment and parts comprising the unit specified herein shall be new and unused, of current manufacture and of highest grade.

.3 Equipment furnished under this section shall be guaranteed against defective parts or workmanship for one year after acceptance.

.4 The manufacturer shall be capable of maintaining and servicing this equipment without causing the Owner either to carry expensive parts, or to be subject to the inconvenience of long periods of interrupted service because of lack of available parts.

.5 The engine shall be in-line or 'V' configuration and directly connected to the generator by a suitable coupling. Vibration caused by misalignment or imbalance will not be accepted. Documentation shall be provided indicating actual vibration levels for the assembled standby generating set.

.6 The standby generator set shall be suitable for operation at 600 m above sea level, and in a maximum ambient temperature of 45^{o}C. Furthermore, the standby plant shall start reliably, without any delay or manually priming, at an ambient temperature of 15^{o}C., and shall deliver full output within 10 seconds from normal commercial power failure.

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.7 The standby generator set and associated equipment shall be supplied by one manufacturer.

.8 In the event of a utility power failure, the standby generator shall be on line and loaded within ten (10) seconds of the signal of a power failure.

1.4 SUBMITTALS

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

.2 Before fabrication and/or assembly of the generator set, shop drawings and complete wiring diagrams shall be submitted to the Consultant for review. As part of the shop drawings, provide details of the enclosure, silencer, vibration isolators, generator controller, and sub-base fuel tank.

1.5 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for generating units for incorporation into manual.

.2 Three (3) sets of complete operating, maintenance and parts manuals, drawings, and a sequence of operation covering all equipment for the standby generator, transfer switch, etc., shall be provided.

1.6 WARRANTY

.1 Contractor hereby warrants generating unit, equipment and accessories against defects and malfunction in accordance with General Conditions, for one year.

1.7 MAINTENANCE - EXTRA MATERIALS

.1 Provide the following:

.1 Provide generator unit with standard set of engine manufacturer's spare parts for one year normal operation of minimum 500 operating hours.

.2 Spares to include:

.1 Six fuel filter elements for each type of fuel filter/water separator.

.2 Three air cleaner elements.

.2 Provide conclusive evidence that local distributor has been established and will stock in Saskatchewan spare parts likely to be required during normal life of engine.

Part 2 Products

2.1 GENERAL

.1 The generator set shall operate at 347/600 volt, 3 phase, 4 wire, 60 cycle and shall be sized as shown on the drawings.

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.2 The rated net H.P. of the engine at the generator synchronous speed with all accessories attached, shall not be less than that required to produce the kilowatt rating specified. The H.P. rating shall take into account generator efficiency losses, and accessories such as air cleaners, lubricating oil pump, fuel pump, jacket water pump, governor, etc.

.3 The entire standby generator set, including engine, shall be capable of delivering rated power at existing site conditions without exceeding the maximum temperature rise, maximum voltage drop or maximum frequency variation. Voltage drop shall not exceed 15%.

.4 These ratings must be substantiated by manufacturer's standard published curves. Special ratings or maximum ratings are not acceptable.

.5 The engine shall be water cooled in-line or Vee type four stroke cycle compression ignition diesel. It shall meet full load when operating on No. 2 or No. 1 domestic burner oil. The engine shall be capable of operating at idle or light loads for extended periods of time.

.6 Flexible fuel, coolant, exhaust and electrical lines shall be installed on the standby generator in order to absorb the initial vibration caused by engine starting and the normal vibration of the engine under load.

.7 The engine shall be equipped with a suitable electronic governor to maintain frequency within limits as specified below, by controlling engine and generator speed. Governor shall be electronic, fully enclosed, and capable of providing accurate speed control within 1/2% of rated speed. The speed control shall be designed to limit speed over-shoot on engine starts to less than 102% of rated speed.

.8 The speed of the engine shall not exceed 1800 r.p.m. at rated output.

.9 The gear type lubricating oil pump shall supply oil under pressure to the main bearings, crank pin bearings, pistons, timing gears, crankshaft bearings, and valve rocker mechanism. Effective full flow lubricating oil shall be continuously filtered, except during periods when oil is by-passed to protect vital parts such as when filters are clogged. Replaceable resin impregnated cellulose type filter elements shall be accessible and easily removable. The filter system shall be equipped with a spring loaded bypass valve as an insurance against stoppage of lubricating oil circulating in the event filters should become clogged.

.10 A suitable water-cooled engine mounted lubricating oil cooler shall be provided.

.11 Provide engine jacket coolant heater complete with immersion type thermostat. Size heater to maintain coolant at required temperature in an ambient temperature found in exterior weatherproof enclosures. Obtain circulation of heated coolant on thermosyphon principle. However, if this does not provide sufficient circulation to avoid hot spots in the system, provide electrical motor driven circulating pump to operate automatically when heater is energized. Motor shall be 120 volt, single phase, splashproof type.

.12 Fuel system shall be equipped with replaceable fuel filter elements which may be easily removed without breaking any fuel line connections or disturbing the fuel pump, or any other part of the engine. The engine fuel system shall be equipped with a water separator installed at the engine. The fuel filter shall be a centrifugal type capable of filtering the entire fuel flow for the engine plus the injector cooling requirements.

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.13 All cabling 120 volt and above shall be rated Teck 90 cable. All communications / alarm cabling shall be armoured control cable.

.14 All hot and rotating equipment shall be guarded.

.15 Provide one or more engine mounted dry type air cleaners of sufficient capacity to protect engine working parts from dust and grit.

.16 Cooling and combustion air requirements shall be adequately sized to allow the generator set to supply full rating continuously at 40°C ambient.

.17 The standby generator set shall be mounted on a common channel iron base, which in turn shall be set on a concrete foundation. Rubber or spring type isolators shall be provided between the channel iron base and the enclosure. The rubber isolators shall be resilient to oil and other petroleum products, and shall be manufactured by the Stiles Rubber Company or approved equal. The spring type isolators shall be manufactured by Lo-Rez or approved equal.

.18 The engine shall be equipped with the following gauges:

.1 Oil Pressure

.2 Coolant Temperature

.3 Fuel Pressure

.19 The engine shall be equipped with a 24 V.D.C., electrical start system of sufficient capacity to crank at a speed which will start the engine under normal operating conditions. The starting pinion shall disengage automatically when the engine starts. Heavy duty lead acid storage batteries with sufficient capacity to crank the engine for at least two (2) full cranking cycles at firing speeds, and with capacity for starting the engine a minimum of three (3) times, shall be provided. Necessary stranded battery cable and connections shall be furnished and installed. The batteries shall be located adjacent to the standby unit, enclosed in a heavy gauge poly-resin container with removable lid. The battery box shall be supported by a stand constructed from angle iron. Battery leads shall be equipped with compression type lugs, which in turn shall be bolted to the battery posts and engine starter.

.20 Crank control with time delay relays shall provide at least three (3) cranking periods. Each cranking period shall be at least fifteen (15) seconds long and the cranking attempt shall be separated by fifteen (15) second rest periods. Total cranking cycle shall not be less than seventy-five (75) seconds. A speed sensing device shall automatically disconnect the starting circuit when the engine has started. If engine has not started, at completion of the starting program, the overcranking alarm shall activate, the engine starting control shall be locked out, and no further starting attempts shall take place until the alarm has been manually reset.

.21 The alternator shall be a 4 pole, brushless synchronous alternator designed in accordance with NEMA MG1, Part 32 and CSA Standard C282. Construction shall be of a fabricated steel or cast iron frame with cast end plate and coupling adapter. Machine construction shall be drip proof to 30 degrees from horizontal, air ventilated with cast aluminum fan. The alternator shall also comply full with applicable standards as specified be CSA, CEMA, IEC and BS5000, part 99.

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.22 The alternator shall be fitted with a large, terminal box with removable side and top covers. A bus bar terminal board shall be provided inside the terminal box and, where necessary, additional bus bar connecting links shall be provided for re-connection. The machine shall be fitted with long life sealed bearings.

.23 The stator shall be NEMA Class H insulated and all windings impregnated in a triple dip, thermo setting, moisture, oil and acid resisting Class H varnish.

.24 The rotor shall be of salient pole form, layer wound with expanding wedges utilized to support the windings. The rotor shall be NEMA Class H insulated, utilizing a solvent-free epoxy system providing high mechanical strength at temperatures of 155°C. and above. A final coat of anti-tracking varnish shall be applied to all wound and unwound components for added moisture protections. The stator and rotor shall have a temperature rise of 105°C. over a 40°C. ambient at an altitude of 1000 metres when operating at 100% load at 0.8 PF and nominal voltage.

.25 A fully connected damper winding shall be included and all stator windings shall utilize a 2/3 pitch winding to eliminate 3rd, 9th, and 15th harmonics on the line-neutral waveform.

.26 The generator control system shall be based on a permanent magnet generator (PMG) which provides excitation power via the automatic voltage regulator to the main exciter. The PMG shall be axially mounted on the main generator shaft. The main exciter output shall be fed into the main rotor windings via a three (3) phase, bridge rectifier incorporating a surge suppressor to protect the diodes against voltage transients, heavy load surges, i.e. short circuits or out-of-phase paralleling.

.27 The automatic voltage regulator (AVR) shall maintain voltage regulation within ±1% of nominal voltage from no load to full load and vice-versa, including cold to hot variations at any power factor between 0.8 lagging and unity inclusive of speed variations of 4½%. The regulation shall be based on the average of the three phase voltages. The AVR shall be self-protecting against over-excitation caused by internal or external fault and shall protect the output leads between the generator and the main breaker. The circuit shall collapse the excitation system when a fault occurs. The time of collapse shall be dependent on the severity of the overload. The circuit shall be automatically reset when the generating set is shut down. The AVR shall incorporate an adjustable frequency sensitive circuit providing a voltage characteristic which falls off with reduction in speed of the prime mover.

.28 Generator controls shall be provided for voltage level and voltage gain controls that are easily accessible for normal operation and adjustments. Voltage adjustment instructions and generator schematic wiring diagrams shall be provided, permanently attached on the inside of the exciter assembly.

.29 The PMG shall have sufficient capacity to sustain a short circuit at not less than 300% of full load current for not less than 10 seconds without damage to the generator under the following conditions:

.1 Three phase symmetrical fault

.2 Phase to phase fault

.3 Phase to ground fault

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Generator decrement and heat damage curves shall be submitted to show fault current sustaining ability.

.30 The AVR shall be provided with an external fine trimmer with a maximum range of ±5%.

.31 Upon application of full load at 0.8 PF, the generator shall recover to within ±3% of nominal voltage in 0.35 seconds. Total voltage waveform distortion with open circuit between phases, or between phases and neutral shall be in the order of 2%. On a three phase balanced harmonic free load, the distortion shall be in the order of 3.5%. The T.I.F. factor shall be 50 or less, per NEMA MG1, Part 32. All ratings and components shall be based on a maximum allowable voltage of 300 volts.

.32 The engine and generator components shall be shielded or suppressed for the suppression of radio frequency interference to meet requirements of MIL-1-11683.

.33 The generator drive shall be free from critical torsion vibration within the range of operating speed.

.34 Positive ground shall exist:

.1 Between generator frame and base through mounting pads, and

.2 Between generator and engine.

.35 Overall efficiency of generator shall not be less than 92%.

.36 The generator and engine shall be oversized as required to facilitate the powering of the loads. The generator shall be oversized to accommodate non linear loads. Increase amount of oversizing to accommodate non-linear loads listed above if required. Provide information as part of the shop drawing submission from the generator manufacturer to substantiate the ability of the system to power the above loads without wave form or other system degradation.

.37 Cool-down time delay shall be provided to keep engine running for up to five minutes after load has been removed.

.38 The generator shall be protected by a moulded case circuit breaker. The moulded case circuit breakers shall have adjustable trip unit. As part of the shop drawing, submit circuit breaker time current characteristics and generator heat damage curves to demonstrate that circuit breaker is providing suitable protection.

2.2 FUEL TANK

.1 The generator unit shall receive its fuel from an adjacent exterior above ground fuel tank provided by Mechanical Contractor.

.2 The electrical contractor shall be responsible for supplying all fuel required for testing of diesel generator unit, as well as fuel supply to leave exterior fuel tank full upon completion of testing. Provide twisted shielded pair Teck cable from the fuel tank level contacts to the generator controller.

.3 The fuel tank will have an inner tank leak alarm that shall be connected to the generator control panel by the electrical contractor that shall annunciate a warming signal and illuminate

a fault light. Provide twisted shielded pair Teck cable from the fuel tank alarm contacts to the generator controller.

.4 The owner shall be responsible for providing enough fuel to initially fill the tank. The electrical contractor shall be responsible for providing all fuel associated with the required testing and then for leaving the tank full once all testing and training has been completed.

2.3 EXTERIOR WEATHERPROOF ENCLOSURE

.1 The generator supplier shall supply and install the generator unit and all other equipment within a custom built generator enclosure. The enclosure shall be sized to allow continuous operation of the generator unit without derating of the generator unit. The enclosure shall contain all interconnecting fuel lines, heaters, battery charger, 12 volt trouble light, batteries, circuit breaker, generator controller, and other related and required equipment within. The electrical contractor shall be responsible for supplying all fuel required for testing of diesel generator unit, as well as fuel supply to leave the fuel tank full upon completion of testing.

.2 The enclosure shall have the following characteristics:

.1 Weather proof steel or aluminum shell painted to suit Owner requirements. Final custom colour to be finalized with Owner.

.2 The enclosure shall have the following characteristics:

.1 Skin-tight, insulated and suitable for local environmental conditions

.2 Walls and roof insulated and covered with suitable steel/aluminum shell.

.3 Walk-on roof.

.4 Exhaust openings provided in the end wall c/w rain shield

.5 Muffler supports provided in the roof

.6 Sound attenuation for enclosure to: 75 dB(A) @ 7 metres in a free field condition.

.7 A viewing window for external viewing of generator control panel.

.8 Two (2) double doors with “D” ring type recessed, lockable door hardware, bulb type weather seals and drip edge

.9 Doors to provide complete access to the generator circuit breaker and control panel, enclosure combination panel and engine compartment

.10 Exhaust penetration in the end wall complete with rain shield

.11 Drip mouldings around enclosure perimeter

.12 Provisions for lifting, dragging, and securing unit to ground to ensure stability

.3 For enclosure ventilation purposes, the intake air shall enter via lined weather/snow hood with bird screen, insulated (R8) aluminum volume control damper, 120V damper motor. (Spring open / power close). The discharge shall occur through

insulated aluminum volume control damper, 120V damper motor, lined weather/snow hood with galvanized bird screen

.4 The basic electrical provisions shall be as follows:

.1 One (1) 24 circuit, 100 amp, 120/208V, 3 phase, 4 wire panel with branch breakers as required

.2 120 volt incandescent/LED lights

.3 12VDC incandescent/LED light

.4 One (1) 15 amp GFCI Duplex receptacle

.5 Required heaters with integral thermostat

.6 Alternator heater with integral thermostat wired to the panel

.7 120 volt battery warming plates.

.8 Electric engine block heater complete with immersion type thermostat controlled to maintain manufacturers recommended engine coolant temperature to meet start-up requirements of NFPA-99 and NFPA-110, Level 1

.9 Battery charger wired to panel

.10 Damper motor wiring

.11 All electrical devices and wiring shall be CSA approved

.12 All wiring shall be in surface mounted EMT conduit or Teck cable.

.3 The enclosure shall have suitable clearance on the sides of the genset rails and radiator. The Generator Control panel and circuit breaker shall be installed to face to the side of the engine/generator.

.4 The painting of the enclosure shall be as follows:

.5 The enclosure shall be factory painted and shall perform to meet the requirements of the environment.

.5 It is the manufacturer's responsibility to ensure that insulation provided for this remote application must be sufficient in order to avoid the prolonged continuous operation of the thermostatically controlled device heaters and to ensure that the generator unit will start when required to do so.

.6 Factory standard isolators are acceptable. Manufacturer shall be responsible for any problem issues resulting from any specified product deviation.

.7 The generator enclosure shall include the requirement for recirculating air dampers. The enclosure shall be designed for winter conditions and shall employ factory approved strategies for ensuring that the genset performs as required under the conditions to which it will be exposed.

.8 Factory standard enclosures are acceptable with the condition that the enclosure provides adequate insulation sufficient to avoid the prolonged continuous operation of the thermostatically controlled device heaters and to ensure that the generator unit will start when required to do so. Variations in insulation and exterior wall metal gauges are acceptable.

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2.4 VENTILATION AND EXHAUST

.1 An engine mounted radiator with blower type fan shall be sized to maintain safe operation at 40°C. maximum ambient temperature. The radiator shall be equipped with a duct adapter flange. Air flow restriction from the radiator shall not exceed 125 Pa. Cooling and combustion air requirements shall be adequately sized to allow generator set to supply full rating continuously at 40°C. ambient. The engine cooling system shall be filled with a solution of 50% ethylene glycol and water. Provide Nalcool coolant additive for the entire system. The engine shall be equipped with an engine driven pump for circulating water through the cooling system.

.2 Exhaust piping of suitable material shall connect the exhaust manifold of the engine to a Hospital grade class silencer. The muffler shall provide attenuation of 35 to 40 dBA from 63 Hz to 7500 Hz, and shall be located at the engine within the enclosure. Coordinate the exhaust piping installation and size with enclosure manufacturer to ensure the back pressure does not exceed the generator manufacturer's recommendations, and to ensure that the engine is able to produce the maximum power required for this application. A flexible connection shall be mounted between the engine exhaust manifold and the muffler. Supply muffler complete with flexible connectors and a thimble for the penetration through the enclosure. Coordinate with manufacturer for the required size and configuration of the thimble and exhaust piping. The exhaust manifold and piping within the enclosure shall be insulated with a heat-resistant covering to protect personnel.

.3 Silencer outlet to be a 45 degree cut with bird screen and will extend out the end of the enclosure above the discharge hood.

.4 The standby generator manufacturer and supplier shall be responsible for reviewing the mechanical ventilation, fuel and exhaust requirements of their equipment to ensure that the provisions of the enclosure are adequate for their equipment.

.5 The genset supplier shall be responsible for ensuring and coordinating that the provisions of the enclosure for the above systems are suitable for the proper and desired operation of the genset in the environmental conditions found at this site.

Standby Power Rating @ 0.8 p.f. 350 kW

2.5 BATTERY CHARGER

.1 A battery charger shall be provided, and shall be capable of operating the control panel and charging the diesel batteries simultaneously. The battery charger shall meet the following requirements:

.1 Wall mounted type

.2 Input voltage 60 Hz. 120 volt, A.C.

.3 Output nominal voltage 24 volt

.4 Adjustable float voltage from 95% to 130% of nominal voltage.

.5 Adjustable high rate voltage float voltage to 130% of nominal voltage.

.6 Voltage stability +0.5% for conditions of 1% to 100% full load, ±10% input voltage variation and ±5% frequency deviation.

.7 Ampere minimum 10 amp and taper to 0 amp

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.8 Automatic charge control that shall automatically switch to high rate if the battery demands full output from the charger.

.9 Float and high rate switches

.10 Equipped with ammeter and voltmeter ± 2% accuracy.

.11 Low battery voltage alarm contacts for use with control panel.

.12 Battery charger shall not subject batteries to prolonged charging periods or trickle charging.

.13 Battery charger shall be capable of recharging fully discharged battery within twelve (12) hours.

.14 When battery charging is not occurring, the batteries shall be constantly monitored when battery voltage drops below 24.5 volts, an alarm indicating light on the generator control panel shall be activated along with alarm signal. This monitoring system shall be fully independent of the battery charger and shall monitor the batteries regardless of whether the battery charger is energized.

.15 Battery charger shall be SAFT NIFE SLR24-12 or approved equal.

2.6 SHUTDOWN AND ALARMS

.1 In the building, provide an emergency shutdown pushbutton complete with a safety guard. This should take precedence over the master switch on the diesel control panel. This push-button shall shutdown the engine by interrupting the power to the engine controls and by dumping the engine air box or by shutting off the fuel supply. The engine air box and its configuration if utilized for shutdown shall be designed to facilitate an emergency shutdown without damage to either the engines or the air box.

.2 Provide the following engine automatic shutdown devices, complete with red indicating light on the generator control panel:

.1 High coolant temperature

.2 Low oil pressure

.3 Engine over speed

.4 Over crank

.5 Low coolant level

.6 Over vibration (use of Murphy switch)

.7 Emergency Stop (either control panel switch or remote building switch)

The low oil pressure protection system shall be locked out until the engine speed reaches 90% of rated speed and for a period of twenty (20) seconds after engine start.

.3 Provide the following advisory alarms complete with alarm indication on the generator control panel:

.1 Low battery voltage

.2 Abnormal selector switch position

.3 Under frequency

.4 Low fuel

.5 Low coolant temperature

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.6 Ready to Start
.7 Unit running
.8 Battery charger fault
.9 Fuel Tank Leak
.10 Auxiliary fault (field selectable)

2.7 CONTROL PANEL

.1 Provide a unit mounted digital control panel. The control panel shall be as detailed on the drawings and shall include, but not be limited to, the following:

.1 Voltmeter with phase selection
.2 Hour meter
.3 Frequency meter
.4 Ammeter with phase selection
.5 Engine and electrical automatic shutdown indicator lights.
.6 Advisory alarm indicator lights.
.7 Emergency Stop
.8 Sixteen (16) programmable contact inputs; (7) Contact outputs: (3) 30A dc and (4) programmable 2A dc rated contacts
.9 RUN / OFF-RESET / AUTO

.2 Provide a separate remote digital monitoring and control panel for use within the building installed into the electrical room using Teck cable or conduit/wire. It shall also be used to display to display all alarms and pre-alarm conditions. It shall be c/w an audible alarm horn and lamp test and alarm silence switches.

.3 All system controls shall be microprocessor based. Relays and relay based logic will not be permitted. The controller shall be powered from the stand-by generator batteries in an appropriate fashion so as to ensure reliable operation under normal and emergency conditions.

.4 The electronic governor and control scheme shall be capable of operating with isochronous cross current compensation.

.5 The entire diesel electric set shall be supplied by Finning (Kramer Tractor), Wajax Power Systems or Generac.

2.8 WORKMANSHIP

.1 Manufacture and construct equipment free from blemishes, defects, burrs and sharp edges; accuracy of dimensions and marking of parts and assemblies; thoroughness of welding, brazing, painting and wiring, alignment of parts and tightness of assembly screws and bolts.

Part 3 Execution

3.1 INSTALLATION

.1 Check the site and determine the size and weight of the sections into which the equipment shall be divided for shipment to ensure that they can easily be moved into or out of the

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electrical rooms, as shown on the drawings. Special arrangements will be required to move the new equipment into the existing building. Protect existing building finishes and repair all damage resulting from installation of new equipment.

.2 The ground bus shall be connected to the ground network. Refer to specifications and the drawings for further grounding requirements.

.3 Provide one litre of touch-up paint for each major component color in aerosol cans. Touch up paint finish where required.

.4 Exhaust piping shall be insulated with proper cladding.

.5 The Electrical contractor shall supply all fuel for completion of the acceptance tests after which, leave the fuel tank full.

3.2 ACCEPTANCE TESTS AND TRAINING

.1 Prior to the final acceptance tests, a qualified representative of the manufacturer of the generator control panels shall field verify and correct as necessary, all control circuitry, terminations of field wiring and operation of control systems. The representative shall also provide on site technical assistance to the contractor as required during the course of the installation, and shall also be present during the final acceptance tests. This representative shall visit the site a minimum of three (3) times.

.2 The final acceptance test shall include, but not necessarily confined to, the following recorded verifications:

.1 Engine, generator and control panel nameplate data and operating characteristics.

.2 Cooling system, including radiator, piping, motorized louvres and controls.

.3 Provide portable meters to facilitate vibration tests. Provide documentation to demonstrate vibration readings are within engine and generator manufacturers tolerances. On completion of the mechanical installation, a complete vibration analysis shall be performed, and a hard copy of the vibration x-y plots provided. The vibration points shall be taken at a minimum of seven points both in the vertical and horizontal plane. All points shall be marked using red paint to ensure that future vibration readings are taken from identical points. Vibration readings shall not exceed 16.5 mm per second at any order within the first five orders of operating speed. The overall vibration reading shall not exceed 0.20 mm filter-out reading.

.4 Provide a recording harmonic meter to demonstrate that the generated wave form does not include objectionable harmonic distortion particularly third harmonic.

.5 Automatic engine and electrical shutdown protection devices, and all advisory non shutdown alarms.

.6 Control panel operation.

.7 Battery charger and its operation.

.8 Automatic and manual starting, at no load, half load and full load. Voltage, current, frequency, oil pressure, engine water temperature and enclosure temperature shall be recorded.

.9 With normal building load, demonstrate automatic start and transfer switch operation. Also demonstrate manual starting.

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.10 Provide a load bank to demonstrate the unit's capability to carry 100% load continuously for two (2) hours while operating within specified ratings and temperature limits.

.11 Demonstrate emergency shutdown at 30% load.

.3 On site testing load banks, temporary wiring, instrumentation and all personnel required to satisfactorily complete these tests shall be the responsibility of the Electrical contractor. A qualified representative of the equipment manufacturer must also be in attendance to certify all test data.

.4 Three written reports shall be prepared by the contractor and standby generator supplier, showing all engine gauge readings, all generator meter readings and room ambient temperature during the acceptance test.

.5 The Electrical contractor shall have the installation 100% complete and tested for correct operation before the acceptance tests start.

.6 The Owner's operating and maintenance personnel shall be instructed in the operation of the system for a minimum period of four (4) hours. Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in operating instructions and service manuals.

END OF SECTION

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Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for automatic load transfer equipment which can monitor voltage on all phases of normal power supply, initiate cranking of standby generator unit, transfer loads and shut down standby unit.

1.2 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical.

1.3 REFERENCES AND CODES

.1 Canadian Standards Association (CSA International)

.1 CAN3-C13-M83(R1998), Instrument Transformers.

.2 and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

.3 CSA C22.2No.178-1978(R2001), Automatic Transfer Switches.

.2 American National Standards Institute (ANSI)/National Electrical Manufacturers Association (NEMA)

.1 ANSI/NEMA ICS 2-2000, Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.

1.4 SYSTEM DESCRIPTION

.1 Automatic load transfer equipment to:

.1 Monitor voltage on phases of normal power supply.

.2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage on any one phase below preset adjustable limits for adjustable period of time.

.3 Transfer load from normal supply to standby unit when standby unit reaches rated frequency and voltage pre-set adjustable limits.

.4 Transfer load from standby unit to normal power supply when normal power restored, confirmed by sensing of voltage on phases above adjustable pre-set limit for adjustable time period.

.5 Shut down standby unit after running unloaded to cool down using adjustable time delay relay.

.2 Should normal power fail, the automatic transfer switches shall sense the voltage failure, send a signal to the standby generator unit to start and transfer the load to the emergency system as soon as voltage appears on the emergency feeds. When normal power is restored, the sequence shall be automatically reversed.

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.3 The manufacturer shall be capable of maintaining and servicing this equipment without causing the Owner either to carry expensive parts, or to be subject to the inconvenience of long periods of interrupted service because of lack of available parts.

1.5 SHOP DRAWINGS

.1 Three (3) sets of complete operating, maintenance and parts manuals, drawings, and a sequence of operation covering all equipment shall be provided.

.2 Before fabrication and/or assembly, submit shop drawings and complete wiring diagrams for review.

.3 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.4 Include:

.1 Make, model and type.
.2 Single line diagram showing controls and relays.
.3 Description of equipment operation including:
.1 Automatic starting and transfer to standby unit and back to normal power.
.2 Test control.
.3 Manual control.
.4 Automatic shutdown.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual.

.2 Detailed instructions to permit effective operation, maintenance and repair.

.3 Technical data:

.1 Schematic diagram of components, controls and relays.
.2 Illustrated parts lists with parts catalogue numbers.
.3 Certified copy of factory test results.

Part 2 Products

2.1 MATERIALS

.1 Instrument transformers: to CAN3-C13.

.2 Contactors: to ANSI/NEMA ICS2.

2.2 CONTACTOR TYPE TRANSFER EQUIPMENT

.1 Contact Type Transfer Equipment: to CSA C22.2No.178.

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.2 The emergency power generator automatic transfer switch shall be suitable for resistive or inductive loads, and rated as specified herein, 300 volts, 60 Hz, 3 pole for use on a 3 phase, 4 wire system, having available short circuit current of 22,000 amps symmetrical.

.3 The transfer, bypass and isolation switch shall be of the closed EEMAC 1 enclosure type for mounting on wall, as shown on the drawings. The enclosure & switch shall be factory assembled.

.4 Transfer switch shall be electrically operated, mechanically held, and shall obtain control and transfer power from the source to which it is being transferred. It shall operate so that a neutral position will not be possible, except for requirements noted otherwise.

.5 Full protection shall be provided by means of 3 solid state voltage sensing relays, and these relays shall have adjustable pick-up and drop-out settings.

.6 The transfer switches shall be a closed transition transfer switch with an microprocessor based controller with full draw-out two-way bypass-isolation switch. The two-way bypass-isolation switch shall provide manual bypass of the load to either source and shall permit isolation of the automatic transfer switch from all source and load power conductors. The switch shall incorporate “Failure to synchronize” indication and “Extended parallel time protection”. The switch shall allow bypass-isolation without load interruption.

.7 A non-chattering relay shall be provided to prevent transfer to the emergency source until both the frequency and voltage have reached a preset value. An auxiliary contact shall be provided to initiate generator start-up on failure of normal power supply.

.8 The following timing adjustments to be supplied:

.1 Time delay for re-transfer from emergency to normal after restoration of normal power 0-10 minutes.

.2 Time delay normal to emergency 0-60 seconds.

.3 Time delay on engine starting to over-ride momentary voltage fluctuations 0-60 seconds.

.4 Maintained contact Test selector switch to simulate failure of normal power.

.9 Provide in-phase monitor for synchronized switching in both sequences, emergency to normal, and normal to emergency or provide further time delay 0-10 seconds for transferring from normal to emergency, and emergency to normal. As the standby generator will be required to be on line and loaded within 10 seconds, the signal to start the unit shall be sent at the commencement of the 0-10 second time delay.

.10 The transfer switch control panel shall be mounted separately on the door and connected to the transfer switch by means of a wire harness and disconnect plug. The control panel shall also be capable of being removed for bench maintenance, without disturbing the power being supplied to the load.

.11 The by-pass switch shall have the same basic design as the transfer switch and shall have identical electrical ratings. It shall be operated manually by means of a by-pass handle, with quick-make/quick-break action. The handle shall have three positions: automatic, by-pass to normal and by-pass to emergency. In the automatic position, the by-pass to normal and by-

pass to emergency contacts shall remain open and not exposed to the destructive effects of full currents of wear during normal operation.

.12 When the isolation switch is in the 'isolate' position, the by-pass switch shall serve as a manual transfer switch, allowing the load to be switched from one source to the other. The isolation switch shall provide a redundant back-up to the transfer switch. Regenerative voltage from the load shall be prevented from feeding back into the transfer switch during the source to source manual transfer.

.13 The isolation switch shall be integrated with the transfer switch and shall be a non-draw out type. Correct alignment in positive connection and disconnect shall be accomplished through the operation of the isolation handle. All power connection shall be made with silver plated copper. Means shall be provided to padlock the isolation handle in the open position.

.14 The by-pass handle shall permit load by-pass to either source without any interruption of the power to the load. There shall be three positions: automatic, by-pass to normal, and by-pass to emergency.

.15 The isolation handle shall be interlocked with the by-pass function and shall be capable of being operated only when the by-pass handle is in the by-pass position. The isolation handle shall have three positions as follows:

.1 **Closed** - the automatic transfer switch shall be connected to both power sources and the load in the normal operating mode.

.2 **Test** - in this position the automatic transfer switch shall be withdrawn from the load circuits. However, both sources shall still be connected to allow electrical functional testing without disturbing the load which has been by-passed directly to a source.

.3 **Open** - all power to the transfer switch shall be disconnected and it shall be completely isolated for maintenance. The transfer switch may be serviced.

.16 Both handles shall be accessible from the exterior of the switchgear. Handle positions and operating instructions shall be clearly indicated. Provide indicator showing:

.1 Utility source available

.2 Emergency source available

.3 By-pass to emergency

.4 By-pass to Utility

.5 Transfer switch closed on Utility

.6 Transfer switch closed on emergency

.17 Transfer switches shall be manufactured and assembled by ASCO or approved equal.

.18 The manufacturer shall be brought in to provide commissioning of the transfer switch prior to it being energized and ensure that it is safe to be commissioned with source voltages present. They shall also be used to commission the switch and provide commissioning reports.

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2.3 ACCESSORIES

.1 Pilot lights to indicate power availability normal and standby, switch position, green for normal, red for standby, mounted in panel.

.2 Provide the following relays and modules for each transfer switch.

- .1 Relay to signal start-up of generator.
- .2 Time delay relay to signal engine when cool-down period has occurred.
- .3 Position sensing contacts for Emergency power Position, Normal Power position, Bypass - Emergency power Position, Bypass - Normal Power position.
- .4 Remote Test Input.
- .5 Adjustable Pre-transfer contacts
- .6 ATS Position pilot lights
- .7 Source Availability contacts
- .8 3 phase under/over voltage – Emergency and Utility
- .9 Phase Rotation Monitor
- .10 Maintained Remote Test selector switch
- .11 General Transfer Switch Alarm

.3 Provide 2#16AWG in EMT from each position sensing contact, remote test input, transfer switch alarm for each transfer switch. Run to generator controller.

2.4 EQUIPMENT IDENTIFICATION

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

.2 Control panel:

- .1 For selector switch and manual switch: size 4 nameplates.
- .2 For meters, indicating lights, minor controls: size 2 nameplates.

2.5 SOURCE QUALITY CONTROL

.1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested.

.2 Tests:

- .1 Operate equipment both mechanically and electrically to ensure proper performance.
- .2 Check selector switch, in modes of operation Test, Auto, Manual, Engine Start and record results.
- .3 Check voltage sensing and time delay relay settings.
- .4 Check:
  - .1 Automatic starting and transfer of load on failure of normal power.
  - .2 Retransfer of load when normal power supply resumed.

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.3 Automatic shutdown.

Part 3 Execution

3.1 INSTALLATION

.1 Locate, install and connect transfer equipment.

.2 Check time settings and adjust as required.

.3 The ground bus shall be connected to the ground network. Refer to specifications and the drawings for full grounding requirements.

END OF SECTION

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Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

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

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.2 American National Standards Institute (ANSI)

.1 ANSI C82.1, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast.

.2 ANSI C82.4, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.3 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.4 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.

.5 American Society for Testing and Materials (ASTM)

.6 ASTM F1137, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.7 United States of America, Federal Communications Commission (FCC)

.8 FCC (CFR47) EM and RF Interference Suppression.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Shop drawings for each fixture shall include but not be limited to, lamps, ballasts, fixture cuts, custom colors, and special mounting details. All pertinent information for each fixture shall be stapled separately from other fixtures.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 10 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide detailed lighting calculation drawings for fixtures that are submitted for approval for closed office areas, open office areas, training rooms or as requested by the consultant. These shall be submitted no later than 10 working days before tender close.

.4 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 LAMPS

.1 Provide in wattages and types to properly suit the specified fixtures.

.2 T5 Linear Fluorescent Lamps:

.1 Miniature Bi-pin, slim 5/8" diameter for operating with high frequency electronic programmed start ballasts

.2 Colour Rendering Index (CRI) of 85

.3 Colour Temperature: 3500°K

.4 Nominal Life Rating: 20,000 hours

.3 Lamps for T5 linear fluorescent lighting fixtures shall be manufactured by Osram-Sylvania or Philips.

2.2 BALLASTS

.1 Ballasts for fluorescent fixtures shall be supplied with the fixtures, pre-wired for operation with the compatible lamps and quantity of lamps specified for the fixture. Provide ballasts in the voltage noted with the fixture specification.

.2 Fluorescent ballast systems shall include:

.1 Operate lamps for maximum efficacy, high lumen output operation and operate for full lamp life

.2 Eliminate lamp flicker

.3 UL Listed Class P, Type 1 Outdoor

.4 CSA Certified
.5 70°C Maximum Case Temperature
.6 FCC 47CFR Part 18 Non-Consumer for EMI and RFI filtering
.7 Class A Sound Rating
.8 ANSI C62.41 Category A Transient Protection
.9 CFCI Compatible

.3 Ballasts for Linear T5 Lamps

.1 Starting Method: Programmed Rapid Start
.2 Stepped Switching Ballast System where indicated bi-level 100% and 50% stepped output
.3 Ballast Factor (BF): 1.00
.4 Circuit Type: Series
.5 Lamp Frequency: >40kHz to reduce potential interference with infrared control systems
.6 Lamp Current Crest Factor (CCF): less than 1.6
.7 Total Harmonic Distortion: <10% THD
.8 Power Factor: >98%
.9 End of Lamp Life Sensing
.10 Manufacturer:

Sylvania 'Quicktronic PROStart T5 Professional Series
Advance 'Optanium Step Dim EL' series, available in 120-volt only

.4 Dimming Fluorescent Ballasts for T5 Lamps

.1 Starting Method: Programmed Rapid Start System
.2 Ballast Factor (BF): 1.00 – Normal Ballast Factor
.3 Circuit Type: Series
.4 Lamp Frequency: >40kHz to reduce potential interference with infrared control systems
.5 Lamp Current Crest Factor (CCF): less than 1.7
.6 Total Harmonic Distortion: <10% THD
.7 Power Factor: >98%
.8 Dimming Range: 100 to 10%
.9 1 – 10 Volt Control
.10 Anti-Flash Circuitry turns on in dimmed mode
.11 End of Lamp Life Sensing for T4 and T5 lamps
.12 Compatible with 4-pin compact fluorescent lamp types
.13 Manufacturers (unless noted otherwise):

Lutron 'Hi-Lume' series
Sylvania 'Quicktronic – Powersense' series
Advance Mark 10

.5 Fluorescent ballasts shall have inrush current limiting capability to assure compatibility with all lighting systems controls.

.6 Ballast Warranty: All fluorescent ballasts shall include a written manufacturer's warranty against defects in materials and workmanship for 60 months from date of substantial completion and include a nominal replacement labour allowance.

2.3 LED LIGHTING – LAMP MODULES AND DRIVERS

.1 Solid-State Lighting (LED luminaires) shall comply with ENERGY STAR® SSL test standards for the following qualification requirements:

.1 Testing: SSL testing standards including IES LM-79-2008 and LM-80-2008 as performed by an independent test lab.

.2 Efficacy: The luminaire test data and submitted report shall demonstrate a minimum of 35 lumens per watt and 575 lumens for the least efficient LED for apertures ≥ 4.5" (345 lumens for apertures ≤ 4.5"), lowest efficient optic, and hottest luminaire configuration for the product group submitted for qualification.

.3 Colour: LED luminaire shall demonstrate colour uniformity across the aperture.

.4 Power: The driver/power supply must have a power factor of > 0.90 for all non-residential products, meet FCC requirements, sound rating of A and provide transient protection.

.5 Reliability: The LED luminaire shall demonstrate 70% lumen maintenance at 35,000 hours for non-residential products, as calculated using the DOE's linear extrapolation model.

.2 Tight chromaticity specification and LED colour binning process shall ensure LED colour uniformity, sustainable Colour Rendering Index (CRI) and Correlated Colour Temperature (CCT) consistency over the useful life of the LED. Consistent colour uniformity and tight colour control shall be maintained even during dimming.

.3 LED modules shall be InGaN (Indium Gallium Nitride) semiconductor material, absent of UV and minimal IR wavelengths. The conglomeration of diodes covered with remote phosphor technology shall provide consistent colour uniformity and tight colour control.

.4 LED Light Engine (Driver)

.1 Over-voltage, over-current and short-circuit protected

.2 Thermal management of the LED system shall be designed to yield 70% lumen maintenance after 50,000 hours of operation

.3 Total Harmonic Distortion: < 20% THD

.5 LED fixtures where specified as dimmable, shall have a dimming range of 100% to 10% unless otherwise noted.

.6 Warranty: The light engine and power components of LED luminaires installed for indoor applications shall be free from defects in material and workmanship for a minimum period of three (3) years from date of original purchase. Warranty shall cover only product failure due to defective material or workmanship, and does not include labour to remove or install fixtures. Defective LED's shall be considered if a minimum of 5% of LEDs per luminaire are non-operative in the fixture or module.

2.4 LUMINAIRES

.1 Contractor is responsible for all required mounting details for all lighting fixtures. If mounting of fixture is uncertain, contractor shall confirm prior to finalising pricing.

.2 Lighting fixtures shall be of the makes indicated. Similar types of fixtures shall be by one manufacturer.

.3 Only clean luminaires and lamps will be accepted at time of final inspection.

.4 Recessed fixtures shall generally be supplied complete with trim, plaster frame or ring and mounting brackets where installed in plaster, or without plaster frame in acoustic ceilings.

.5 Fixtures shall bear appropriate CSA labels.

.6 Cooperate with all other trades for the proper installation of all lighting fixtures.

.7 Verify the quantity of fixtures before placing orders.

.8 Verify all ceiling types with architectural drawings and the General Contractor before ordering fixtures.

.9 Fluorescent lighting fixtures shall be so designed that the temperature on the ballast case shall not exceed a maximum of 70°C in an ambient temperature of 25°C.

.10 Co-ordinate with drawings to ensure that all fluorescent fixtures are equipped with ballasts of a suitable voltage to match branch circuitry.

.11 All fluorescent fixtures such as troffers, specified as being equipped with flat acrylic lens, shall be provided with lens not less than 3.175 mm thick, regardless of catalogue numbers specified.

.12 All fluorescent troffers specified as being installed in inverted T-bar ceilings shall be painted on bottom face of fixture to match the T-bar splines unless otherwise noted.

.13 A self adhesive small circular label coloured blue shall be placed on a T-bar spline adjacent to each fixture housing the ballast to facilitate its location.

.14 All fluorescent luminaires installed on branch circuits with voltages exceeding 150 volts-to-ground shall be provided with a disconnecting means integral with the luminaire that simultaneously opens all circuit conductors between the branch circuit conductors and the conductors supplying the ballast(s), and shall be marked in a conspicuous and permanent manner adjacent to the disconnecting means so as to identify the disconnect.

.15 The new light fixture lamps shall not be used during construction. The contractor may use their own temporary lamps during construction at their own expense with the Owner's approval. The contractor shall replace temporary lamps with new lamps upon completion of work. All fixtures shall be cleaned inside and outside prior to substantial completion.

.16 Provide lighting fixtures of type and quality as specified in the following schedule. Fixtures shall be complete with necessary accessories, lamps and ballasts. The contractor shall advise of any restrictions on providing luminaire, lamp and ballast as specified during tender period.

.17 The lighting fixtures shall be as specified in the following schedule, and the manufacturer's numbers shown shall not reduce or amend the requirements as outlined under the description of each fixture type.

2.5 LUMINAIRE SCHEDULE (NON-HOUSING BUILDING)

.1 Fixture type ‘AA’

.1 Luminaire: Vandal proof corner mounted fluorescent, 1220 length,14 gauge cold rolled steel construction, seam welded, smooth finish with one piece piano hinged door frame, 1/4” thick polycarbonate outer lens, K12 internal lens, two 28 watt T5 fluorescent lamps and one 9 or 13 watt compact fluorescent lamp for night lite, two ballasts one for T5 lamps and one for compact fluorescent lamp.

.2 Lamps: 2 x F28 watt T5 lamps, 2600 initial lumens per lamp @ 25°C and one PL 9 or PL13 compact fluorescent lamp.

.3 Ballasts: Programmed rapid start electronic ballasts, **120 volt**

.4 Manufacturer:

Lighting Dimensions #LTMS-3324-12-12-THP-FNL

Cooper Lighting #FMC Corner Luminair

Metalumen #SS2 series (5mm polycarbonate outer lens)

Or approved equal.

.2 Fixture type ‘BB’

.1 Luminaire: Surface mounted fluorescent , 1219mm length, die formed cold rolled steel housing and end plates in white finish, clear acrylic prismatic wrap-around lens.

.2 Lamps: 2 x F28 watt T5 lamps

.3 Ballast: Program Rapid start electronic ballast, **120-volt**

.4 Manufacturer:
Cooper Metalux # WN series
Philips Day-Brite #OW Narrow series
Columbia Lighting ‘AWN’ series
Or approved equal

.3 Fixture type ‘CC’

.1 Luminaire: Surface mounted fluorescent strip light, 1219mm length c/w wire guard. Closed top symmetric reflector. Where suspended to 4700mm A.F.F. strip light shall be suspended by conduit. Where suspended to 2700mm, provide chain hanger. Coordinate final mounting height and locations with mechanical equipment and ductwork on site.

.2 Lamps: 2 x F28 watt T5 lamp

.3 Ballast: Program Rapid start electronic ballast, 120-volt

.4 Manufacturer:
Cooper Metalux #ICF series
Philips Day-Brite #SV series
Columbia Lighting #CN series
Or approved equal.

.4 Fixture type ‘DD’

.1 Luminaire: Recessed fluorescent volumetric fixture suitable for inverted t-bar ceiling or metal panel ceiling, 610 x 1220mm, painted white steel frame and side reflectors, hinged center optic component, acrylic center diffuser with satin lens, with one ballast per fixture.

.2 Lamps: 2 – F28 watt, T5 lamps, 3500k color temperature

.3 Ballast: Programmed rapid start electronic ballast, 120-volt.

.4 Manufacturer:

Axis Lighting 'DIA' series

Mark Lighting 'WHISPER' series

Zumtobel 'ML' series

Ledalite 'SHINE' series

Metalumen 'Carlisle TC4' series

Or approved equal.

.5 Fixture type 'DD2'

.1 Luminaire: Recessed fluorescent volumetric fixture suitable for inverted t-bar ceiling or metal panel ceiling, 610 x 1220mm, painted white steel frame and side reflectors, hinged center optic component, acrylic center diffuser with satin lens, with one ballast per fixture.

.2 Lamps: 2 – F28 watt, T5 lamps, 3500k color temperature

.3 Ballast: Programmed rapid start electronic dimming ballast, 120-volt.

.4 Manufacturer:

Axis Lighting 'DIA' series

Mark Lighting 'WHISPER' series

Zumtobel 'ML' series

Ledalite 'SHINE' series

Metalumen 'Carlisle TC4' series

Or approved equal.

.6 Fixture type 'EE'

.1 Luminaire: Surface mounted fluorescent fixture, 1250mm length x 305mm width, 16 ga. continuous steel housing. Nominal .125 prismatic acrylic inner lens, .125 UV stabilized injection molded clear polycarbonate vandal proof outer lens, stainless steel Torx head screws to prevent unauthorized access. Fixture shall include radio interference suppressor option. Provide matching Torx screw driver tool.

.2 Lamps: 2 x F28 watt T5 lamps

.3 Ballast: Programmed rapid start electronic ballast, 120-volt.

.4 Manufacturer:
Cooper Lighting Fail-Safe #FMS-D12-T5-UNV-80/84-EB51-LNL series
Kenall Mighty Mac #SDA-4-2/2-2-28-RS-1-120-1/G-1-DLN Series
Or approved equal.

.7 Fixture type 'FF'

.1 Luminaire: Fluorescent wall mount , 1219mm length, fixture frame in white finish, smooth opalescent acrylic diffuser. Mount up 150mm above vanity mirror.

.2 Lamps: 1 x F28 watt T5 lamp

.3 Ballast: Program start electronic ballast, 120-volt.

.4 Manufacturer:
Cooper Metalux #BC series
Lithonia #WC series
Philips Day-Brite #CSW series
Columbia Lighting #W series
Or approved equal.

.8 Fixture type 'GG'

.1 Luminaire: Surface mounted fluorescent strip light, 1219mm length c/w wire guard. Mount to the underside of deck. Coordinate final mounting height and locations with mechanical equipment and ductwork on site.

.2 Lamps: 2 x F28 watt T5 lamp

.3 Ballast: Program Rapid start electronic ballast, 120-volt

.4 Manufacturer:
Cooper Metalux #ICF series
Philips Day-Brite #SV series
Columbia Lighting #CN series
Or approved equal.

.9 Fixture type 'A'

.1 Luminaire: Keyless ceramic socket c/w screw-in type 13 watt compact fluorescent lamp. Ceiling mounted or wall mounted 150mm above door header.

.10 Fixture type 'C'

.1 Luminaire: Recessed LED fixture suitable for wet location, fully gasketed with lens, 150mm diameter aperture, aluminum reflector with white trim.

.2 Lamp: 20 watt, 1100 lumen LED module with remote phosphor technology, 4100K, 80 CR1, 50000 hours at 70% lumen maintenance,

.3 Driver: over-voltage, over-current and short-circuit protected, 120 volt, < 20% THD, dimmable.

.4 Manufacturers:

Prescolite "LF6LED" Series

Conventry "6VLED" Series

Maxilume "HV6 LED" Series

Or approved equal.

.11 Fixture type 'D'

.1 Occupied sign fixtures shall be LED (Lighting Emitting Diodes), solid state design with high output LED's for a maximum 2 watts per sign, 120 volt, multi-tap for 347 volt and 120 volt monitoring connections. Aluminum housing in white finish, acrylic barrier, Red "IN USE" or special wording confirm wording with owner. Universal mounting, minimum five year warranty. Signs shall be one of the following manufacturers:

Ready-Lite ‘RA’ Series, Beghelli ‘Quadra’ #RM series, Emergi-Lite #EA series,

.12 Fixture type ‘F’

.1 Luminaire: Recessed LED downlight suitable for mounting in inverted T-bar or drywall ceiling, 127mm diameter aperture, specular reflector with white trim, soft focus diffused lens.

.2 Lamps: 1200 lumen LED module, 3,500K, 80 CRI, 50000 hours at 70% lumen maintenance.

.3 Driver: over-voltage, over-current and short-circuit protected, 120-volt, <20% THD, dimmable.

.4 Manufacturers:
Cooper Lighting Halo # ML56 LED Series

Elite “B5 LED” Series

Prescolite “LC6LED’ Series
Or approved equal.

.13 Fixture type ‘G’

.1 Luminaire: Exterior surface mounted LED suitable for wet locations, extruded aluminum driver enclosure, die cast aluminum housing in powder coat grey finish, vandal resistant one-piece injection molded clear polycarbonate lens. Type III cut-off lighting distribution pattern, 120 volt LED driver with 0-10V dimming, <20% total harmonic distortion, >0.9 power factor, start-up operation -40 degree C to 40 degree C, 90% lumen maintenance at 60,000 hours, 56 input watts, 5,374 delivered lumens, 4000°K, c/w c/w integral photocell control. Fixture shall be mounted up 4,200 A.F.G. c/w 178mm length wall bracket. Five year warranty. Refer to lighting plan drawings and details.

.2 Manufacturers:
Cooper Lighting # GLEON series
Philips Gardco # ECOFORM series
Beacon #Viper Small 22NB series
Or approved equal.

.14 Fixture type ‘H’

.1 Luminaire: Surface fluorescent fixture suitable for wet location, 16 gauge CRS backplate, gasketed for wet locations, UV stabilized injection molded polycarbonate tamper resistant gasketed lens, stainless steel Torx Head security screws. Fixture shall be GFCI protected.

.2 Lamp: 2 - 13 watt, triple tube fluorescent , 3500K, 80 CR1, 40000 hours at 70% lumen maintenance,

.3 Ballasts: Rapid Start HPF electronic ballasts, <10% THD, **120 volt**

.4 Manufacturers:
Cooper Lighting #Fail-Safe VR2000 Series, flat configuration
Canlyte Keene Model GR c/w opal lens & open bezel, shallow depth
Kenall Model Millenium Round MR13FL c/w pearlescent polycarbonate lens
RAB Lighting VAN1I
Or approved equal.

.15 Fixture type ‘K’

.1 Luminaire: Recessed LED downlight suitable for mounting in inverted T-bar or drywall ceiling, 86mm diameter aperture, white reflector with die-cast aluminum white trim ring, diffuse dome polymer lens. Five year warranty.

.2 Lamps: 700 lumen LED module, 3,500K, 80 CRI, 50000 hours at 70% lumen maintenance.

.3 **Driver: over-voltage, over-current and short-circuit protected, 120-volt, <20% THD, dimmable.**

.4 Manufacturers:

Cooper Lighting # Halo H4 Series

Elite “LED2-4” Series

Intense “ICRLS4” Series

Or approved equal.

.16 Fixture type ‘PL1’

.1 Luminaire: Exterior pole mounted LED suitable for wet locations, extruded aluminum driver enclosure, die cast aluminum housing in powder coat grey finish, vandal resistant one-piece injection molded clear polycarbonate lens. Type III cut-off lighting distribution pattern, 120 volt LED driver with 0-10V dimming, <20% total harmonic distortion, >0.9 power factor, start-up operation -40 degree C to 40 degree C, 90% lumen maintenance at 60,000 hours. 157 input watts, 15,669 delivered lumens, 4000°K, c/w c/w integral photocell control. Luminaire shall have five year warranty. Poles shall be 155mm square steel, 9144 mm (30 foot) and shall include anchor bolts, full base cover, hand hole, ground lug, top cap and all necessary accessories as required. Post top luminaire and lamp pole standard shall be grey finish. Refer to site plan drawings and details.

.2 Manufacturers:
Cooper Lighting # GLEON series
Philips Gardco # ECOFORM series
Beacon #Viper Large 64NB series
Valmont Pole ‘6SS-(20-40) series
Keene SR2 series
Or approved equal.

2.6 LUMINAIRE SCHEDULE (HOUSING)

.1 Fixture L

.1 Wall mounted fixture with opal glass white finish, two lamps, 120 volt. 114mm in diameter and 395mm in length, 2 x 60 watts medium base lamps.

.2 Replace lamps with LED, A19 medium base, 10 watt lamps.

.3 Fixture is to be mounted horizontal, 150mm above vanity mirror.

.4 Manufacturer:
Russell #775-102/WH
Or approved equal.

.2 Fixture N

.1 Ceiling fan and light kit.

.2 Ceiling mount fan on down rod, 5 blades at 12 degree pitch, housing in satin nickel finish and white / matching switch blades.

.3 Total width of 52” and height.

.4 Full function remote control adaptable.

.5 Three medium base lamp light kit c/w white glass shades and satin nickel housing, 120 volt lamps.

.6 Contractor shall replace standard incandescent lamps with 13w LED bulb.

.7 Full range dimming.

.8 Manufacturer:
Ceiling fan: 'Kendal' #AC6852-SN
Lighting kit: 'Kendal' #SG9042-WH
Or approved equal.

.3 Fixture O

.1 Surface mounted fixture with brushed chrome finish and mounting clips, faux glass shade. 405mm in diameter x 127mm height, 3 x 60 watts medium base lamps, 120 volt.

.2 Contractor shall replace standard incandescent lamps with 13w LED bulb.

.3 Full range dimming.

.4 Manufacturer:
Russell #341-716
Or approved equal.

.4 Fixture P

.1 Recessed anodized LED downlight for wet location with white powder coat painted trim and white anodiized aluminum reflector, frosted lens.

.2 67mm aperture.

.3 120 volts electronic dimming driver.

.4 8 watts, P16 LED input with 510 lumen output with 4000°K color temperature and CRI of 80+.

.5 Manufacturer:
Contrast Lighting #S3450-C-01
Or approved equal

.5 Fixture Q

.1 Surface mounted ceiling mounted fixture with brushed chrome finish, faux glass shade, 381mm in diameter, 305mm high, 3x100 watts medium base 120 volt lamps.

.2 Contractor shall replace standard incandescent lamps with 13w LED bulb.

.3 Full range dimming.

.4 Manufacturer:
Russell #321-713/BCH
Or approved equal.

.6 Fixture R

.1 Wall mounted outdoor fixture with black finish.

.2 193mm in diameter and 254mm in height. 1 x 60 watts medium base lamps.

.3 Manufacturer:
Russell #799-601/BLK
Or approved equal.

.7 Fixture S

.1 Recessed LED downlight suitable for mounting in drywall ceilings, 6-inch aperture, clear specular reflector and white painted trim, medium beam reflector.

.2 Recess depth of 200mm.

.3 Lamp assembly complete with die-cast aluminum heat sink, fixed LED module, 20-watt, 1100 delivered lumens, 3500^{O}K, CRI of 80, 120-volt electronic driver, dimmable to 10%.

.4 Manufacturer:
Canlyte 'Lightolier' #C6L1520DL30KMCLW/C6L20N1 series
Cooper Lighting 'Portfolio' #LD620-ERM6 series
Lithonia Gotham #ECSR series
Or approved equal.

.5 LED Replacement Lamps:

.6 Medium base

.7 Rated average life: 25000 hours

.8 Color Temperature 2700k and CRI of 80+

.9 800 minimum lumen output

2.7 ADDITIONAL MATERIALS

.1 In addition to the materials specified and the quantity of materials as determined on the plans, provide for the supply and installation of the following additional materials, which shall be turned over to the owner if not installed during construction:

.1 Lamps:

.1 28 watt T5 Fluorescent Lamps: 30 lamps

.2 13 watt medium base LED lamps

.2 Ballasts:

.1 Instant Start Electronic ballasts for T5 lamps, 120 volt: 3 x ballasts

.3 Fixtures:

.1 Fixture type 'BB' : 2 x additional fixtures

.2 Fixture type 'CC': 5 x additional fixtures

.3 Fixture type 'DD' : 2 x additional fixtures

.4 Fixture type 'F' : 2 x additional fixtures

Part 3 Execution

3.1 INSTALLATION

.1 The contractor under this Division shall be responsible for expediting the delivery and installation of the fixtures to suite the construction schedule and the work of other trades.

.2 Remove packing material and debris from the job site immediately after installation of fixtures and lamps. Debris shall not be allowed to accumulate more than a reasonable amount.

.3 Industrial fixtures where suspended shall have 12 mm conduit hangers and ball aligners, the length and location shall clear equipment ducts and pipes.

.4 Lighting fixture diffusers are not to be installed until the area is completely finished in order to minimize the amount of dirt collection on these units.

.5 Exit signs shall be wired in a separate conduit system.

.6 Conduit installation shall conform to the specifications.

.7 Emergency battery lighting units shall be connected to the room's 120-volt lighting circuit, non-switched leg.

3.2 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

3.3 WIRING

.1 Each fixture shall be fed with a separate flex or AC-90 drop. Looping between fixtures or wiring rows through ballast channel will not be accepted.

3.4 LUMINAIRE SUPPORTS

.1 Lighting fixtures shall be supported independent of plasterboard or acoustic tile. Support from structural members of the building or ceiling.

.2 Fixtures installed in exposed ceilings may require plywood backing behind the acoustical panels. Confirm support requirements with manufacturer.

3.5 LUMINAIRE ALIGNMENT

.1 Luminaires shown in continuous lines or rows shall be carefully aligned so that all rows appear as straight lines.

.2 Fixtures shall be installed accurately in line and level. Any fixtures which are not installed properly shall be taken down and re-installed at no change to the contract sum. Plaster frames

and rings required for recessed fixtures shall be supplied under this section, and installed under the lathing and plaster or acoustic ceiling divisions. The work of the electrical division shall include the necessary co-ordination with the above divisions in regard to the correct location and installation of the plaster frame and rings.

3.6 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

3.7 VERIFICATION

.1 Perform tests in accordance with:

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

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.8 TRAINING

.1 Perform training in accordance with:

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

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 CSA C22.2 No. 141, Unit Equipment for Emergency Lighting

.3 National Building Code 2010 (NBC 2010)

.4 National Fire Code 2010

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Shop drawings for each fixture shall include but not be limited to, lamps, ballasts, fixture cuts, custom colors, and special mounting details. All pertinent information for each fixture shall be stapled separately from other fixtures.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance information

.1 Section 01 78 00 - Closeout Submittals

.2 Include:

.1 Operation instructions

.2 Description of system operation

.3 Description of each subsystem operation

.4 List specifying each piece of equipment in system or subsystem by its original manufacturer name and model number.

.5 Parts list specifying parts used in equipment by identification numbers that are standard to electronic industry.

1.6 WARRANTY

.1 The warranty period for the supply and installation of emergency battery units and remote emergency lighting fixtures shall commence on the date of substantial completion regardless of the manufacturer's specific warranty disclaimers with respect to date of shipment or date of installation of the equipment. The warranty period from date of substantial completion is one full year.

.2 Provide a full replacement warranty of the emergency lighting equipment free of defects in material and workmanship for a period of (1) one year from date of substantial completion. In addition to this requirement:

.1 Batteries shall include a pro-rated warranty for a minimum (5) five years shall commence the date the full warranty period ends.

.2 Integral and remote MR16 LED lamps shall have a (5) year warranty from date of substantial completion.

.3 A battery determined to be defective during the pro-rated warranty period shall be repaired or replaced at a cost equal to the net price in effect at the time, reduced by the percentage obtained in multiplying 10% by the number of full years remaining in the total warranty period. Such repair or replacement at this adjusted price shall be the purchaser's exclusive remedy.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No. 141.

.2 Supply voltage: 120 V, ac.

.3 Output voltage: 12 V, dc.

.4 Operating time: 60 minutes

.5 Battery: sealed long-life, maintenance free lead acid battery with 10-year life expectancy.

.6 Charger: solid state, pulse type charger, current limited, temperature-compensated, short-circuit proof, reverse-polarity protected. Unit standard with electronic lockout and brownout circuits. Complete battery recharge in 24 hours.

.7 Solid state transfer circuit.

.8 Low voltage battery circuit protection to disconnect the battery form the fused output circuit at the end of discharge.

.9 Non-audible LED diagnostic display to identify source of failure: battery, charger circuitry or lamps.

.10 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.11 Automatic self-test system: 1 minute every 30 days; 10 minutes on the 6th month and 30 minutes every 12 months.

.12 Lamp heads: Integral to battery unit unless otherwise noted, 345° horizontal and 180° vertical adjustment without need for tools to adjust aim. Lamp type: 6 watt 12-volt MR16 LED.

.13 Emergency lighting units and remote fixtures shall be as specified in the following schedule, and the manufacturer's numbers shown shall not reduce or amend the requirements as outlined under the description of each fixture type.

Fixture type 'E-MA': Emergency lighting battery contained unit with two integral lighting heads equipped with 2 x 6 watt, 12-volt MR16 LED lamps. The emergency battery unit shall have a minimum **108 watt** capacity for 30 minutes (63 watt capacity for 60 minutes). Fully gasketed cast aluminum back plate in white finish with clear polycarbonate cover, NEMA 4X certified. Equipped with tamper-proof screws.
Beghelli – Bravado BRV series
Emergi-Lite - #Survive-All NXM series
Lumacell #RG-NX series
Ready-Lite - #LDX-NM series

Fixture type 'E-MB': Emergency lighting battery contained unit with two integral lighting heads, 6 watt, 12-volt MR16 LED lamps. The emergency battery unit shall have minimum 144 watt capacity for 30 minutes (84 watt capacity for 60 minutes). Steel cabinet with removable front cover, equipped with test switch and LED indicator lights.
Beghelli – Nova NV series
Emergi-Lite – ESL series
Lumacell – RGS series
Ready-Lite – LDX series

Fixture type 'E-MC': Emergency lighting central battery unit with no integral heads. The battery unit shall have a minimum 144 watt capacity for 30 minutes (84 watt capacity for 60 minutes) to operate remote emergency lighting fixtures and DC terminal connection to exit signs. Steel cabinet with removable front cover, equipped with test switch and LED indicator lights.
Beghelli – Nova NV series
Emergi-Lite – ESL series
Lumacell – RGS series
Ready-Lite – LDX series

Fixture type 'E-R2' – Emergency remote light fixture powered from fixture type 'E-MA', 'E-MB' or 'E-MC' battery units as indicated, 2 x 6 watt 12-volt MR16 LED lamps, fully gasketed cast aluminium back plate in white finish, clear polycarbonate cover, NEMA 4X certified. Equipped with tamper-proof screws.
Beghelli – Bravado BRV-R series

Emergi-Lite – EF40 series
Lumacell – MQMP-NX series
Ready-Lite – TUF NM series

2.2 ADDITIONAL MATERIALS

.1 In addition to the materials specified and the quantity of materials as determined on the plans, provide for the supply and installation of the following additional materials, which shall be turned over to the owner if not installed during construction:

Fixture type 'E-R2': 3 fixtures

.2 For each spare emergency light fixture listed, include in the base pricing the supply and installation of 2 # 10 RW90 and insulated ground in 10 meter length of 16mm conduit (including fittings).

Part 3 Execution

3.1 INSTALLATION

.1 The contractor under this Division shall be responsible for expediting the delivery and installation of the fixtures to suite the construction schedule and the work of other trades.

.2 Batteries for lighting units if placed in storage prior to installation shall be placed in an environment protected from cold and extreme heat. Store batteries in accordance with the manufacturer's recommendations. Batteries shall have a maximum storage life (shelf life) of 6 months. Batteries must be recharged or placed in service within the 6 months of storage life.

.3 Remove packing material and debris from the job site immediately after installation of fixtures and lamps. Debris shall not be allowed to accumulate more than a reasonable amount.

.4 Lighting fixtures installed in any area that is not completely finished shall be cleaned at the end of the construction.

.5 Emergency battery lighting units shall be direct connected to the room's 120-volt light circuit (non-switched leg). Branch circuit as indicated on the drawings.

.6 Battery units shall be labeled with identification numbers to match the owner's existing numbering system. Contractor shall coordinate with the owner.

.7 Mounting heights: The minimum mounting height of emergency lighting battery units and remote emergency light fixtures shall be as noted herein, unless otherwise noted on drawings:

.1 Emergency battery units: 2100mm above finished floor.

.2 Emergency remote fixtures: Ceiling mounted or wall mounted as indicated on the floor plans. Wall mounted fixtures shall be a minimum 2100mm above finished.

.8 Lighting heads shall be adjusted on site to provide optimum lighting within the area with an emphasis directed at illuminating means of egress towards the exits.

3.2 WIRING

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

.2 Conductors: In accordance with Section 26 05 21 – Wires and Cables 0 – 1000 V

.1 In accordance with Section 26 05 21 – Wires and Cables 0 – 1000 V

.2 Minimum #12 AWG Copper up to maximum 5% voltage drop.

.3 Each fixture shall be fed with a separate flex or AC-90 drop.

.4 Providing wiring from the battery unit emergency dc circuit to the exit sign DC terminal block.

3.3 LUMINAIRE SUPPORTS

.1 Lighting fixtures shall be supported independent of plasterboard or acoustic tile. Support from structural members of the building or ceiling.

.2 Fixtures installed in exposed ceilings may require plywood backing behind the acoustical panels. Confirm support requirements with manufacturer.

3.4 LUMINAIRE ALIGNMENT

.1 Fixtures shall be installed accurately in line and level. Any fixtures which are not installed properly shall be taken down and re-installed at no change to the contract sum.

3.5 VERIFICATION

.1 Perform tests in accordance with:

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

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.6 TRAINING

.1 Perform training in accordance with section 26 05 01 - Common Works Results – Electrical.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

.2 National Building Code 2010 (NBC 2010)

.3 National Fire Protection Association (NFPA)

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Shop drawings for each fixture shall include but not be limited to, lamps, ballasts, fixture cuts, custom colors, and special mounting details. All pertinent information for each fixture shall be stapled separately from other fixtures.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

Part 2 Products

2.1 STANDARD UNITS

.1 Exit signs: NBC 2010 compliant. NRCAN/CSA C860 compliant. CSA C22.2 No.141 for self-powered exit signs.

.2 Exit light fixtures shall have the following:

- .1 LED (Lighting Emitting Diodes), high output or ultra-bright LED's.
- .2 Solid state design.
- .3 Voltage: Universal input voltage of **120**, 277 or 347 volt ac.
- .4 Power consumption: Maximum 2 watts single or double face.
- .5 Aluminum housing in white finish.
- .6 Acrylic barrier
- .7 Three green 'RUNNING MAN' pictogram for direction selection (straight, left and right).
- .8 Universal mounting: ceiling, wall or end wall mounting.
- .9 DC terminal block.

.3 Exit signs shall be one of the following manufacturers:

AimLite 'RPALW' series
Beghelli 'Quandra' #RM series
Emergi-Lite #EA series
Lumacell #
Ready-Lite 'RA' Series,
Beghelli 'Quadra' #RM series

2.2 Fixture Type 'X1'

Exit sign, ceiling mounted, single face, direction indicators as shown on drawings.

2.3 Fixture Type 'X2'

Exit sign, ceiling mounted, double face, direction indicators as shown on drawings.

2.4 Fixture Type 'X3'

Exit sign, surface wall mounted, single face, bottom of fixture mounted 100mm above door, direction indicators as shown on drawings.

2.5 ADDITIONAL MATERIALS

.1 In addition to the materials specified and the quantity of materials as determined on the plans, supply and install the following additional exit sign fixtures:

Fixture type 'X1': 2 exit sign fixtures
Fixture type 'X3': 2 exit sign fixtures

.2 For each additional exit sign fixture listed, include supply and installation conduit/wire for connection of the additional exit fixtures:

.1 120 Volt AC: 10 meters of 2 # 12 RW90 plus insulated ground wire in 10 meters of 16mm conduit per fixture

.2 12 Volt DC: 10 meters of 2 # 10 RW90 in 10 meters of 16mm conduit per fixture.

.3 Location of the additional exit sign fixtures to be confirmed on site with the Consultant.

Part 3 Execution

3.1 INSTALLATION

.1 The contractor under this Division shall be responsible for expediting the delivery and installation of the exit fixtures to suit the construction schedule and work of other trades.

.2 Install exit signs so as to be visible from the exit approach.

.3 Exit signs shall be wired in a separate conduit system.

.4 Interconnect exit fixtures to the emergency lighting battery unit emergency dc circuit.

.5 Ensure the exit sign circuit breaker is locked in the 'ON' position.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

3.3 VERIFICATION

.1 Perform tests in accordance with:

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

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

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

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

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

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.2 Canadian Standards Association, (CSA International)

.1 CSA-T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568A with modifications).

.2 CSA-C22.2 No. 214, Communications Cables (Bi-national Standard, with UL 444).

.3 CAN/CSA-C22.2 No. 182.4, Plugs, Receptacles, and Connectors for Communication Systems.

.3 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.8 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

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.9 TIA/EIA T568-A UTP wiring/pinout

.4 The structured communication wiring system shall comply with Treasury Boards Information Technology Standard for wiring as described in the TBITS 6.9 document. TBITS 6.9 – Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings – Technical Specifications) shall be as per Information and Technology Standards:

http://www.tbs-sct.gc.ca/it-ti/itp-pti/its-nit-eng.asp

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 SYSTEM DESCRIPTION

.1 The data and voice cable installation, shall include all cable, connectors, patch panels, patch cords, racks, BIX blocks, etc., as specified and shown on the drawings

.2 The cabling system shall meet or exceed the minimum characteristics as outlined TIA Standards Category 6A. In addition, the testing method and parameters shall be as per the TIA recommendations.

.3 The cabling installer shall be a Belden Certified System Vender installing Belden components. Once completed, the installation must be a Belden Certified System. The data system and components shall be guaranteed for a period of twenty (20) years from the date of installation against defects in materials and workmanship.

1.6 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results, Electrical.

.2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, cabling, hardware and components, patch cords, tester information, and labeling.

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.3 Submit manufacturer's certification documentation that guarantees installation techniques, cable and cabling components and carry a minimum 20 year certification from the manufacturer for the capability to support gigabit applications such as 1000 Base-T, 622MB/s and 2.4 Gb/s ATM and work case channel performance based on the values indicated. The term channel performance incorporates manufacturer certified patch cords.

.4 Upon request and at no cost, the contractor shall provide a manufacturer's technical representative to conduct an onsite visit to ensure complete technical compliance.

.5 The manufacturer's certification must guarantee that design or installation negligence on the part of the certified contractor will not negate or void any portion of the certified system. The manufacturer must guarantee that all material, components and labour are covered for the full certification period. It must also guarantee that in the event a contractor is no longer in business, the full certification remains valid.

1.7 CONTRACTOR QUALIFICATIONS

.1 The Installer (Firm and Employees) conducting the installation shall have full working knowledge of cabling low voltage applications such as, but not limited to data/voice communications cabling systems. The Installer shall have at least five years of continuous recent experience on similar projects. The Installer shall hold recent, up-to-date licenses, certifications and training certificates in the area the project is located and for the equipment to be installed. The Installer shall:

.1 Provide references of the type of installation provided for this specification;

.2 Be a Belden Certified System Vendor.

.3 Have a knowledge of all applicable Telecommunication standards such as but not limited to CSA, TIA/EIA, IEEEE and ANSI;

.4 Have a experience in the installation of pathways and support for horizontal and backbone cabling;

.5 Be experienced in the installation and testing of telecommunication network cabling system, including the use of light meter and OTDR.

.6 Provide proof of being a manufacturer certified installer for all cable network components being installed such as but not limited to cables, connectors and end termination equipment. The use of non-manufacture certified installer is not permitted.

1.8 PROJECT CLOSEOUT

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures and 26 05 01 – Common Work Results, Electrical.

.2 Operating and Maintenance Manuals at project closeout shall include

.1 List of cables, hardware and components;

.2 Copies of approved shop drawings;

.3 Record drawings.

.4 Warranty certification from the Manufacturer

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.5 Receipts that include the listing of spare parts, materials and supplies, including patch cables and equipment cords.

.6 Test and verification reports (may be submitted on CD Disk inserted in an appropriate envelope page in the manual).

Part 2 Products

2.1 COMMUNICATION CABLES, PATHWAYS AND TERMINATION BLOCKS

.1 Refer to Section 27 05 14 - Communication Cables Inside Buildings

.2 Refer to Section 27 05 28 – Pathways for Communications Systems

.3 Refer to Section 27 11 19 – Communications Termination Blocks

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 The communications cabling system and testing shall comply with the following standards. All standards shall be as per the latest revision at the time of tendering this project.

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision

.2 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.3 TIA/EIA T568-A UTP wiring/pinout

.4 BICSI, TDMM Telecommunications Distribution Methods Manual (latest edition)

.5 CAN/CSA-T529-M91

.6 CAN/CSA-T530-M90

.7 CAN/CSA-T527-94, EIA/TIA-607

.8 CAN/CSA-T528-93, EIA/TIA-606

.9 EIA/TIA-TSB 40-A

.10 EIA/TIA-TSB 67

.11 EIA/TIA-569

.12 EIA/TIA-606

.3 The total installation shall be completed by the cable Installer who is certified by the manufacturer for Category 6A cable installations. The Installer shall submit photocopies of accreditation certificates with the shop drawings. Submit testing method and tester with shop drawings.

.4 The contractor shall submit the verified test result on each cable, connector, and connection for the total installation, including back-bone and horizontal cabling. The model number and manufacturer of the Category 6A cable shall be documented. The type of tester used for testing the Category 6A cabling must also be documented.

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.5 Test results shall be evaluated by the test equipment using the most up-to-date criteria from the TIA/EIA Standard. This information shall be supplied in electronic format.

.1 Room number of installation

.2 Wall plate ID

.3 Test Results with an identification of type of test used and whether the result was PASS or FAIL

.6 Category 6A cable tests shall provide results for the following tests:

.1 Near End Crosstalk (NEXT)

.2 Attenuation

.3 Ambient Noise

.4 Attenuation to Crosstalk Ration (ACR)

.5 Far End Crosstalk (FEXT)

.7 Provide with maintenance manuals, a marked set of prints illustrating the network drop name for each drop location. No other as-built information shall be provided on these prints unless it relates to the data or voice network.

.8 The consultant will spot test this testing following test completion. Contractor shall provide the testing technician for (2) hours, and the completed test charts, for spot check verifications.

3.2 GROUNDING AND BONDING FOR COMMUNICATION SYSTEM

.1 Bonding Backbone shall consist of green jacketed stranded copper conductors and insulated ground bars.

.2 Install a #6 AWG insulated ground connection directly to each equipment rack in LAN Rooms. Each ground connection shall be terminated at the existing building ground system.

.3 Bus bars shall be an insulated pre-drilled, electro tin plated copper busbar, minimum 6mm thigh x 100mm wide x 305mm long (or length that is determined by the number of required connections including space for additional bond connections). Mount up 300mm above finished floor near the equipment rack location.

.4 Aluminum wires, clamps or terminal connectors will not be accepted for grounding and bonding.

.5 Terminations to the telecommunication ground bus bars shall be installed without splices where possible. If splices are necessary, they shall be as few as possible. Use irreversible compression-type connectors, exothermic welding, or equivalent. The connection to the ground bus bar shall be done using 2-hole compression connectors.

3.3 WARRANTY

.1 Testing and certification of the building network distribution cable installation shall be by the Installer and shall include the provision of a full Manufacturer's and Vendor's Warranty covering performance, products and installation. The Warranties shall cover the full repair and/or replacement of any component failing or failure to meet the design requirements within

one (1) year. Warranties shall be delivered to the Project Manager with the Testing and Certification documentation.

.2 Within ten (10) days after testing, the Installer shall submit the cable test results, and a marked up record drawing(s) of the as-built cable network. The record drawing(s) shall include the cable/jack identification at the outlet locations.

.3 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.4 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts

3.4 VERIFICATION

.1 Perform tests in accordance with:

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

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.5 TRAINING

.1 Perform training in accordance with:

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

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

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

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 National Fire Protection Association (NFPA)

.6 Institute of Electrical and Electronic Engineers (IEEE).

.7 Audio Engineering Society (AES).

.8 Other Applicable CSA and UL approvals.

.2 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.8 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.9 TIA/EIA T568-A UTP wiring/pinout

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

□

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 SYSTEM DESCRIPTION

.1 The data and voice cable installation, shall include all cable, connectors, patch panels, patch cords, racks, bix blocks, etc., as specified and shown on drawings.

.2 The cabling system shall meet or exceed the minimum characteristics as outlined TIA Standards Category 6A. In addition, the testing method and parameters shall be as per the TIA recommendations and meet requirements for testing Category 6A installations.

.3 The cabling system shall use matched components from a single manufacturer certified to deliver system performance over the lifetime of the applications which the cabling system was originally designed to support. The data system and components to be certified by the manufacturer and shall be guaranteed for a period of twenty-five (25) years from the date of installation against defects in materials and workmanship. The manufacturer shall be Belden.

.4 Each cable shall be equipped with connectors on each end and connected to wall jacks or cable connectors. All field communications cabling to be terminated on patch panels located on the drawings.

.5 The data cabling channel shall not exceed four (4) connections and shall not exceed 90m.

Part 2 Products

2.1 HORIZONTAL COMMUNICATIONS BUILDING CABLE (CBC)

.1 All communication cable (data and voice) shall be unshielded twisted pair, Category 6A four (4) pair #23 AWG, CMP (FT6) rated and meet TIA/EIA/ANSI – 568-C.2, latest revision unless noted otherwise. Data and Voice cable shall be blue.

.2 Each cable shall be equipped with connectors on each end at the wall jacks and patch panels at the data equipment racks.

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.3 The data cabling channel shall not exceed four (4) connections and overall length shall not exceed 90m. The maximum distance shall include an allowance of 3 meters from the outlet to the workstation and 6 meters for patch cords.

.4 Data and Voice may be installed in a common box.

.5 A minimum of two (2) Category 6A UTP cables shall be installed at each workstation unless otherwise noted on the drawings.

2.2 NETWORK PATCH CORDS

.1 Pre-terminated, factory tested patch cords shall be of the same manufacturer as the installed system and shall be part of the certified system. Patch cables shall be labeled at both ends.

.2 Patch cords for data and voice cables shall have stranded conductors and meets the requirements of TIA/EIA 568B (latest revision). Patch cords shall meet Category 6A criteria when tested with the components of the system. Patch cords at workstations shall be Category 6A cable terminated with 8 pin modular male jacks, TIA T568A pinout.

.3 Provide two patch cords for each cable drop located on the plans.

.4 Provide cords in the following lengths: 50% (data total) shall be 1.2m length; 30% (data total) shall be 1.8m length; 20% (data total) shall be 2.1m length.

Part 3 Execution

3.1 INSTALLATION OF COMMUNICATION CABLES

.1 All cable shall be pulled using proper wire grips. Pulling force and bend radius shall not exceed manufacturer's specifications.

.2 Velcro straps shall be used in all locations, cable ties are unacceptable.

.3 Parts of cables not in cable management trays shall be strapped at least every 250mm along cable.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

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.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

.4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.3 VERIFICATION

.1 Perform tests in accordance with:

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

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer's best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

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

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

.1 The Electrical Contractor shall be bound by industry standards, as interpreted by the Consultant, whether or not specifically referenced in this document. Comply with Electrical Protection Act and rules and regulations made pursuant thereto, including the 2012 Canadian Electrical Code. Also, comply with applicable standards of the following:

.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.
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.7 Audio Engineering Society (AES).
.8 Other Applicable CSA and UL approvals.

.2 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;
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.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;
.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;
.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;
.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;
.8 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision
.9 TIA/EIA T568-A UTP wiring/pinout

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

□

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, outlets, coverplates, “water fall kits”, cable management.

1.4 PRODUCT APPROVALS

.1 Manufacturers’ and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.5 SYSTEM DESCRIPTION

.1 Telecommunications raceways system consists of outlet boxes, cover plates, cabinets, conduits, cable troughs, pull boxes, sleeves and caps, fish wires, service poles, service fittings, concrete encased ducts.

Part 2 Products

2.1 MATERIAL

.1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

.2 Cable troughs: type, in accordance with Section 26 05 36 - Cable Trays

.3 Junction boxes, in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets

2.2 OUTLET BOXES

.1 Outlet boxes shall be 100mm square boxes. Multiple boxes shall not be ganged unless noted otherwise.

.2 Wall plates for communication cable systems shall have integral self label. The wall plates must support up to four (4) network drops and be run in a minimum of **27mm** conduit to the nearest equipment rack or stub at the basket tray in the accessible ceiling. Provide blank filler plates for unused drops.

.3 Wall plates shall be modular and in ‘Keystone’ format opening to allow the possibility of changing connector types in the future without replacing the wall plate. Faceplates shall be

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equipped with small form factor terminating connectors to fit the individual outlet's requirements (RJ45 and or Dual LC and or CATV bulkheads).

.4 Wall plates shall be equipped with a minimum of four (4) angled keystone openings. The installer shall equip the wall plate with the required amount of blank inserts as required. The minimum standard of acceptance for wallplates are Corning WLL-PL-AP or Panduit NK4VSFWH.

.5 When the wall plates are equipped with fibre optic port, it must be placed in the bottom keystone port position. Install 'Keystone' fibre 'SC' adapter for frame-station connector.

2.3 CABLE MANAGEMENT

.1 Velcro ties shall be used. Each cable type shall be bundled separately; that is data bundle, voice bundle, and fibre bundle. Cable ties wraps are unacceptable.

Part 3 Execution

3.1 SECURITY

.1 All cabling shall be installed in conduit in areas deemed unsecured. Unsecured areas, unless otherwise noted include the following:

.1 Any area accessible by more than one tenant or the public.

.2 Any area where cabling crosses from one tenant space to another tenant space.

.2 No communication (data, voice or fibre) cabling shall share same raceway or junction boxes with any other pathway system.

3.2 INSTALLATION

.1 All horizontal cables shall be run in conduit. All raceways shall be grounded. All conduits shall have suitable bushings.

.2 Backbone/riser cables (fibre, copper) and horizontal cables shall be run in EMT conduit, minimum 27mm diameter unless otherwise noted on drawings. Maximum allowable percentage conduit fill shall not exceed 40%.

.3 EMT conduit shall be reamed and bushed at both ends and bonded to the distribution system. Rigid PVC or flexible metallic or PVC conduits are not acceptable.

.4 Inside radius bend in EMT conduit shall not be less than 6 times the internal diameter for conduit sizes up to 41mm inside diameter; 10 times the internal diameter for conduit sizes 53mm diameter and larger.

.5 Pull boxes shall be installed in conduit runs where the total number bends exceed 180 degrees; where the overall length of the conduit run is more than 30m, or if there is a reverse bend in the run.

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.6 Pull boxes shall be installed in the straight sections of the conduit run and shall not be used lieu of a bend. Corresponding ends of conduit shall be aligned with each other. Conduit fittings shall not be used in place of pull boxes or bends.

.7 Use of LL, LR and LL conduit fittings is not permitted.

.8 The use of J-Hooks, brackets, cable ties and other attachments to support cabling **is not** permitted. Meshed-basket Data Cable tray is required.

.9 In all wall outlet boxes, the contractor shall leave 400mm length of cable in each box.

.10 In all wall workstation drops, leave 300mm of cable slack before entering wall or workstation in suspended ceiling.

3.3 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

.4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.4 VERIFICATION

.1 Perform tests in accordance with:

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.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer's representative. The contractor shall also provide any required

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equipment such as ladders, scaffolding, etc.

3.5 TRAINING

.1 Perform training in accordance with:

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

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

□

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The General Conditions of Contract, Division 01 General Requirements and all Addenda thereto form an integral part of and must be read in conjunction with the requirements of this Section.

.2 Cooperate and coordinate with the requirements of other units of work specified in other Sections.

1.2 REFERENCES AND CODES

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.1 CSA C22.1-2012, Canadian Electrical Code, Part 1.

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

.3 National Electrical Manufacturers Association (NEMA).

.4 National Building Code 2010 (NBC 2010)

.5 Institute of Electrical and Electronic Engineers (IEEE).

.2 Canadian Standards Association (CSA) International

.1 CAN/CSA-C22.2 No.182.4, Plugs, Receptacles and Connectors for Communication Systems.

.2 CSA T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568a with modifications).

.3 Telecommunications Industry Association (TIA)

.1 TIA/EIA/ANSI – 568-B.1/2/3 latest revision Commercial Building Telecommunications Cabling Standards for Telecommunications Pathways and Spaces;

.2 TIA/EIA/ANSI – 515000 Generic Specification for Optical Fibre and Cable Splices

.3 TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises;

.4 TIA-568-C Series Commercial Building Telecommunications Cabling Standard;

.5 TIA/EIA-569 Commercial Building Standard for Telecommunications Pathway and Spaces;

.6 TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building;

.7 TIA/EIA-607-A Commercial Building Ground (Earthing) and Bonding Requirements for Telecommunications;

.8 Category 6A system and testing as released by TIA/EIA/ANSI – latest revision

.9 TIA/EIA T568-A UTP wiring/pinout

.4 Other Applicable CSA and UL approvals.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with:

.1 Section 01 33 00 - Submittal Procedures

.2 Section 26 05 01 – Common Work Results

.2 Submit shop drawings for review prior to ordering equipment. Shop drawings shall include but not be limited to, photocopies of accredited installers, copper patch panels, copper termination jacks, coax jacks, communication racks, cable management, and sample labeling.

1.4 PRODUCT APPROVALS

.1 Manufacturers' and model numbers named in these specifications indicate an acceptable technical standard of performance and are not intended to be exclusive. Products submitted as alternates must result in a control system that meets or exceeds all technical performance criteria as described.

.2 Products proposed as alternatives to those specified, shall only be considered if submitted for approval no later than 15 working days before tender close. Submit alternates, for approval, as one complete listing. Provide complete product specification sheets with request for approval.

.3 The Bidder must provide a complete list of primary system products offered with their bid.

1.7 SYSTEM DESCRIPTION

.1 Termination, patch cords, and cross-connection equipment installed inside building for voice and data for telecommunications systems employing unshielded-twisted-pair (UTP), coaxial (CXC) cables. Refer to drawings for special details.

Part 2 Products

2.1 PATCH PANELS, CONNECTORS AND ADAPTORS

.1 Data and voice patch panels shall be 24 or 48-port panels mounted in the communication equipment racks, as indicated in rack diagrams. A minimum of 12 ports shall be spare for future. Patch panels shall be compatible with Category 6A installations, and shall accept snap-in non keyed modular 8-pin jacks with T568-A pinout.

.2 Connectors shall be modular 8 PIN jacks, rated Category 6A – TIA/EIA T568-A UTP wiring/pinout. All jacks shall be blue. All ESS network jacks shall be green.

2.2 NETWORK COMMUNICATION RACKS

.1 Contractor to supply rack as specified.

.2 Communication equipment racks shall be 2 post style free standing with floor mounting kit, 2108mm (83 inch) high x 546mm (21.5-inch) wide x 381mm (15-inch) deep providing 44U rack units. The equipment rack shall be in black finish. Racks shall be RF MOTE Ltd Series RFM-1944-RB-TBS or approved equal.

.3 Racks shall be equipped with 19" mounting rails and full length vertical management trough.

.4 Provide a 1U cable management between each patch panel.

.5 Racks shall have a minimum clearance as follows: front – 914mm, rear – 1067mm, one side – 762mm. Refer to drawings

.6 Provide two (2) 6-outlet power bars per rack with 12-foot shielded cord set, integral on/off switch, 15-amp breaker reset, EMI/RFI filtering and surge protection. Mounting within the equipment rack at the base, facing the rear.

.7 All racks shall be grounded with a minimum #6 AWG insulated ground wire connected to the building ground bus within the data/com room.

.8 Provide electrical circuits installed into each rack as follows:

.1 2 x 120V 20A

.9 Provide cable tray and "waterfall" kit above each equipment rack.

Part 3 Execution

3.1 LABELLING

.1 Cable labels shall be self laminating labels as manufactured by Burndy or Panduit.

.2 Bix Blocks, patch panels, and wall plates shall have integral labeling; self-adhesive labels will not be acceptable. Wall plates shall have self-adhesive icons adjacent to each jack of either a telephone or workstation to illustrate type of jack.

.3 Cable labels shall be self laminating labels as manufactured by Burndy or Panduit.

.4 Labeling shall be neatly typewritten and be in accordance with TIA 660. Cabling shall be labeled with the drop ID number at both termination points. Cable labeling shall be a logical numbering system. Confirm if owner has special labeling system prior to installation. If owner has no set labeling system, confirm contractor suggested labeling with owner or consultant prior to any installation. The owner or consultant must sign off on labeling prior to installation; this sign-off shall be included in the maintenance manuals.

.5 Bix Blocks, Patch panels, and wall plates shall have integral labeling; self-adhesive labels will not be acceptable. Wall plates shall have self-adhesive numbering label adjacent to each jack jack.

3.2 WARRANTY

.1 The contractor must make available to the Owner a local service department of a duly authorized distributor of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repair technician available to the Owner on 24 hours' notice.

.2 Provide warranty of installation of equipment installed by this contractor to be free of defects

for a period of (1) one year from date of Substantial Completion.

.3 Provide during the warranty period, all service, maintenance, parts, etc., required for normal operation of the systems, such that Owner needs not purchase additional maintenance agreement or contracts. Upon request, the manufacturer and his agent shall provide direct to the Owner the following proposals:

.1 Continuation, after the warranty period, of full maintenance, including all service, labour, parts, etc. required to maintain the systems in a fully operational condition.

.4 During the warranty period, provide three (3) separate site visits of four (4) hours each on site for owner revisions and additional training.

3.3 VERIFICATION

.1 Perform tests in accordance with:

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

.2 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check and test the entire system. Certification of all tests shall be submitted in writing to the Consultant and shall certify the following:

.1 That the system is complete in accordance with this specification

.2 That the system is installed in accordance with the manufacturer’s best recommendations

.3 During the certification tests, the contractor shall provide one (1) electrician and (1) helper to assist the manufacturer’s representative. The contractor shall also provide any required equipment such as ladders, scaffolding, etc.

3.4 TRAINING

.1 Perform training in accordance with:

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

.2 Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 Wherever practical and reasonable, all cabinets and electrical boxes shall be installed in the locations shown on the attached floor plans.

.2 Drawings show conduit connection requirements. Actual conduit runs shall run parallel to building lines.

.3 Unless specified otherwise, all conduits shall be sized according to the number of cables in the run. Maximum conduit fill is 50%.

.4 Unless specified otherwise, all junction boxes (J1, J2, J3, etc.) shall be steel and sized according to the number of conduits they must accommodate.

.5 Backboard space below the splitter trough(s) is reserved for PTSS equipment, see A4 and A5 backboard descriptions.

.6 Unless noted otherwise, all cables pulled to an A4 or A5 backboard shall have no less than 6000mm of cable slack in the splitter trough.

.7 Unless noted otherwise, all cables pulled to a 'T' Type cabinet (T1, T2, T3, etc.) shall have no less than 1200mm of cable slack in the ‘T’ cabinet.

.8 Unless noted otherwise, all cables terminating in a device or outlet box shall have no less than 600mm of cable slack at the device/outlet box.

.9 All cables terminating in a cabinet, a splitter trough, a device box, a utility box or an outlet box shall be labelled.

.10 The contractor shall test all cables installed as part of this contract for opens, grounds and shorts. The contractor shall replace any cables found to be defective by the owner.

1.2 MATERIALS & PRODUCTS

.1 Conduit

.1 Unless specified otherwise, all conduits shall be EMT.

.2 Junction, Outlet and Pull Boxes

.1 Unless specified otherwise, all outlet, device and pull boxes shall be steel.

.3 Splitter Troughs

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.4 Ground Bar

.1 Hoffman ASG8

.5 Cable

.1 All telephone type (Cat3) cables shall be NORDX D-INSIDE CABLE, 24 AWG, CMR, Category 3 solid copper with a grey jacket (or equivalent).

.2 All Category 5e (Cat5e) cables shall be Provo 24104L5E (or equivalent).

.3 All Category 6 (Cat6) cables shall be Provo 24104L6 (or equivalent).

.4 All LVT cables shall be four (4) conductor #18 solid AWG Standard Control LVT cable.

.5 All coaxial cable shall be Provo 5911 (or equivalent).

.6 All siamese cable shall be Provo 5934A (or equivalent).

.7 All single pair shielded cable shall be Provo 7722 cable (or equivalent).

.8 All 8 conductor overall shielded cable shall be Provo 6708 cable (or equivalent).

.9 All 12 conductor overall shielded cable shall be Provo 6712 cable (or equivalent).

.10 All two pair shielded cable shall be Provo 5402 (or equivalent).

.6 Pull Cord/Tape

.1 Polypropylene type, 200 lb tensile strength minimum.

Part 2 EXECUTION

.1 A4 Backboard

.1 Supply and install 19mm G1S plywood backboard to cover all of the appropriate wall in Room 143 floor to ceiling (as per floor plans).

.2 Plywood backboard to be primed and painted to match adjacent walls.

.3 Supply and install one Hoffman AST4223R 1219W X 210H X 114Dmm Splitter Trough.

.4 Supply and install a Hoffman ASG8 Ground Bar near, but not inside, the splitter trough. Bond to main building ground with a #6 AWG stranded, bare copper conductor.

.5 Supply and install one recessed duplex 120VAC receptacle in the center of the backboard and 2100mm AFF:

.6 Do not run 120VAC inside the splitter trough.

.7 This duplex receptacle shall be wired to a separate 120VAC circuit, on its own breaker, which is connected to emergency backup power (when available).

.8 Supply and install four structured wiring/data outlets mounted in the center of the backboard and 2100mm AFF.

.9 Provide structured cabling from the wiring/data outlets and terminate on a patch panel in the building’s Server/Router rack.

.10 Provide patch cords and cross connect from patch panel to available ports on a data switch.

.11 The plywood backboard space above/below the splitter trough is reserved for PTSS equipment. Do not run surface conduit in this area.

.2 **A5 Backboard**

.1 Supply and install 19mm G1S plywood backboard to cover all of the appropriate wall in Room 143 floor to ceiling (as per floor plans).

.2 Plywood backboard to be primed and painted to match adjacent walls.

.3 Supply and install one Hoffman AST4223R 1219W X 210H X 114Dmm Splitter Trough.

.4 Supply and install a Hoffman ASG8 Ground Bar near, but not inside, the splitter trough. Connect this ground bar to the ground bar on the A4 backboard.

.5 Supply and install one recessed duplex 120VAC receptacle in the bottom left hand corner of this backboard:

.6 Do not run 120VAC inside the splitter trough.

.7 This duplex receptacle shall be wired to a separate 120VAC circuit, on its own breaker, which is connected to emergency backup power (when available).

.8 Supply and install four structured wiring/data outlets on the south side of this backboard.

.9 Provide structured cabling from the wiring/data outlets and terminate on a patch panel in the building's Server/Router rack.

.10 Provide patch cords and cross connect from patch panel to available ports on a data switch.

.11 The plywood backboard space above/below the splitter trough is reserved for PTSS equipment. Do not run surface conduit in this area.

.3 **F1 Fire Alarm Connection**

.1 Supply and install conduit from the main fire alarm control panel to a junction box in the area.

.2 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from the main fire alarm control panel to the splitter trough on the A4 backboard.

.3 Leave 1200mm of cable slack inside the main fire alarm control panel.

.4 **J3 Junction Box (200H X 200W X 100D)**

.1 Supply and install one 200H X 200W X 100Dmm junction box 150mm above the suspended ceiling. If the ceiling is finished the junction box should be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Junction box must be accessible and serviceable.

.3 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area OR to the splitter trough on the A4 backboard.

.5 **J4 Junction Box**

.1 Supply and install one junction box above the suspended ceiling. If the ceiling is finished the junction box should be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F.. Junction box shall be sized according to the number of conduits that must be accommodated.

.2 Supply and install conduit, sized to fit cables, from this junction box to the splitter trough on the A5 backboard (as per floor plans).

.6 **J5 Junction Box**

.1 Supply and install one junction box above/below the floor of the cell block. Junction box shall be sized according to the number of conduits that must be accommodated.

.2 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area OR to the splitter trough on the A5 backboard (as per floor plan).

.7 **J6 Junction Box (450H X 450W X 150D)**

.1 Supply and install one 450H X 450W X 150Dmm junction box on the floor of the mechanical/service area above the monitoring console(s) in the Guardroom OR on the ceiling of the floor below the monitoring console(s) in the Guardroom.

.2 Supply and install four 38mm conduits from this junction box to the splitter trough on the A5 backboard in Room 143 (as per floor plan).

.8 **J7 Junction Box**

.1 Supply and install one junction box above the suspended ceiling. If the ceiling is finished the junction box should be recessed on a wall 100mm below finished ceiling but no higher than 2400mm A.F.F.. Junction box shall be sized according to the number of conduits that must be accommodated.

.2 Supply and install conduit, sized to fit cables, from this junction box to the T3 cabinet in Room 143.

.9 **J8 Junction Box (300H X 300W X 100D)**

.1 Supply and install one recessed 300H X 300W X 100Dmm Type 1 Telephone cabinet (BEL Products TCFKO12124) mounted 150mm above the suspended ceiling. If the ceiling is finished, the cabinet should be recessed on the wall 100mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit, sized to fit cables, from this junction box to another junction box in the area (as per floor plans).

.10 **T2 "T" Cabinet (300H X 300W X 100D)**

.1 Supply and install one 300H X 300W X 100Dmm Type 1 Telephone cabinet with wood back (BEL Products TCFKO12124WB or equivalent) mounted 150mm above the suspended ceiling on the protected side of the wall. If the

ceiling is finished, the cabinet should be recess mounted 225mm above the strike side of the frame on the protected side of the wall. See detail drawings E9 for Access Controlled doors. Cabinet must be accessible and serviceable.

.2 Supply and install conduit, sized to fit cables, from this cabinet to another T2 in the area OR to a J3 in the area OR to the splitter trough on the A4 backboard (as per floor plans).

.3 Supply, install and label one Provo 6708 cable (or equivalent) and one 4 conductor 18 AWG solid copper LVT cable in the conduit from the T2 cabinet to the splitter trough on the A4 backboard.

Note: Supply no less than 6000mm of cable slack at the A4 splitter trough.

.11 **T3 "T" Cabinet (450H X 450W X 100D)**

.1 Supply and install one surface mounted 450H X 450W X 100Dmm Type "T" cabinet, complete with 3/4" wood back, centered 300mm A.F.F..

.12 **T4 "T" Cabinet (450H X 450W X 100D)**

.1 Supply and install one 450H X 450W X 100Dmm Type 1 Telephone cabinet mounted 150mm A.F.F.. Surface mount the cabinet so that it remains accessible yet concealed by the Guard / Matron's console.

.2 Supply and install a duplex 120VAC receptacle in the top left corner inside this cabinet (mount receptacle on the side of the cabinet not the back). This duplex receptacle shall be wired to a separate 120VAC circuit, on its own breaker, which is connected to emergency backup power (when available).

.3 Supply and install two 32mm conduits from this cabinet to the J6 junction box.

.4 Supply, install and label five Provo 5911 co-ax video cables (or equivalent) in each conduit from this cabinet to the splitter trough on the A5 backboard (total of 10 cables from each T4).

.5 Supply, install and label two Category 5e (Cat5e) cables in each conduit from this cabinet to the splitter trough on the A5 backboard (total of 4 cables from each T4).

Note: Supply no less than 6000mm of cable slack at the T4 cabinet. Supply no less than 4500mm of cable slack at the A5 splitter trough.

.13 **T7 "T" Cabinet (450H X 300W X 100D)**

.1 Supply and install one recessed 450H X 300W X 100Dmm Type 1 Telephone cabinet, complete with 3/4" wood back (BEL Products TCFKO18124WB or equivalent) centered 2250mm A.F.F..

.2 Supply and install one duplex 120VAC receptacle in the top left corner inside this cabinet (mount receptacle on the side of the cabinet not the back). This duplex receptacle shall be wired to a separate 120VAC circuit, on its own breaker, which is connected to emergency backup power (when available).

.3 Supply, install and connect one 24VAC 75VA transformer and one RELECO C3-A30X/24VAC 3PDT relay (or equivalent) inside this cabinet.

.4 Connect Riot Alarm Panic pushbuttons (see device 53), Riot Alarm horns (see device 04) and the Riot Alarm RESET pushbutton (see device 73) to the 3PDT relay inside the T7 cabinet as per detail drawing E9 “SCHEMATIC - CELL BLOCK RIOT ALARM” and as per floor plans.

.5 Supply and install one 19mm conduit from the T7 cabinet to the splitter trough on the A4 backboard (as per floor plans).

.6 Supply, install and label three 4 pair telephone (Cat3) cable(s) in the conduit from the T7 cabinet to the splitter trough on the A4 backboard in Room 143.

.7 Test each Riot Alarm Panic pushbutton for proper operation. The panic pushbuttons latch the horn(s) and the Reset pushbutton silences the horn(s).

.14 **01 Device Box**

.1 Supply and install one recessed 76H X 100W X 63Dmm double gang device box c/w blank cover plate 150mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit from this device box to a device/junction box in the area (as per floor plans).

.3 Supply, install and label two 4 pair telephone (Cat3) cables in the conduit from this outlet box to the A4 backboard.

.15 **04 Riot Alarm Horn**

.1 Supply, install and connect one Edwards 874-G5 24VAC vibrating alarm horn (or equivalent) in a recessed 4" square outlet box mounted 100mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit from this outlet box to a Riot Alarm Reset Pushbutton outlet box in the area OR to the T7 cabinet (as per floor plan).

.3 Supply, install and label one 4 conductor 18 AWG solid copper LVT cable in the conduit from this outlet box to the T7 cabinet.

.4 Connect vibrating alarm horn to the 3PDT relay in the T7 cabinet as per detail drawing E9 “SCHEMATIC - CELL BLOCK RIOT ALARM”.

.16 **11 Square Outlet Box**

.1 Supply and have door-frame fabricator spot weld one 100H X 100W X 40Dmm square outlet box on top of the frame as per detail drawing E9 “PROTECTED DOOR - ELEVATION OF SINGLE DOOR WITH DOOR CONTACT”.

.2 Drill a 19mm hole 75mm (center point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.

.3 Supply and install conduit from the outlet box in the door frame to a 76H X 50W X 63Dmm single gang pull box mounted above the door on the protected side of the wall. This pull box shall have a blank cover plate installed and shall be mounted above the suspended ceiling OR 100mm below the ceiling if the ceiling is finished.

.4 Supply and install conduit from the pull box to a device/junction box in the area (as per floor plans).

.5 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame to the splitter trough on the A4 backboard.

.6 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

.17 **12 Square Outlet Box**

.1 Supply and have door-frame fabricator spot weld one 100H X 100W X 40Dmm square outlet box on top of the door frame as per detail drawing(s) E9 for access controlled doors.

.2 Drill a 19mm hole 75mm (center point) from the edge of the door casing to allow for door switch installation and access to frame mounted outlet box.

.3 Supply and install conduit from the outlet box in the door frame to a T2 cabinet in the area (as per floor plan).

.4 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from the outlet box in the door frame to the T2 cabinet.

.5 The cable slack at the outlet box in the door frame shall be tucked into the outlet box to protect the cable from damage.

.18 **21 Device Box**

.1 Supply and install one recessed 76H X 150W X 63Dmm three gang device box c/w blank cover plate centered 1500mm A.F.F..

.2 Supply and install conduit from this device box to a device/junction box in the area (as per floor plans).

.3 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from this device box to the splitter trough on the A4 backboard.

.19 **31 Conduit to Electric Strike**

.1 Supply and install conduit from a point 25mm above the strike plate inside the door frame to a T2 cabinet in the area (as per floor plans).

.2 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from the door frame to the T2 cabinet. Leave 600mm of slack inside the door frame.

Note: For more information, see detail drawing(s) E9 for access controlled doors.

.20 **41 Octagon Outlet Box**

.1 Supply and install one 4" octagon outlet box located no more than 300mm above the suspended ceiling. If the ceiling is finished, the outlet box should be recess mounted and supplied with a cover plate.

.2 Supply and install conduit from this outlet box to a device/junction box in the area (as per floor plans).

.3 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from this outlet box to the splitter trough on the A4 backboard.

Note: Supply no less than 3600mm of cable slack at the outlet box.

.21 **44 Device Box**

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate centered 100mm above the top of the door frame on the protected side of the wall as per detail drawing(s) E9 for access controlled doors.

.2 Supply and install conduit from this device box to a T2 cabinet in the area (as per floor plans).

.3 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from this device box to the T2 cabinet.

Note: For more information, see detail drawing(s) E9 for access controlled doors.

.22 **52 Device Box**

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate. Mount device box below the finished counter top in a location which is accessible. Installation on a wall behind a removable drawer or at the rear of installed millwork is acceptable.

.2 Supply and install conduit from this device box to a device/junction box in the area (as per floor plans).

.3 Supply, install and label one 4 pair telephone (Cat3) cable in the conduit from this device box to the splitter trough on the A4 backboard.

Note: Supply no less than 3600mm of cable slack at the device box.

.23 **53 Riot Alarm Panic Pushbutton**

.1 Supply, install and connect one red 57mm mushroom head “Square D” 9001KR25R momentary pushbutton with two “Square D” 9001KA2 normally open contact blocks and one “Square D” 9001K25 Flush Plate in a recessed 76H X 50W X 63Dmm single gang device box centered 1350mm A.F.F..

.2 Supply and install conduit from this device box to a device/junction box in the area OR to the T7 cabinet (as per floor plans).

.3 Supply, install and label one 4 conductor 18 AWG solid copper LVT cable in the conduit from this device box thru all junction/device boxes and terminate at the T7 cabinet.

.4 Connect the panic switch to the 3PDT relay in the T7 cabinet as per detail drawing E9 “SCHEMATIC - CELL BLOCK RIOT ALARM”.

.24 **61 Device Box**

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate centered 1300mm A.F.F..

.2 Supply and install conduit from this device box to a T2 cabinet in the area (as per floor plans).

.3 Supply, install and label one Provo 6708 cable (or equivalent) in the conduit from this device box to the T2 cabinet.

Note: For more information, see detail drawing(s) E9 for access control on doors with wall mounted readers.

.25 **73 Riot Alarm Reset Pushbutton**

.1 Supply, install and connect one green 57mm mushroom head “Square D” 9001KR25G momentary pushbutton with one “Square D” 9001KA3 normally closed contact block and one “Square D” 9001K25 Flush Plate in a recessed 76H X 50W X 63Dmm single gang device box centered 1500mm A.F.F..

.2 Supply and install conduit from this device box to the T7 cabinet (as per floor plans).

.3 Supply, install and label one 4 conductor 18 AWG solid copper LVT cable in the conduit from this device box to the T7 cabinet.

.4 Connect reset pushbutton to the 3PDT relay in the T7 cabinet as per detail drawing E9 “SCHEMATIC - CELL BLOCK RIOT ALARM”.

.5 Label pushbutton:

RIOT ALARM

RESET

.26 **81 Octagon Outlet Box (2-1/8" Deep)**

.1 Supply and install one recessed 4" octagon outlet box, 2-1/8" deep, c/w blank cover plate in the ceiling. If ceiling is suspended, the octagon outlet box shall be located 300mm above the suspended ceiling.

.2 Supply and install conduit from this outlet box to a device/junction box in the area OR to the A5 splitter trough (as per floor plans).

.3 Supply, install and label one Category 5e (Cat5e) cable in the conduit from the outlet box to the A5 splitter trough.

Note: Supply no less than 2400mm of cable slack at the outlet box. Supply no less than 4500mm of cable slack at the A5 splitter trough.

.27 **82 Octagon Outlet Box (2-1/8" Deep)**

.1 Supply and install one recessed 4" octagon outlet box, 2-1/8" deep, in a corner of the ceiling (as per floor plan). See detail drawing E9 titled DETAIL DRAWING CELL BLOCK CCVE - OCTAGON BOX FOR CORNER MOUNT DOME CAMERA for more information regarding exact location in the corner of the cell’s ceiling.

.2 Supply and install conduit from this outlet box to a device/junction box in the area OR to the A5 splitter trough (as per floor plans).

.3 Supply, install and label one Category 5e (Cat5e) cable in the conduit from the outlet box to the A5 splitter trough.

Note: Supply no less than 600mm of cable slack at the camera housing. Supply no less than 4500mm of cable slack at the A5 splitter trough.

.28 **83 Device Box**

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate. Mount device box 300mm below finished ceiling but no higher than 2400mm A.F.F..

.2 Supply and install conduit from this device box to a device/junction box in the area (as per floor plans).

.3 Supply, install and label one Category 5e (Cat5e) cable in the conduit from this outlet box to the A5 splitter trough.

Note: Supply no less than 1200mm of cable slack at the outlet box. Supply no less than 4500mm of cable slack at the A5 splitter trough.

.29 **84 Octagon Outlet Box (2-1/8" Deep)**

.1 Supply and install one recessed 4" octagon outlet box, 2-1/8" deep, c/w blank cover plate in the ceiling. If ceiling is suspended, the octagon outlet box shall be located 300mm above the suspended ceiling.

.2 Supply and install conduit from this outlet box to a J7 junction box in the area (as per floor plan).

.3 Supply, install and label one Provo 5911 co-ax video cable, one Category 5e (Cat5e) cable and one 4 conductor 18 AWG solid copper LVT cable in the conduit from this outlet box to the T3 cabinet in Room 143.

Note: Supply no less than 2400mm of cable slack at the outlet box. Supply no less than 6000mm of cable slack at the T3 Cabinet.

.30 **85 Octagon Outlet Box (2-1/8" Deep)**

.1 Supply and install one recessed 4" octagon outlet box, 2-1/8" deep, c/w blank cover plate in the ceiling. If ceiling is suspended, the octagon outlet box shall be located 300mm above the suspended ceiling.

.2 Supply and install conduit from this outlet box to a J8 junction box in the area (as per floor plan).

.3 Supply, install and label one Category 5e (Cat5e) cable in the conduit from this outlet box thru all junction boxes to the A5 splitter trough.

Note: Supply no less than 2400mm of cable slack at the outlet box. Supply no less than 4500mm of cable slack at the A5 splitter trough.

.31 **86 Junction Box**

.1 Supply and install one Hoffman A806CHNF 152W X 203H X 89Dmm Type 4 Junction Box. Mount 3000mm above concrete sidewalk or above ground level on the exterior side of the building.

.2 Supply and install conduit from this junction box to a device/junction box in the area OR to the A5 splitter trough (as per floor plans).

.3 Supply, install and label three Category 5e (Cat5e) cables in the conduit from this junction box to the A5 splitter trough.

.4 Note: Supply no less than 1200mm of cable slack at the junction box. Supply no less than 4500mm of cable slack at the A5 splitter trough.

.32 **91 Device Box**

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate centered 1400mm A.F.F..

.2 Supply and install conduit from this device box to a J7 junction box in the area (as per floor plan).

.3 Supply, install and label one Provo 7722 cable and one Category 5e (Cat5e) cable in the conduit from this device box to the T3 cabinet in Room 143.

Note: Supply no less than 6000mm of cable slack at the T3 cabinet.

.33 **92 Device Box**

.1 Supply and install one recessed 76H X 50W X 63Dmm single gang device box c/w blank cover plate centered 1400mm A.F.F..

.2 Supply and install conduit from this device box to a J8 junction box in the area (as per floor plan).

.3 Supply, install and label one Provo 7722 cable (or equivalent) in the conduit from this device box to the J8 junction box.

Note: Supply no less than 4500mm of cable slack at the J8 junction box.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 01 – Common Work Results – Electrical

1.2 REFERENCES AND CODES

.1 NBC-2010, National Building Code of Canada.

.2 All equipment shall be listed by Underwriters' Laboratory of Canada. The entire installation shall be in full compliance with the 2010 National Building Code, 2012 Canadian Electrical Code, National Standard of Canada/Underwriters' Laboratory of Canada Standards, and the Saskatchewan Human Rights Commission, Accessibility Standard.

.3 The system design, installation and verification, shall comply with the following National Standard of Canada/Underwriters' Laboratories of Canada Standards:

.1 CAN/ULC-S524-M06 "Standard for the Installation of Fire Alarm Systems".

.2 CAN/ULC-S536-M04 "Standard for the Inspection and Testing of Fire Alarm Systems".

.3 CAN/ULC-S537-M04 "Standard for the Verification of Fire Alarm System Installations".

1.3 DESCRIPTION OF SYSTEM

.1 Provision of a new non-coded, closed circuit, annunciated, single stage, addressable fire alarm system as shown on the drawings and as herein specified.

.2 The system design, installation and verification shall comply with the United States ADA Accessibility Guidelines.

.3 All fire alarm equipment shall be powered from a single source as shown on the drawings.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 01 – Common Work Results – Electrical.

.2 Shop drawings shall include but not be limited to complete floor plans, riser, equipment, control schematics and wiring diagrams. Each component shall be identified as to manufacture, type, description and catalogue number.

1.5 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into electrical maintenance and operating manual specified in Section 16050 – Basic Electrical Materials and Methods.

.2 Include:

.1 Overall system riser wiring diagram identifying control equipment, initiating addresses, signalling circuit; identifying terminations, terminal numbers, conductors and raceways.

.2 Details and performance specification of devices added for control, annunciation and peripherals with item by item cross reference to specification for compliance.

.3 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.

.4 Technical data - illustrated parts lists with parts catalogue numbers.

.5 Copy of approved shop drawings.

.6 List of recommended spare parts for system.

.7 Certification of tests, upon completion, shall be issued in writing to the Consultant by the manufacturer's representative.

.8 Certification shall include audibility test results of the fire alarm system measured within each room affected by the project as required by the National Building Code.

Part 2 Products

2.1 MATERIALS

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

.1 Control Panel
.2 Remote Annunciator Panel
.3 Remote Booster Power Supply Panels
.4 Manual Pull Stations
.5 Detectors
.6 Duct Detectors
.7 Remote Keyed Test Stations for Duct Detectors
.8 Monitor Modules
.9 Control Modules
.10 Fault Isolator Modules
.11 Audible/Visual Fire Alarm Signal Devices

.2 All products shall have been manufactured within at least one year prior to their installation. Products older than this criterion will be rejected. Provide supporting documents within the shop drawing submission.

.3 All devices shall be installed in outlets boxes.

.4 All wiring shall be run in conduit raceway.

.5 All equipment and devices shall be manufactured by **Edwards** or **Notifier (**Notifier supplied by Alsask Fire Equipment**).**

2.2 DESCRIPTION OF SYSTEM

.1 Provide a complete micro processor based, supervised, non-coded, closed circuit, annunciated, single stage and addressable fire alarm system as shown on the drawings and as herein specified.

.2 The system design, installation and verification shall comply with the United States ADA Accessibility Guidelines.

.3 Addressable fire alarm system includes:

.1 Control panel programming revisions to carry out fire alarm and protection functions including receiving alarm signals, initiating alarm, supervising system continuously, and initiating trouble signals.

.2 Trouble signal indication.

.3 Manual alarm stations.

.4 Automatic alarm initiating devices.

.5 Audible signal devices.

.6 Visual alarm signal devices.

.7 End-of-line devices

.8 Ancillary devices.

2.3 SYSTEM OPERATION

.1 Single stage addressable operation

.2 For control of initiating devices, the control panel shall have the following features:

.1 Capable of monitoring up to a minimum of two (2) addressable loops as identified on the drawings. All initiating circuits shall be Class 'B' type.

.2 Have the capacity to communicate with up to 125 intelligent addressable devices and 125 intelligent addressable modules including Fault Isolators on each initiating loop.

.3 Have capacity for number of signalling circuits as noted on the drawings. The control panel shall be equipped with all hardware and provisions the required number of signalling circuits.

.4 Interrogate each device, and interpret the response from each device, analyzing the response from each device according to specific address, type of device and its present status.

.5 Provide a numeric display which shall uniquely show the loop number, the device type and its specific address.

.6 Provide alarm confirmation by device. To avoid spurious nuisance alarms, the control panel will identify the device and location as well as noting its continuing alarm status thereby cause the control panel to initiate the required sequence.

.7 Detect and identify a loop short circuit, ground or open circuit.

.8 Through the use of fault isolator modules, immediately isolate the wiring fault so that as few as possible field devices are made inoperative with all other devices remaining fully operational.

.9 Through the use of signal isolator modules, immediately isolate the signal wiring fault so that as few as possible signal devices are made inoperative with all other signal devices remaining fully operational.

.10 Provide a day/night mode to enable a higher level of detector sensitivity (for example) during a buildings non-occupied time and a lower sensitivity during heavily occupied hours.

.3 If an alarm is caused by activation of any of the following devices:

.1 Pulling a manual station;

.2 Operation of an automatic fire alarm thermal detector;

.3 Operation of a smoke detector (ceiling or duct mounted); or

.4 Operation of a sprinkler flow valve

The following shall occur:

.1 The evacuation alarm shall sound on all audible signal appliances throughout the building. All strobe lights installed as visual alarms shall flash.

.2 The main control panel shall record the alarm location and address alarm type (pull station, smoke detector, thermal detector, etc.), location description along with time. The control panel and remote annunciator panel LCD shall indicate a priority alarm and will also advise of location, type and time.

.3 The evacuation alarm shall continue until the alarm is acknowledged and the system is silenced. The device causing the alarm shall cause the system to remain in alarm until the device is cleared or reset, and the system alarm is acknowledged.

.4 The system shall automatically send a signal to the fire department. The fire alarm system shall be interconnected to the new building security alarm panel, which provides a signal to the Owner's off-site central monitoring agency. The fire department connection to the security alarm panel shall be the responsibility of the Owner to maintain.

.5 The BMS shall receive contact closure from the fire alarm main control for an alarm condition. The BMS shall then control the ventilation system during these fire alarm conditions. The electrical contractor shall provide all required wiring connections to the BMS for fire alarm monitoring conditions. Final shutdown sequences of all ventilation systems shall be confirmed during final commissioning.

.6 The fire alarm system shall release all electromagnetic locks at egress doors by providing a fire alarm module to open the magnetic lock power circuit at the door location.

.7 A subsequent alarm from any receiving circuit (device) shall cause the audible signals to sound again. Subsequent alarms shall be recorded by the system in order of priority and then in the order in which they occur. Subsequent alarms may occur prior to acknowledgement of the initial alarm.

.8 All alarms shall be recorded by the main fire alarm panel.

.4 The entire system shall be electrically supervised against opens, shorts and grounds on any wire on the alarm initiating circuits or any wire on the signal circuits. Trouble conditions shall display as a lower priority than an alarm. Fault isolators shall be provided for all initiating circuits which pass through each floor and each fire barrier and shall be provided every twenty five (25) devices minimum.

.5 Coordinate with the Mechanical Contractor to ensure that all necessary wiring and controls have been provided to accommodate fire alarm interconnections with the sprinkler and mechanical control systems.

.6 Ensure that all necessary wiring and controls have been provided to accommodate fire alarm interconnections to shut down the make-up air, exhaust fans, central air conditioning units, and release of all door hold open devices. Provide separate fire alarm control modules for all mechanical shut down points and/or starters.

.7 There shall be a capability provided in the fire alarm control panel and remote annunciator panel that permits the operator to bypass or disable the shutdown of the mechanical ventilation system during testing of the fire alarm systems; for testing purposes only. The Electrical Contractor with the Mechanical Contractor shall confirm the ventilation units to be controlled on site the ventilation units to be bypassed during the testing. Activation of this bypass shall initiate a trouble condition on the fire alarm system.

.8 Sprinkler and fire hose cabinet shut-off valves equipped with tamper switches shall be connected to the fire alarm system and each assigned a separate address point. Tamper switches shall cause a trouble indication when the shut-off valve is closed or partially closed. Coordinate final location and quantity with the Sprinkler Contractor and Mechanical Contractor.

.9 Provide a control relay module at the door access control panel to release and reset all electric locks simultaneously.

.10 All new points shall be included into the computer software program, and the software program shall be regenerated twice. The first regeneration shall be provided during the completion of the fire alarm system. The second regeneration shall be provided approximately three months after the first regeneration and shall reflect any contract changes and any owner initiated changes.

.11 All new fire alarm equipment shall be powered from a single source as shown on the drawings.

2.4 REMOTE ANNUNCIATOR PANEL

.1 Remote Annunciator Panels: Intelligent annunciator panels shall be as located on the floor plans. The annunciator panels shall include the following features:

.1 80-character backlit LCD fire annunciator panel, compact design, semi-flush cabinet for mounting in new and existing partitions. Cabinet shall include hinged door with key lock.

.2 Power from the host control panel.

.3 Non-volatile memory.

.4 Mimic all display information on the host control panel.

.5 Keypad with audible feedback.

.6 LED indication for Power, Fire, Security Alarm, Supervisory, Trouble, Signals Silence, CPU Failure.

.7 Switches for Acknowledge, Signal Silence, System Reset, and Lamp Test.

.2 Provide a manually operated switch in the annunciator panel to bypass the shutdown of ventilation equipment during fire alarm testing purposes only. Activation of the bypass switch shall initiate a trouble condition on the fire alarm system.

.3 Provide a manually operated switch in the annunciator panel that will permit the resetting of the electromagnetic locks in the facility following the disabling of the locks upon activation of the fire alarm system.

2.5 DEVICES

.1 **Manual Pull Stations:** Manual fire alarm pull stations shall be addressable single-stage, pull lever, finished in red metal semi-flush mounting. Manual pull stations shall be mounted up 1350mm.

.2 **Detectors:** Provide multi-sensor low-profile intelligent analog detectors designed to increase immunity to false alarms. The detectors shall be microprocessor-based, combination photoelectric and thermal technology. The detector shall adjust its sensitivity automatically without needing operator intervention or control panel programming. The thermal sensing rating shall be fixed-temperature set point 135°F (57°C). Includes LED red indicator when in alarm; flashes green in standby for normal conditions. The device shall include LED red indicator flashes when in alarm, flashes green when polled in normal conditions.

.3 **Thermal Detectors:** Provide low-profile intelligent thermal detectors using thermistor sensing circuit to produce 135°F (57°C) fixed temperature. Includes LED red indicator when in alarm; flashes green in standby for normal conditions.

.4 Thermal detectors located in high ambient rooms such as Boiler Rooms, Generator Rooms, attic spaces, shall be fixed temperature, 200°F (93°C).

.5 **Duct Detectors:** Photoelectric type smoke detectors shall operate on the light scattering principle and be activated by smoke particles. Smoke duct detectors shall be plug-in base type equipped with sampling tubes and framework to support the sampling tubes. LED's shall be provided on the detector to indicate an alarm condition. Duct detectors shall be of the same manufacturer as the fire alarm system from which the device is connected.

.6 **Monitor and Control Relay Modules:** Provide addressable monitor and control relay modules to interface to conventional non-addressable devices. All modules shall be of the same manufacturer as the fire alarm system from which the devices are connected.

.1 Monitor modules shall be installed to supervise a circuit of dry-contact input devices, such as conventional thermal detectors and pull stations, or monitor and power a circuit of two-wire smoke detectors. Powered directly by the SLC loop, high-noise (EMF/RFI) immunity, LED flashes green for normal operation and latches on steady red to indicate alarm.

.2 Control modules provide the control panels a circuits for operating horns, strobes, speakers, etc., or to monitor a telephone circuit. Addressability allows the control module to be activated, either manually or through panel programming on a select zone or area of coverage. LED blinks green each time a communication is received from the control panel and turns on in steady red when activated.

.3 Relay modules provide the system with a dry-contact output for activating a variety of auxiliary devices, such as fans, dampers, control equipment, etc. Addressability allows the dry contact to be activated, either manually or through panel programming. LED blinks green each time a communication is received from the control panel and turns on in steady red when activated.

.4 In locations where there are a multiple of devices required to be monitored, 10-input monitor modules may be supplied and installed. Such locations best suited for this requirement are at the main sprinkler assembly where multiple points are required to be monitored by the fire alarm system. The 10-input monitor module shall be mounted in a surface mounted lockable cabinet.

.7 **Fault Isolators:** Provide fault isolator modules to detect and isolate short-circuited segments of the Class 'A' fault tolerant loops. The module shall automatically determine return-to-normal condition of the loop and restore the isolated segment.

.8 **End-of-Lines:** End-of-line devices for signalling zones and sprinkler flows and tampers shall be mounted in separate single gang box with red cover plate. Mount end of line in wall above device but not above 1800 mm above finished floor.

.9 **Audible/Visual Fire Alarm Signalling Devices:** Audible and visual signal devices shall be combined horn/strobe type, surface wall mounted unless otherwise noted. The horns shall produce a code-3 temporal pattern. The horn shall have a minimum dBA output of approximately 92 dBA. The horns shall be provided with adjustable audible output with High setting for 98 dBA output or Low setting for 94 dBA sound output. The synchronizing strobe shall produce white light with a minimum of 75 candela across all viewing angles in common areas. Signal devices shall be surface wall mounted on flush outlet boxes.

.10 Ceiling mounted audible/visual signal devices shall be low-profile, combination horn/strobe type, surface mount application, white textured housing and clear polycarbonate lens. The horns shall produce a code-3 temporal pattern and shall have a minimum dBA output of 92 dBA. The synchronizing strobe shall produce white light with a minimum 75 candela across all viewing angles common areas.

.11 Audible/visual signalling devices shall be WHITE and shall be labelled with 'FIRE markings in RED.

.12 All signal circuits shall be supervised. All signal devices shall be synchronized.

2.6 SPARE DEVICES

.1 Provide the following spare devices with material, labour, and verification to install the devices along with 10m of conduit and wire and associated commissioning, verification costs, back boxes/outlet boxes to/for each device. (Should the spare devices be required after substantial completion, then additional costs for travel back to site are not part of this contract):

.1 Two (2) pull stations

.2 Four (4) multi-sensor detectors

.3 Six (6) monitor modules

.4 Six (6) control relay modules

.5 Eight (8) horn/strobes, surface wall mounted

Part 3 Execution

3.1 INSTALLATION

.1 The contractor must make available to the Owners a local service department of the equipment manufacturer, which shall stock the manufacturer's standard parts. The service department shall have at least one factory trained repairman available to the Owner on a 24 hours' notice. The systems shall be guaranteed for a period of one year. Refer to section 260501 – Common Works Results. Provide, during the guarantee period, all service, maintenance, parts, etc., required for the normal operation of the systems, such that the Owner need not purchase additional maintenance agreement or contracts. The manufacturer shall perform the above noted maintenance including the trip to site at no cost to the owner during the guarantee period.

.2 The overall system coordination shall be the responsibility of the contractor, and he shall ensure that all of the necessary system components are installed to result in a complete, workable system.

.3 All field devices including manual pull stations, detectors, monitor, control and relay modules shall be externally labelled showing the address and device controlled and monitored. A self-adhesive identification label shall be applied to the device, and shall be 12mm WHITE laminated marker tape with black typed lettering. Identification shall be placed on the inside of doors where doors are either controlled by magnetic door holders, electric locks, or magnetic locks.

.4 Detectors shall be mounted in suitable mounting plates with finish ring. Where shown in proximity to unit heaters, detectors shall be located at least 3000mm from such unit heaters, and out of line of direct heat. Detectors shall be located 1500mm from any air handling diffusers or grilles.

.5 All ceiling mounted fire detection devices shall be installed as close as possible to the centre of ceilings in rooms, shafts and portions of corridors or as noted on drawings. Detectors in stair shafts shall be safely reachable by ladder. Detectors shall be mounted at highest point of area to be protected. Ensure that these detectors are sufficiently spaced from supply air diffusers, light fixtures and other ceiling mounted items that might block the movement of heat or smoke to the detectors. Smoke detectors shall not be located within 900mm of the peak of a vaulted ceiling.

.6 Duct detectors shall be provided with new sampling tubes and framework to support the sampling tubes. Detector assembly shall be security mounted on the outside of the duct in a location easily accessible for servicing. Detectors shall be located along a straight section of the duct away from bends, silencers, coils and vanes. An air-flow meter shall be used to ensure that the air sample through the detectors is acceptable for the manufacturer’s listing requirements.

.7 Where duct detectors are located in areas where it is difficult to reach or access by ladder for verification purposes, remote keyed test stations shall be installed.

.8 Where fire alarm devices are installed within unheated spaces or spaces where temperatures may drop below 0°C, appropriate cold temperature rated and moisture proof fire alarm devices intended for those conditions shall be provided.

3.2 WIRING

.1 Perform tests in accordance with Section 260501 – Common Works Results, and CAN/ULC-S537.

.2 All wiring shall be color coded. Wire and conduit necessary to make the system operable shall be provided and installed as instructed by the manufacturer of the fire alarm system. All wiring shall be installed in conduit with a maximum conduit fill of 40%.

.3 Wiring shall be as follows:

.1 Wiring for signal device circuits shall be a minimum #14 gauge RW90, 300 volt, solid copper. Wiring may be run in same conduit system as the initiating circuits.

.2 Addressable devices shall be #18 gauge, twisted shielded jacketed pair. Shielding must be continuous throughout and isolated from ground except at the control panel. All existing shielded wiring being reused for the addressable loops shall be taped at every termination point.

.3 Ancillary circuits shall be #14 gauge RW90, 300 volt, solid copper. Run in separate conduit.

.4 Annunciator wiring shall be as per manufacturer's recommendations.

.5 Interconnection to the Building Security Alarm Panel shall be 2 x Z-wire, 4 conductor #22 AWG solid copper.

.4 All wiring and its installation must comply with all appropriate codes including CAN/ULC-S524-M06. Refer to Appendix 'A' of CAN/ULC-S524-M06 for further requirements.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 – Common Work Results - Electrical, and CAN/ULC-S537.

.2 Manufacturer shall allow for a required amount of on-the-job site assistance for the contractor during the construction period.

.3 The entire installation shall be performed under the supervision of the manufacturer. Upon completion of the installation, the manufacturer shall check the entire system to the approval of the Consultant. The manufacturer shall verify the entire system and demonstrate its complete operation to those having jurisdiction.

.4 The manufacturer shall perform a complete verification and inspection of all installed equipment, including each and every component, such as manual stations, automatic detectors, sprinkler switches, audible signalling appliances, station indicating lamps, control equipment, remote peripherals, etc., to ensure the following:

.1 That the type of equipment installed is that designated by the Consultant's specifications and plans;

.2 That the wiring connections to all equipment are correct and in accordance with CSA and ULC requirements;

.3 That the equipment is installed in accordance with the manufacturer's recommendations;

.4 That the regulations concerning the supervision of components have been adhered to (e.g. stations, detectors, signal devices, etc.), and are properly wired and supervised;

.5 That any subsequent changes necessary to conform to the above will be done by the contractor, with technical advice supplied by the manufacturer.

.5 During the period of inspection, the Contractor shall supply to the manufacturer, one (1) electrician and one (1) helper.

.6 The contractor shall also supply any required equipment such as ladders, scaffolding, etc.

.7 To assist the installer in preparing his bid, the manufacturer shall indicate the number of hours necessary to complete this inspection.

.8 Upon completion of the inspection, and when all of the above conditions have been compiled with, the manufacturer shall issue to the Consultant the following:

.1 A copy of the inspecting technician's report, showing the location of each device, and certifying the test results of each device.

.2 A certificate of verification confirming that the inspection has been completed, and showing the condition upon which such inspection and certification have been rendered.

.3 Proof of liability insurance for the inspection.

.9 All verification certificates shall include the testing of the audibility of the signal devices to confirm compliance with the 2010 National Building Code.

3.4 TRAINING

.1 The Owner's operating and maintenance personnel shall be instructed in the operation and maintenance of the system for a minimum of two (2) separate 1-hour training sessions totally two (2) hours. Written documentation bearing name and signature of Owner's personnel who received the above instructions shall be included in the operating instructions and service manuals.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Salvaging and stockpiling topsoil.

1.2 RELATED WORK

.1	Tree Protection	Section 01 56 39
.2	Site Preparation	Section 02 41 13
.3	SiteGrading	Section 31 22 00
.4	Topsoil and Finish Grading	Section 32 91 19
.5	Seeding	Section 32 92 20

Part 2 Products

2.1 MATERIALS

.1 Existing Topsoil: existing natural onsite organic topsoil, capable of supporting good vegetative growth. Existing topsoil shall meet the requirements of Section 32 91 19 – Topsoil and Finish Grading. Do not screen.

.2 Imported Topsoil: topsoil hauled from offsite sources. Imported topsoil shall meet the requirements of Section 32 91 19 – Topsoil and Finish Grading. Do not screen.

Part 3 Execution

3.1 TOPSOIL STRIPPING

.1 Remove vegetation, stones, debris and other foreign material in excess of 50 mm diameter before start of work, per Section 02 41 13 - Site Preparation.

.2 Strip existing topsoil only from those areas that will be disturbed by excavation, filling, road or building construction, or compaction by equipment.

.3 Determine soil stripping depth by taking soil cores within areas to be stripped. Topsoil depth averages 80 mm, per Geotechnical Report by Clifton Associates Ltd., dated on December 2013, but may be variable throughout the site. Avoid mixing topsoil with subsoil.

.4 Avoid stripping material in either wet or dry conditions to minimize degradation of soil structure.

.5 Imported topsoil (if required) shall be hauled to the site and stockpiled in locations designated by the Owner of General Contractor.

.6 Salvaged existing topsoil exceeding the quantity required shall be disposed of at Contractor’s expense.

.7 All planned erosion and sediment control practices shall be in place and functioning properly prior to stripping.

3.2 STOCKPILING

.1 Do not screen salvaged existing topsoil or imported topsoil prior to stockpiling.

.2 Locate stockpiles to avoid slopes, natural or constructed drainage, and traffic routes.

.3 No soil stockpile shall exceed 2.0 meters in height.

.4 All topsoil stockpiles shall be protected from sediment erosion by surface roughening, watering, and perimeter silt fencing.

.5 Stabilize stockpiles within seven (7) days of stockpile formation by seeding with a temporary cover crop such as oats or barley nurse crop, or approved equivalent, or the approved specified final seed mixture. Maintain vegetative cover throughout life of stockpile; re-seed annually as required.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 The work under this Section shall include excavation of the police building crawlspace, backfilling of the police building crawlspace skirting, grading of the site and construction of the road approach to the site at Highway No. 964.

1.2 RELATED WORK

.1 Aggregate Base Courses – 32 11 23.

1.3 SAFETY

.1 Excavation shall be in accordance with municipal safety regulations and Occupational Health and Safety recommendations.

1.4 EXISTING UTILITIES

.1 Locate buried utilities and services prior to excavation.

.2 Locations of any utilities and services on the Drawings are approximate only. Further utilities and services may exist in addition to those shown.

1.5 PROTECTION OF PROPERTY

.1 All work shall be executed in such a manner as to protect private property, fences, utility poles, survey pins and markers, manholes, valve boxes and other utility appurtenances. Any of these items which are damaged or removed by the Contractor in the performance of his work shall be repaired or replaced to their original condition at the expense of the Contractor.

1.6 MAINTENANCE

.1 Defects or misalignment of any part of the work caused by settlement or faulty workmanship and materials during the maintenance period shall be corrected by the Contractor at his expense.

Part 2 Execution

2.1 SITE GRADING

.1 After development area has been cleared, grubbed and stripped of topsoil, commence site grading. Co-ordinate clearing, grubbing and topsoil stripping with Landscape Drawings and specifications.

.2 Excavate all non-organic materials to construct site area and road approach to the lines and grades as shown on the Drawings.

.3 Place excavated material suitable for site grading on fill areas. Place excavated material unsuitable for site grading in the toe and side slopes of road approach, other back slope and non-traffic areas or dispose of off-site.

.4 Place fill material for site grading in maximum loose lift thickness of 150mm. Compact with mechanical compaction equipment to a minimum 98% of the maximum Standard Proctor Density at optimum moisture content.

.5 The allowable moisture content tolerance during fill placement is +/- 2% of optimum. Water or dry soil material to achieve acceptable moisture conditions within the specified limits.

.6 Rocks shall be included as common excavation. Remove rocks over 150mm in diameter from the fill material. No extra payment will be made for rock excavation. Dispose of rocks in a designated area as outlined on the landscape drawigns or dispose of off-site.

.7 No extra shall be allowed for wet excavation.

.8 Remove and dispose of concrete, rubble, organic or frozen material or other debris such as brush and roots from fill and dispose off-site.

.9 Dispose of other excess materials off-site.

.10 Disposal of materials must be to a place approved by local governing authority or Municipality.

2.2 CRAWL SPACE EXCAVATION

.1 Coordinate with architectural and structural drawings to excavate crawl space area to specified elevation.

.2 Excavate area to provide level area beneath footprint of building. Level and compact excavated area to be within 25mm of design elevation. Dispose of excess excavated material off-site if not needed to grade other areas of the site.

.3 Slope excavation walls beyond skirting to allow for construction of skirting.

2.3 SKIRTING BACKFILL

.1 Upon completion of skirting construction, backfill up to skirt with clean, free draining surface gravel material as specified in section 32 11 23. Backfill in lifts of 300mm and compact to eliminate settlement. Ensure backfill material is placed to have positive drainage gradient of at least 3% away from the building unless otherwise noted or specified.

.2 Backfill top 300mm with granular base as specified in section 32 11 23.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This Section describes the work required for the excavation and backfilling of utility trenches for the installation of water distribution and sewage collection pipelines.

1.2 RELATED WORK

.1 Site Water Utility Distribution Piping: Section 33 11 16.

.2 Site Sanitary Utility Sewerage Piping: Section 33 31 15.

1.3 SAFETY

.1 Trench excavation to be in accordance with municipal safety regulations and Occupational Health and Safety recommendations.

1.4 MAINTENANCE

.1 Defects or misalignment of any part of the work caused by settlement or faulty workmanship and materials during the maintenance period shall be corrected by the Contractor at his expense.

1.5 ROAD CLOSURES & TRAFFIC COORDINATION

.1 Apply for road closures from governing authorities as required.

.2 Coordinate road closures to ensure full access is available to the Black Lake community at all times.

Part 2 Products

2.1 BACKFILL MATERIAL

.1 Backfill material over pipelines shall be native excavated material, free of large rocks or boulders, tree stumps, large roots or other deleterious material.

2.2 BEDDING SAND

.1 Bedding sand shall conform to the following gradation limits:

Sieve Size	% Passing
5 mm	95 - 100
2 mm	75 - 100
0.90 mm	40 - 80
0.40 mm	15 - 45
0.16 mm	0 - 20
0.071 mm	0 – 5

2.3 CRUSHED ROCK

.1 Uniformly sized 20mm crushed rock.

Part 3 Execution

3.1 GENERAL SURFACE EXCAVATION

.1 Where applicable, salvage granular material on roadways prior to trenching for placement on road surface after trenching and backfilling.

3.2 WATER AND SEWER UTILITY TRENCH EXCAVATION

.1 Excavate sufficiently to allow for the installation of pipes, fittings and appurtenances to the lines, grades and elevations as shown on the Drawings. Pipes shall rest on approved compacted granular material. Over-excavation shall be brought up to grade using compacted granular material at the expense of the Contractor.

.2 Obey laws, rules and ordinances respecting excavation. Trenches shall be sheeted or braced as required by the regulations of the Workers' Compensation Board and to protect life, property and the Work. Open V-cut methods of excavation may be used provided the trench sides meet regulations.

.3 The maximum trench width at the top of the pipe shall be:

.1 Pipe 900 mm nominal diameter and over; the outside diameter of the pipe plus 600 mm.

.2 Pipes under 900 mm nominal diameter; the outside diameter of the pipe plus 400 mm, except the Contractor will not be required to excavate a trench less than 900 mm wide.

.4 Replace unstable foundation material with compacted crushed rock, or other special foundation as required. This shall be classified as extra work under the terms of the contract. Dewater excavations. No extra shall be allowed for wet excavation.

.5 Unsuitable backfill material such as rocks and chunks of concrete and masonry over 200 mm in diameter shall be hauled from the site and disposed or placed in approved designated areas. Clearance between rocks left in place in the trench and the wall of the pipe shall be a minimum of 150 mm, the space between the rock and the pipe shall be filled with selected and compacted material or bedding sand.

.6 Trench bottom shall be free from sloughed sidewall material, large stones, large dirt clods, frozen material or any other condition that could lead to non-uniform or unstable support of the pipe. Keep trench bottom dry during installation of the pipe and embedment material.

3.3 ROCK EXCAVATION

.1 Where solid masses of rock are encountered in the excavation for water and sewer utility trenches, drill, blast and excavate detached rocks.

.2 Rock masses shall be shattered 300mm below the rock subgrade for the full width of the cut section including the grade of the trench bottom. To obtain uniform shattering, drilling shall extend to a plane parallel to profile and cross-section at least 600mm below grade.

.3 The spacing of drill holes shall not exceed the depth of the cut at the point of drilling.

.4 Blasting shall be carried out according to current Blasting Safety Regulations under the *Occupational Health and Safety Act* and performed by qualified, licenced personnel.

3.4 WATER AND SEWER UTILITY TRENCH BACKFILLING

.1 Initial backfilling to 500mm above the pipe shall be as described as pipe bedding in the sections for the specific utility.

.2 Above the 500mm layer, the backfill shall be Class II. Approved excavated material shall be placed in maximum 300 mm lifts and compacted to a minimum of 95% of the Standard Proctor Density using mechanical compaction equipment.

.3 Stones and blast rock over 200mm in diameter, chunks of concrete, organic or frozen material or other debris such as brush and roots are not allowed in the backfill. Large rocks may be useable for landscaping purposes. Coordinate with Landscape Drawings and Specifications accordingly.

.4 Where utility pipes cross each other, the material between the pipes shall be compacted bedding sand to eliminate settlement.

.5 Leave a maximum of 5m of trench open at the end of a working day. This open trench must be appropriately secured and marked according to rules and regulations in force for the safety of pedestrians and vehicles.

.6 Backfill all excavations prior to leaving site for planned days off.

.7 Place salvaged granular materials on top of the trench cut on existing roadways and compact and trim to match existing roadway lines and grades.

.8 Upon completion of the work, remove all unused or damaged material and other construction debris from the site and dispose at an approved disposal area. Blade all areas smooth and level where work has been performed and leave the site in an acceptable appearance.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This Section describes the work required for the preparation, gravelling, compaction, shaping and trimming of road approach, driving and parking surfaces within the Detachment site.

1.2 PROTECTION OF PROPERTY

.1 All work shall be executed in such a manner as to protect private property, fences, utility poles, survey pins and markers, manholes, valve boxes and other utility appurtenances. Any of these items which are damaged or removed by the Contractor in the performance of the work shall be repaired or replaced to their original condition at the expense of the Contractor. Earth, rock or debris deposited in sewer manholes, pipes and in valve boxes shall be completely removed prior to acceptance of the work.

1.3 SUBMITTALS

.1 The Contractor shall submit granular and bedding material sieve results prior to material being incorporated into the Work.

.2 The Contractor shall coordinate and cover testing costs and submit all density testing results expeditiously as Work progresses.

Part 2 Products

2.1 SURFACE GRAVEL

.1 The Contractor shall supply the gravel. Road approach, driving and parking surface gravel shall be composed of fragments of durable rock free from undesirable quantities of soft or flaky particles, loam, and organic or otherwise deleterious material.

.2 Gravel used for road approach, driving and parking surfaces shall be Saskatchewan Ministry of Highways and Infrastructure Type 104 or approved alternate.

2.2 GRANULAR BASE

.1 Granular base used for secure bay ramp shall be Saskatchewan Ministry of Highways and Infrastructure Type 31 or approved alternate.

Part 3 Execution

3.1 SURFACE PREPARATION

.1 Upon completion of building construction and utility installations within the site, construct road approach, driving and parking surfaces to the lines and grades as shown on the Drawings.

.2 Compact surfaces to a minimum Standard Proctor Density of 98%. Surface moisture shall be corrected as required to achieve the specified density.

3.2 SURFACE GRAVEL

.1 Upon completion of the preparation of driving and parking surfaces, supply and place Type 104 gravel to a finished compacted depth of 125mm.

.2 Compact, shape and trim gravelled surfaces to ensure a smooth, dense surface to support normal road traffic without rutting or becoming unstable.

3.3 SECURE BAY RAMP

.1 Coordinate infill of secure bay ramp with General Contractor.

.2 Once timbers are in place and secured, fill ramp area with Type 31 granular base. Place in maximum loose lifts of 150mm and compact to 98% of maximum Standard Proctor density.

.3 Fill top 75mm of ramp with Type 104 surface gravel compacted to 98% of maximum Standard Proctor density.

3.4 MANHOLE AND VALVE BOX ADJUSTMENTS

.1 Adjust manholes and valves to approximately 150mm below finished grade.

.2 Manholes shall be adjusted by removing or adding adjusting rings to a maximum ring depth of 300mm with a minimum depth of 100mm.

.3 Valve boxes shall be adjusted by raising or lowering the telescoping top section of the box or by adding approved risers.

.4 Gravel and earth shall be kept out of valve boxes and sanitary sewers. Any such material deposited in these appurtenances shall be removed by the Contractor. The Contractor shall be completely responsible for all conditions which arise as the result of this material entering the sanitary sewer systems.

.5 Valve boxes, manholes, and curbs damaged by the Contractor shall be repaired or replaced at their expense.

.6 Place temporary fabric underneath manhole frame to prevent granular material from entering the sanitary sewer system. Sanitary sewer manholes will be inspected prior to and upon completion of granular material placement. Any debris in the manholes shall be cleaned out and the sewer mains flushed, at the expense of the Contractor.

END OF SECTION

PART 1 General

1.1 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet.

.3 Shop Drawings:

.1 Indicate location, type, size, arrangement, anchor and mounting details.

1.2 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 STORAGE AND PROTECTION

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

PART 2 Products

2.1 PRODUCTS

.1 Fence Fabric: 50 mm mesh by 9 gauge, zinc coated after weaving. Minimum zinc coating to be 490 grams per square metre of surface area.

.2 Fabric height: See drawings.

.3 Terminal and Straining Posts: The terminal posts and straining posts shall be 90 mm O.D. with minimum weight of 11.24 kg per metre, Schedule 40 pipe, zinc coated with minimum coating of 490 grams per square metre. The minimum length of terminal posts and straining posts shall be 2,900 mm

.4 Line Posts: Posts shall be 60 mm O.D. with minimum weight of 5.43 kg per metre, Schedule 40 pipe, zinc coated with minimum coating of 490 grams per square metre. The minimum length of line posts shall be 2,670 mm unless otherwise indicated.

.5 Top Rails and Pipe Braces: The top rails and pipe braces shall be 43 mm O.D., Schedule 40 pipe, zinc coated with minimum coating of 490 grams per square metre.

.6 Top and Bottom Wire: Wire shall be Number 6 Gauge, single strand 57 grams electro-galvanized and be stretched taut along the top and bottom of the fabric fastened at 460 mm intervals

.7 Gate Frames: Gate frames are to be made of 43 mm O.D., Schedule 40 pipe, zinc coated with minimum coating of 490 grams per square metre. All joints to be electrically welded.

Gates are to be supplied complete with zinc coated malleable iron hinges, latch and latch catch. Double gates to have centre rest with drop bolt for closed position and chain hold open. Gate latches are to be suitable for padlock which can be attached and operated from either side of gate. Hinges are to permit gate to swing back 180 degrees against fence. Gate braces shall be 33 mm O.D. zinc coated steel pipe with minimum coating of 490 grams per square metre.

.8 Accessories: other components such as tension bars, bands, rail ends, terminal post tops, line post tops, top rail sleeves, wire ties, nuts, bolts, and washers to be zinc coated steel with a minimum coating of 490 grams per square metre.

PART 3 Execution

3.1 INSTALLATION

.1 Embed terminal posts and straining posts 900 mm. Set terminal posts and straining posts plumb and in accordance with the alignment staked.

.2 Straining posts shall be installed as per the manufacturer's instructions.

.3 Brace terminal sections, straining sections and corner sections with a pipe brace as per the manufacturer's instructions and as shown in the detailed plans and specifications.

.4 Attach fence fabric, wire ties, top rail, pipe braces, tension bar and fittings to the posts and assembled according to the manufacturer's instructions and as specified on the plans as designated by the Engineer.

.5 The chain link fence fabric shall be attached to the inside of the posts facing the dust collector. Gates open in the direction shown on the drawings.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Topsoil, planting mix, fertilizer and finish grading.

1.2 RELATED WORK

.1	Topsoil Stripping and Stockpiling	Section 31 14 13
.2	Site Grading	Section 31 22 00
.3	Seeding	Section 32 92 20

1.3 SOIL TESTS

.1 Conduct soil tests of topsoil and planting mix as required to determine recommended soil amendments and fertilizer compositions for seeding, sodding and planting. Samples shall be taken in accordance with recommendations of approved testing laboratory. Testing regimen as follows:

- .1 PSA-2 (Particle size analysis).
- .2 C-TOT-ORG (organic carbon).
- .3 SAL-DETAIL+TGR (detailed salinity).
- .4 Soil Analysis Package 1 (for NPKS - with recommendations).

.2 Soil tests shall be paid for by the Contractor and shall be conducted by an approved testing laboratory.

.3 Submit two (2) copies of soil test results and fertilizer recommendations to the Consultant for review.

Part 2 Products

2.1 MATERIALS

.1 Topsoil: stripped and stockpiled or imported material to be reasonably free from subsoil, roots, grass, weeds, toxic materials, stones and foreign objects, and shall be subject to analysis by a testing laboratory before use. Topsoil shall consist of black topsoil, a fertile, friable natural loam, neither heavy clay nor very light sand; 5-20% organic matter by weight; acidity value ranging from pH 6.0 to 7.5. Amend as recommended by soil tests. Topsoil to be in a moist, not wet, condition when incorporated into the work. Submit a one (1) litre sample to Consultant for approval prior to incorporation into the work. Do not screen topsoil.

.2 Manure: well decomposed cattle excrement, rich in organic matter and humus containing balanced proportions of nitrogen, phosphorus and potash; reasonably free of living vegetation, weed seeds, and couch grass or brome grass rhizomes; in a pulverised, friable condition, not containing fresh or “green” manure, clay, silt, gravel or foreign material.

.3 Fertilizer: Complete commercial synthetic slow release fertilizer with maximum 35% water soluble nitrogen; uniform in composition and free flowing. Formulation ratio: as recommended by soil tests.

Part 3 Execution

3.1 COORDINATION

.1 Ensure proper scheduling of work to avoid conflicts with completed and intended work.

3.2 PREPARATION

.1 Eliminate uneven areas and low spots from areas that have been rough graded. Ensure positive drainage in accordance with grading plans. Notify Consultant of grading problems before proceeding. Remove debris, roots, branches, stones in excess of 50 mm diameter and other extraneous materials. Remove subsoil that has been contaminated with oil, gasoline, calcium chloride or other undesirable chemicals. Dispose of removed materials off-site on a daily basis and at a location approved by local officials.

.2 Cultivate all areas, which are to receive topsoil, to depth of 100 mm. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted the subgrade.

.3 Do not damage structures, membranes, fabrics, gravel or other materials adjacent to or below landscaped areas.

3.3 TOPSOIL AND PLANTING MIX

.1 Do not spread topsoil until Consultant has inspected subgrade.

.2 Spread topsoil with adequate moisture in uniform layers during dry weather over approved, dry, unfrozen subgrade, where seeding, sodding and planting is indicated.

.3 Bring topsoil to finish grade, taking mulching into account.

.4 Uniformly place topsoil or planting mix, as indicated, in maximum 300 mm loose lifts to the following minimum compacted depths:

.1 100 mm topsoil for seeded areas.

.2 Compact each lift to maximum 85% of standard Proctor density.

3.4 FERTILIZER

.1 Apply fertilizer at least 6 days before seeding or planting.

.2 Spread fertilizer uniformly with mechanical spreaders over entire area of topsoil at rate determined on basis of soil tests.

.3 Incorporate fertilizer thoroughly into upper 50 mm of growing media.

3.5 FINISH GRADING

.1 Remove stones, roots, grass, debris and foreign non-organic objects from growing media.

.2 Manually spread topsoil around existing trees and at areas subject to damage by equipment.

.3 Fine grade entire landscaped area to contours and elevations as indicated. Eliminate rough spots and low areas to ensure positive drainage in accordance with the grading plans. Notify Consultant of grading problems before proceeding.

.4 Fine grade and loosen topsoil prior to seeding or sodding. Prepare loose friable bed by means of shallow discing or harrowing and subsequent raking. Roll lightly and rake wherever growing media is loose.

.5 Leave surface smooth and uniform, with a fine loose texture.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 Seed and application of seed.

1.2 RELATED WORK

.1	Topsoil Stripping and Stockpiling	Section 31 14 13
.2	Site Grading	Section 31 22 00
.3	Topsoil and Finish Grading	Section 32 91 19

Part 2 Products

2.1 MATERIALS

.1 **Grass seed:** Certified Canada No. 1 Grade to Government of Canada Seeds Regulations and having minimum germination of 75% and minimum purity of 97%. Submit original seed bag labels for each seed mix.

.2 **Fertilizer:** refer to Section 32 91 19

2.2 SEED MIXES (by weight)

.1 Dryland Mix:

30% Sheeps fescue (*Festuca ovina*)

25% Blue grama (*Bouteloua gracilis*)

20% Buffalo Grass *(Buchloe dactyloides)*

20% Little bluestem (*Schizachyrium scoparium*)

5% Canada Wild Rye *(Elymus canadensis)* – nurse crop

Seed rate: 2.2 kg / 100 m^2

Part 3 Execution

3.1 SEEDING

.1 All areas to be seeded shall be harrowed once with a landscape harrow to a maximum depth of 50 mm.

.2 Fertilize: Apply fertilizer at least 6 days before seeding. Spread fertilizer uniformly with mechanical spreaders over entire area to be seeded at rate determined on basis of soil tests. Incorporate fertilizer thoroughly into upper 50 mm of soil surface.

.3 Seed shall be evenly applied with an approved mechanical seeder. Seeding shall be done in two operations at right angles to one another.

.4 Sow during calm weather (winds less than 10 km/h), using equipment suitable for area involved. Sow half of required amount of seed in one direction and remainder at right angles. Incorporate seed into soil to a maximum depth of 13 mm simultaneously or within one hour after seeding operation. Mix carefully with light chain harrow or wire rakes.

.5 Water with fine spray, avoiding washing out of seed. Apply enough water to ensure penetration of minimum 50 mm.

.6 Protect seeded areas against damage. Maintain protection until acceptance of seeded areas.

.7 Reseed at 2 week intervals where germination has failed.

3.2 MAINTENANCE

.1 Keep soil moist during germination period and adequately water seeded areas until accepted by Consultant.

.2 Apply water to ensure moisture penetration of 50 to 100 mm. Control watering to prevent wash-outs.

.3 Cut grass when it reaches height of 100 mm, and cut to a height of 65 mm. Evenly distribute (do not remove) clippings which exceed 10 mm in depth.

.4 Maintain grassed areas free of weeds and disease.

3.3 ACCEPTANCE

.1 Seeded areas will be accepted provided that:

.1 Seeded areas are properly established for the intended purpose and to the satisfaction of the Consultant and true to grade.

.2 Turf is free of eroded, bare or dead spots and 90 - 95% free of weeds.

.3 Seeded areas have been cut at least twice, the last cut being carried out within 24 hours of acceptance.

.2 Areas seeded in fall will be accepted in the following spring one month after start of growing season provided acceptance conditions are fulfilled.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This Section describes the work required for the installation of sanitary sewer manholes and related structures complete as shown on the Drawings.

1.2 MATERIALS

.1 Materials required to complete the work shall be supplied by the Contractor. They shall be new and of the type specified. They shall be handled and stored in accordance with the manufacturers' written instructions.

1.3 MAINTENANCE

.1 Defects or misalignment of any part of the work caused by settlement or faulty workmanship and materials during the maintenance period shall be corrected by the Contractor at his expense.

1.4 RELATED WORK

.1 Water & Sewer Utility Trench Excavation and Backfill: Section 31 23 16.

.2 Site Sanitary Utility Sewerage Piping: Section 33 31 15.

Part 2 Products

2.1 MANHOLES

.1 Manhole Sections: 1050mm diameter manhole barrels and flat top sections as specified shall conform to ASTM C478-82a. Joints shall be suitable for either rubber gaskets or mastic sealants. Precast base sections may be used. Aluminium steps shall be cast into the sections using polyethylene anchors.

.2 Frame & Cover: Frame and cover shall be Blanchard Foundry Co. No. 4005 or as otherwise approved.

.3 Insulation Plug: Field constructed insulated pressure treated plywood plug to fit manhole barrel, complete with lifting rope.

.4 Insulation: 100mm Plasti-Fab Type 2 insulation molded to fit outside surface of manhole barrel.

.5 Joint Sealant: Ram-Nek Joint Sealant.

2.2 BEDDING SAND

.1 Bedding sand shall conform to the following gradation limits:

Sieve Size	% Passing
5 mm	95 - 100
2 mm	75 - 100
900 mm	40 - 80
400 mm	15 - 45
160 mm	0 - 20
71 mm	0 – 5

Part 3 Execution

3.1 MANHOLES

.1 Construct manholes accurately as detailed and at the locations and grades as shown on the Drawings. Align ladder rungs with manhole cover entry.

.2 Place a layer of 100mm Plasti-Fab Type 2 insulation, molded to fit the outside surface of the manhole barrel, from the top of the pipe to the bottom of the manhole cover according to the manufacturer's instructions.

.3 Fill completely all spaces between manhole sections and ring with mortar or use gaskets. Mortar shall consist of 1 part sulphate resisting cement, 2 parts clean sharp sand and sufficient water to make the mixture workable.

.4 All joints between barrel section (including cone section) shall use Ram-Nek joint sealant to ensure a water tight joint. Install the joint sealant as per the manufacturer's recommendations.

.5 Pipes shall not protrude more than 40 mm inside the manhole. All spaces between the pipes and walls shall be filled with mortar.

.6 Install smooth flow channels to 1/2 pipe diameters as shown on the Drawings. Slope manhole floors to flow channels.

.7 The maximum depth of 600 mm neck sections shall be 200 mm.

.8 Manholes shall have a minimum of 100mm and maximum of 300mm of grade ring below the frame and cover.

.9 Place a 50mm levelling course of bedding sand beneath the manhole.

3.2 INSULATION PLUG

.1 Construct and install insulation plug complete as shown on the Drawings.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This Section describes the work required to construct the water utility distribution pipelines, water service pipelines and water services as shown on the Drawings.

1.2 RELATED WORK

.1 Water & Sewer Utility Trench Excavation & Backfill: Section 31 23 16.

1.3 MATERIALS

.1 Materials required to complete the Work shall be supplied by the Contractor. They shall be new and of the type specified. They shall be handled and stored in accordance with the manufacturers' written instructions.

1.4 TESTING

.1 If there is doubt as to the quality of the pipe, the Owner may retain the services of a testing laboratory to provide test reports on pipe & fittings to show that they are in accordance with the applicable specifications.

.2 Test specimens may be selected by an agent of the Consultant at the place of manufacture or at the job site and shall be delivered to the testing laboratory by the Contractor. The number of specimens to be tested shall not normally exceed 0.5% of the number of pieces to be installed on the job. However, where initial testing indicates the inadequacies in the pipe fittings, additional testing may be required.

.3 The entire cost of such initial testing, including materials and transportation costs, will be paid by the Owner. Any costs incurred for extra testing requested by the Contractor, or caused by inadequacies in the pipe fittings, shall be paid by the Contractor.

1.5 SUBMITTALS

.1 The Contractor shall submit pipe material specifications and heat trace shop drawings prior to the material being incorporated into the Work.

.2 The Contractor shall submit pressure and water quality testing results as specified following installation of the pipeline.

.3 The Contractor shall supply shop drawings of the heat trace system complete with sensor locations as recommended by Urecon.

.4 The Contractor shall supply operation & maintenance manuals for the entire heat tracing system complete with initial commissioning report indicating all systems are operational prior to acceptance of the work.

.5 The Contractor shall supply as-built drawings of all water utility piping infrastructure installed.

1.6 MAINTENANCE

.1 Defects or misalignment of any part of the work caused by settlement or faulty workmanship and materials during the maintenance period shall be corrected by the Contractor at his expense.

1.7 REFERENCE STANDARDS

.1 CSA B137.0: Definitions, General Requirements and Methods of Testing for Thermoplastic Pressure Piping.

.2 CSA B137.1-M89: Polyethylene Pipe, Tubing and Fittings for Cold Water Pressure Services. (1/2" NPS - 6" NPS)

.3 ASTM D3035: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter. (1/2" NPS - 6" NPS)

.4 ASTM D714: Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter (3" to 48").

.5 ASTM D1248: Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

.6 ASTM D3350: Standard Specification for Polyethylene Plastics and Fittings Materials.

Part 2 Products

2.1 GENERAL

.1 Supply the following types or classes of materials. Alternatives shall be approved prior to the closing of tenders.

.2 Bolts and nuts used in buried metal products shall be Type A-304 stainless steel as per ASTM A276.

2.2 WATER UTILITY DISTRIBUTION PIPING AND FITTINGS

.1 Water Utility Distribution/Circulation Pipe: 200mm IPS High Density Polyethylene (HDPE) DR11; pipe shall be Urecon UIP pre-insulated pipe complete with factory installed trace conduit; insulation to be 50mm thickness.

.2 Water Service Piping: 150mm and 50mm IPS High Density Polyethylene (HDPE) DR11; pipe shall be Urecon UIP pre-insulated pipe complete with factory installed trace conduit; insulation to be 50mm thickness

.3 Water Services to Residences: 25mm ASTM D2737 DR9 polyethylene tubing; Pipe shall be Urecon UIP pre-insulated pipe complete with factory installed trace conduit; SDR13 polyethylene or stainless steel inserts, bevelled at one end and flanged at the other are required on all compression fittings; insulation to be 50mm thickness.

.4 Material for HDPE pipe and fittings:

.1 PE4710 resin manufactured in accordance with ASTM F714.

.2 The material shall have a minimum Hydrostatic Design Basis (HDB) of 11.0 MPa (1600 psi) when tested and analyzed in accordance with ASTM D2837.

.3 The materials shall be certified by the pipe manufacturer as a PE4710 resin. A specification sheet for the resin used in the manufacture of the pipe shall be submitted upon request of the Consultant.

.4 Minimum cell classification shall be PE 445574C for PE 4710 as per ASTM D3350.

.5 Fittings for HDPE pipe:

.1 Polyethylene fittings (tees, stub ends, etc.) shall be manufactured from the same resin as the supplied pipe and have dimensions suitable for jointing to the pipe by butt fusion.

.2 Electrofusion couplings and fittings shall be designed and manufactured in accordance with ASTM F-1055 for use with pipe conforming to ASTM D2513/3035, F-714 and with butt fittings conforming to ASTM D3261 as applicable; fittings shall be supplied with an integral identification resistor to automatically set the proper fusion parameters; fittings shall also be supplied with a 24-digit ISO compliant barcode label to facilitate the fusion of fittings from different manufacturer's processors.

.3 Gaskets shall be manufactured from cloth-inserted rubber to the dimensions and as recommended by the manufacturer.

.4 Flanged fittings shall be complete with cast aluminium or epoxy-coated ductile iron slip-on backup ring, gasket and end plate.

.5 Polyethylene smooth Internal Diameter (ID) transitions shall be manufactured from one continuous piece of HDPE pipe and shall be a minimum of one pipe diameter in length. The transition shall have a pressure rating equal to or greater than that of the two pipes being joined.

.6 Polyethylene bends shall have a minimum bend radius of six times the pipe diameter. Bends shall be manufactured from one continuous piece of HDPE pipe of the same internal diameter as the pipeline. The bend shall have a pressure rating equal to or greater than that of the two pipes being joined.

2.3 HEAT TRACING CABLE

.1 Urecon #147E Thermocable complete with accessory kits as required.

2.4 INSULATED HALF-SHELL COVERS FOR FITTINGS

.1 Urecon UIP insulated half-shell covers.

2.5 HEAT SHRINK SLEEVES

.1 CanusaWrap Heat Shrink Sleeves.

2.6 ELECTRONIC THERMOSTAT

.1 Urecon Model No. UTC-2030 with circuit breaker 120/208v, complete with Power Feed Kit PFK-1 and audible alarm.

2.7 VALVES, CURB STOPS & RELATED APPURTENANCES

.1 Resilient seated gate valves conforming to AWWA C509, counter clockwise opening, non-rising stem, with flanged ends to suit the pipe.

.2 Valve boxes: approximately 150mm diameter, asphalt coated iron casting top section with lid and cast iron bottom section. Valve boxes shall be adjustable for height and have sufficient length to suit the depth of bury of the valve. Valve boxes shall be complete with bottom belled section for placement over the valve and an adjustable cast iron top section complete with lid.

.3 Extension stems: 25mm solid square steel shafts complete with stone discs, 50mm top operating nut with skirt, and bottom socket to suit the operating nut on the valve. Stems shall have sufficient length to extend within 300mm of ground surface.

.4 Curb Stops & Valves (50mm & smaller): AWWA approved valves with compression connections and stainless steel inserts; Mueller Mark II Oriseal H-10283 (non-draining).

.5 Curb Boxes: Mueller A-726 complete with stationary rod and lid. Stainless steel extension stem to suit with inverted key and brass cotter pin.

.6 Marking posts for valve and curb box locations: 100mm X 100mm pressure treated spruce or cedar lumber, 2100mm long, painted red.

2.8 HYDRANTS

.1 Canada Valve Inc. "Century" or as otherwise approved. Depth of bury as shown on the Drawings. The hydrant shall have 2 - 62 mm hose nozzles and a 100 mm pumper nozzle. Operating nuts and threads shall match the Community's current equipment. Paint hydrant in accordance with the Community's standard colour.

2.9 ANODES

.1 Colony Vikings Services Ltd. 5.44 kg (12 pound) and 10.88 (24 pound) packaged zinc anodes or as otherwise approved.

2.10 CORROSION PROTECTION

.1 Denso paste and tape.

2.11 BEDDING SAND

.1 Bedding sand shall conform to the following gradation limits:

Sieve Size	% Passing
5 mm	95 - 100
2 mm	75 - 100
900 *u*m	40 - 80
400 *u*m	15 - 45
160 *u*m	0 - 20
71 *u*m	0 – 5

2.12 CRUSHED ROCK

.1 Uniformly sized 20 mm crushed rock.

Part 3 Execution

3.1 UTILITY TRENCH EXCAVATION & BACKFILL

.1 As described in Section 31 23 16.

3.2 PIPE LAYING

.1 Lay pipes accurately to the lines and grades as shown on the Drawings.

.2 Construct water and sewer piping in common trench. Ensure crown of sanitary sewer pipe is a minimum of 600mm below invert of water distribution pipe. Ensure horizontal separation of pipes is a minimum of 300mm.

.3 Method of installation shall conform to current AWWA Specifications for the type of pipe being used.

.4 Prior to installation of the polyethylene piping, the bottom of the trench shall be smooth, straight and free of large rocks such that the piping is supported along its entire length.

.5 Join polyethylene pipe by electrofusion or butt fusion method in strict accordance with the manufacturer's instructions. A certified, trained technician shall perform all joints. Ensure heat trace channels properly align to accommodate installation of heat trace cable system.

.6 Inspect piping and fittings for damage before being lowered into the trench. Damaged materials or those not meeting the specifications shall be rejected and removed from the site.

.7 Keep earth and other foreign material out of pipelines and pipe joints.

.8 Lay piping in a consistent location in the trench for the full length of the pipeline.

.9 Provide concrete thrust blocks to vertical undisturbed trench walls at all bends. Minimum bearing areas against undisturbed material shall be as detailed on the Drawings. Concrete shall be made using sulphate resisting cement and shall have a minimum 28 day strength of 17.5 MPa.

.10 Once construction reaches site property line, vertical separation of water and sewer pipes is no longer required, however, water service invert must never be installed lower than the sewer service invert.

3.3 PIPE BEDDING

.1 Bedding material shall be placed evenly around the pipe to prevent movement of the pipe.

.2 Bedding sand shall be used and placed to a minimum of 500mm above the pipe.

.3 Compact using hand or mechanical methods.

3.4 FITTINGS

.1 Install fittings (bends, tees, reducers, etc.) on the piping at locations as shown on the Drawings using fusion methods.

.2 Install concrete thrust backing to undisturbed soil with concrete bearing area as detailed.

3.5 HEAT TRACING CABLE

.1 As pipe is joined, pull heat tracing cable through the factory installed trace conduit on pipe sections.

.2 Install heat tracing cable continuously along the length of the pipe, including fittings in accordance with manufacturer's instructions.

.3 Install sensors at proper locations in accordance with manufacturers recommendations & shop drawings.

.4 Ensure trace conduits are positioned on top of the water pipe for heat transfer efficiency.

.5 Use manufacturer approved accessory kits for splicing and terminating cable.

.6 Leave adequate length of heat trace cable to allow heat trace to be run to the underside of the detachment and housing unit floor structures. Coordinate length with on-site mechanical and electrical contractors.

.7 Heat trace cable on the mainline will be run continuously to the terminal end near SS MH3 so the system can operate from the controller in the detachment building.

.8 Service connection heat trace systems will be controlled from individual controllers located within the housing units. Coordinate controller installation complete with alarms with mechanical and electrical contractors.

.9 Install sensors securely to pipe wall. Locate sensors 180° away from heating cable. Install all sensors in accordance with manufacturers requirements.

3.6 INSULATED HALF SHELL COVERS FOR FITTINGS

.1 Install insulated half shell covers on all fittings and hydrant risers according to manufacturer's instructions. Ensure a snug fit with the mating of the two halves, trimming ends where necessary.

.2 Notch insulated half shell covers where heat tracing cable rests against the pipe to prevent cable from being pinched between the pipe and the insulation.

.3 When a proper fit is achieved, caulk the mating surfaces with silicone caulking and mate the insulated half shell covers. Fasten with stainless steel bands and gear clamps provided with the covers. Tighten clamps until caulking begins to ooze from seams.

.4 Seal seams with heat shrink sleeves.

3.7 HEAT SHRINK SLEEVES

.1 Before lowering into trench, install heat shrink sleeves on all pipe joints and insulated fittings according to manufacturer's instructions.

.2 Backfill with material free of sharp edges and large particles that may damage the sleeve backing.

3.8 ELECTRONIC THERMOSTAT

.1 Install thermostat complete with power feed to heat tracing cable according to manufacturer's instructions.

.2 Thermostat with power feed connection to be located in the Detachment's Mechanical Room for all mainlines. Co-ordinate installation of controllers with Mechanical and Electrical.

.3 Thermostat with power feed connection to be located in the Housing units for all service lines. Co-ordinate installation of controllers with Mechanical and Electrical.

3.9 VALVES

.1 Set valve plumb and accurately to locations shown on the Drawings. Set valve box vertical and brace into trench walls to eliminate settling.

.2 Compact backfill material around the valve box to ensure that unequal settlements do not occur.

.3 Set top of box to grade as shown on the Drawings. Valve boxes which settle during the maintenance period shall be restored to the required grade by the Contractor.

.4 Mark locations of each valve with a marking post.

3.10 ANODES

.1 Attach anodes to all valves and hydrants.

.2 Place anode as shown on the detail drawing.

.3 Wrap connecting wire around the valve and hydrant, tie, and then connect using a thermite charge. Prepare surface in accordance with the manufacturer's requirements. Welds shall be in strict accordance with the manufacturer's recommendations. Coat connection surface and weld with a cold applied mastic, Denso paste of moulded plastic cap.

.4 Pour 10 litres of water over the anode.

3.11 CONNECTION TO EXISTING WATER UTILITY DISTRIBUTION PIPELINES

.1 Notify Community authorities a minimum of 48 hours prior to connecting to existing mains. Make necessary arrangements for water outage and closing of valves. Keep shutdown time to a minimum.

.2 Locate existing water mains at Poplar Avenue and Boneleye Drive. Cut existing pipelines and connect new HDPE pipe using fittings and adaptors as required.

3.12 SERVICE CONNECTIONS

.1 Coordinate service locations with building contractor to ensure service is placed within 300mm of required location.

.2 Install bends as required to bring services vertical beneath the buildings at the appropriate service locations.

.3 Stub water services 150mm above finished grade at each building. Install coupler on terminal end of water service. Terminal coupler is to be supplied by mechanical contractor.

.4 Ensure adequate heat trace cable is retained above surface to allow mechanical contractor to properly trace services to the underside of the floor structure. Coordinate with other sub-trades as required.

3.13 PRESSURE TESTING

.1 Pressure test all sections of the water utility distribution and water service piping. Should the test disclose any leakage, the Contractor shall locate and repair the defect and retest the pipeline at no additional cost to the Owner.

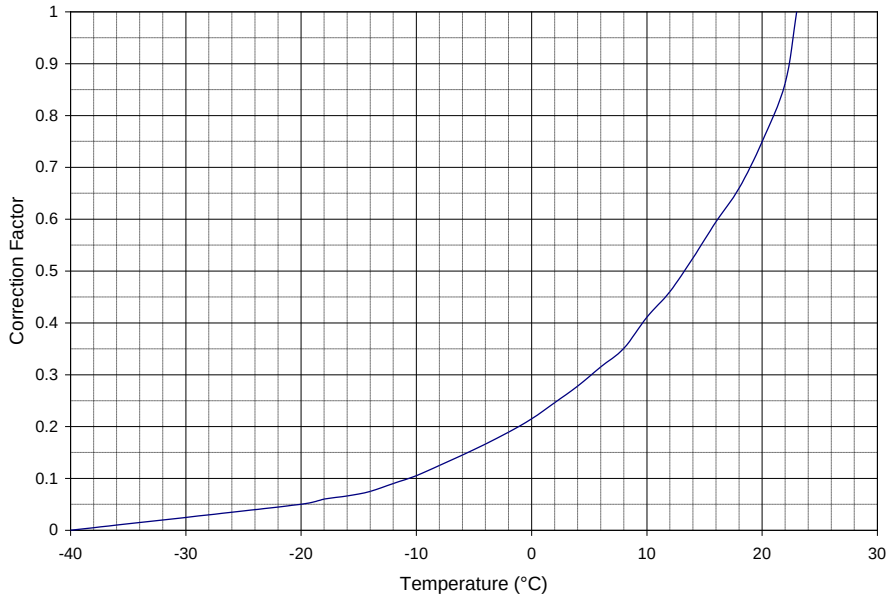
.2 Apparatus and labour required for leakage tests shall be supplied by the Contractor at his expense.

.3 The test pressure shall not exceed 1.5 times the rated pressure of the pipe; measured at the lowest elevation of the test section. The test procedure shall consist of two steps: the initial expansion phase and the test period.

.4 The initial expansion phase shall be four (4) hours in length with sufficient make-up water added, at hourly intervals, to return to the test pressure. After the initial expansion period, the actual test period shall commence. The test period shall be one hour. After this test period, a measured amount of make-up water shall be added to return to test pressure. The amount of make-up water shall not exceed:

Nominal Pipe Size	Allowance for Expansion Per 100 metres (1hr test)
50mm	0.87 litres
100mm	1.63 litres
150mm	3.73 litres
200mm	6.21 litres

.5 Allowable make-up water shall be adjusted according to the water temperature using the following correction factors:



.6 Under no circumstances shall the total time under test exceed eight (8) hours at 1.5 times the pressure rating. If the test is not completed due to leakage, equipment failure, etc., the test section shall be allowed to "relax" for eight (8) hours prior to the next testing sequence.

3.14 FLUSHING AND SWABBING PIPE

.1 The Contractor is responsible to ensure that the interior of all piping is free of all foreign material and air prior to acceptance of the work. The piping shall be filled with suitable quality potable water prior to the completion of the contract.

.2 Dirt and other foreign material shall be removed from the pipe lengths prior to installation. All piping should be visually inspected for foreign material and cleaned..

.3 Air purging and removal of debris from the interior of the piping shall be accomplished by the Pigging or otherwise approved method if pigging is unable to be accomplished. Where foreign material cannot be removed by these or other convenient means, the Contractor shall, where necessary, dismantle and reassemble the piping to effect removal of foreign material.

.4 All practical precautions shall be taken to prevent the introduction of foreign material into previously installed pipelines and/or valves.

.5 Flushing of all piping shall be completed **prior** to the disinfection process.

3.15 DISINFECTION

.1 All piping carrying treated water shall be chlorinated in accordance with Saskatchewan Water Security Agency recommendations **after initial flushing** has been completed.

.2 Provide additional tapings or connections to inject chlorine as required.

.3 Chlorination of the water piping may be accomplished by pumping a chlorine chemical solution into the pipe through a service connection or hydrant. Chemical must be approved by NSF for potable water systems. Water shall be slowly fed into the new pipes and bled at a connection until the section being disinfected is full of chlorinated solution, ensuring proper valves are shut off to prevent solution from entering existing mains. An initial chlorine residual test shall be taken to ensure the system is full of the chlorine solution. The disinfectant shall be left in the pipe for 24 hours. At the end of this period of time there shall be a chlorine residual of 10 mg/l. If this residual is obtained, the chlorine shall be completely flushed from the system. If the residual is not obtained, the pipes shall be re-chlorinated in an approved manner until the required residual is obtained.

.4 Short connections and stub pipes (less than 20 metres) can be chlorinated using HTH disinfection powder.

.5 Dispose of all chlorinated water in an environmentally safe manner.

.6 All testing apparatus, lab testing and labour required for disinfection shall be supplied by the Contractor.

3.16 BACTERIOLOGICAL TESTING

.1 Provide bacterial testing in accordance with Saskatchewan Water Security Agency regulations. All costs of testing shall be borne by the Contractor.

.2 Upon successful completion of disinfection, two (2) consecutive sets of two (2) samples shall be taken from each sample station (samples must be placed in laboratory approved bottle). Sample sets shall be taken at least 24 hours apart but not more than 48 hours. Sample stations shall include one point near the end of the newly constructed water main and one point for every 366m of water main. Samples should be received by the lab within 24 hours and shall remain cool until such time but shall not be subject to freezing.

.3 Each set of samples shall return negative results for Total and Fecal Coliforms; and results less than or equal to 200 colonies of Background Bacteria. If results are returned positive, each station shall be re-sampled and tested. If results return positive again, the water main shall be re-chlorinated as specified before further sampling can continue. Two consecutive sets of samples must return negative results from the lab to satisfy the bacterial testing requirements.

.4 Each sample taken shall be accompanied by test results for turbidity, total chlorine and free chlorine that must fall within the municipality guidelines for each parameter.

.5 Remove or abandon all temporary fittings in an approved manner upon meeting the pressure testing and disinfection requirements.

.6 All testing apparatus, lab testing and labour required for bacterial testing shall be supplied by the Contractor.

.7 The initial two sets of lab samples shall be paid by the Owner. If additional lab testing is required due to a positive test result, all lab and Engineering costs incurred from subsequent testing shall be borne by the Contractor.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This Section describes the work required to construct the sanitary utility sewerage pipelines and sewer service pipelines and sewer service to residences complete as shown on the Drawings.

1.2 RELATED WORK

.1 Water & Sewer Utility Trench Excavation & Backfill: Section 31 23 16.

1.3 MATERIALS

.1 Materials required to complete the Work shall be supplied by the Contractor. They shall be new and of the type specified. They shall be handled and stored in accordance with the manufacturers' written instructions.

1.4 MAINTENANCE

.1 Defects or misalignment of any part of the work caused by settlement or faulty workmanship and materials during the maintenance period shall be corrected at the Contractor 's expense.

1.5 SUBMITTALS

.1 The Contractor shall submit pipe material specifications and heat trace shop drawings prior to the material being incorporated into the Work.

.2 The Contractor shall supply shop drawings of the heat trace system complete with sensor locations as recommended by Urecon.

.3 The Contractor shall supply operation & maintenance manuals for the entire heat tracing system complete with initial commissioning report indicating all systems are operational prior to acceptance of the work.

.4 The Contractor shall supply as-built drawings of all sewerage utility piping infrastructure installed.

Part 2 Products

2.1 GENERAL

.1 Supply the following types or classes of materials. Alternatives shall be approved prior to the closing of tenders.

.2 Bolts and nuts used in buried metal products shall be Type A-304 stainless steel as per ASTM A276.

2.2 PIPE

.1 Sanitary Utility Sewerage Piping: 150mm and 200mm SDR35 PVC pipe conforming to ASTM D-3034; pipe shall be complete with factory installed gasket joints conforming to

CSA B182.2; pipe shall be Urecon UIP pre-insulated pipe complete with factory installed trace conduit; insulation to be 50mm thickness.

.2 Sewer Service Piping: 200mm SDR35 PVC pipe conforming to ASTM D-3034; pipe shall be complete with factory rubber gaskets conforming to CSA B182.2; pipe shall be Urecon UIP pre-insulated pipe complete with factory installed trace conduit; insulation to be 50mm thickness.

.3 Sewer Service Pipe to Residences: 100mm SDR28 PVC complete with rubber gaskets; pipe shall be Urecon UIP pre-insulated pipe complete with factory installed trace conduit; insulation to be 50mm thickness.

2.3 FITTINGS

.1 Sanitary Utility Sewerage and Sewer Service Fittings: Molded PVC fittings for gravity pipe conforming to CSA B182.2 and ASTM D3034 with factory installed rubber ring gaskets.

.2 Sewer Service to Residences Fittings: long sweep bends suited to the pipe being used with bell and spigot joint and rubber ring gasket; watertight saddles suited to the pipe being used.

2.4 HEAT TRACING CABLE

.1 Urecon #147E Thermocable complete with accessory kits as required.

2.5 INSULATED HALF-SHELL COVERS FOR FITTINGS

.1 Urecon UIP insulated half-shell covers.

2.6 HEAT SHRINK SLEEVES

.1 CanusaWrap Heat Shrink Sleeves.

2.7 ELECTRONIC THERMOSTAT

.1 Urecon Model No. UTC-2030 and Model No. UTC-2230 with circuit breaker 120/208v, complete with Power Feed Kit PFK-1 and audible alarm.

2.8 BEDDING SAND

.1 Bedding sand shall conform to the following gradation limits:

Sieve Size	% Passing
5 mm	95 - 100
2 mm	75 - 100
900 *u*m	40 - 80
400 *u*m	15 - 45
160 *u*m	0 - 20
71 *u*m	0 – 5

2.9 CRUSHED ROCK

.1 Uniformly sized 20 mm crushed rock.

Part 3 Execution

3.1 UTILITY TRENCH EXCAVATION & BACKFILL

.1 As described in Section 31 23 16.

3.2 TEMPORARY PUMPING

.1 Provide temporary pumping if required to complete the connection to the existing system. Under no circumstances shall sewage be discharged to the ground.

3.3 PIPE LAYING

.1 Lay pipes accurately to the lines and grades as shown on the Drawings.

.2 Confirm the elevation of the existing force main along Highway No. 964 prior to commencing construction. Advise Consultant immediately if force main will conflict with gravity sewer line design elevation at that location.

.3 Construct water and sewer piping in common trench. Ensure crown of sanitary sewer pipe is a minimum of 600mm below invert of water distribution pipe. Ensure horizontal separation of pipes is a minimum of 300mm.

.4 Method of installation shall conform to current AWWA Specifications for the type of pipe being used.

.5 Prior to installation of the piping, the bottom of the trench shall be smooth, straight and free of large rocks such that the piping is supported along its entire length.

.6 Pipe laying shall commence at the lowest point of the sewer. Pipe shall be laid uphill with the spigot ends laid in the direction of flow.

.7 Inspect piping and fittings for damage before being lowered into the trench. Damaged materials or those not meeting the specifications shall be rejected and removed from the site.

.8 Keep earth and other foreign material out of pipelines and pipe joints. Place a suitable cover over the end of the pipe during excavation and when the work is shut down.

.9 Join pipes and fittings in accordance with manufacturer's instructions using gaskets and lubricants as supplied or specified by the manufacturers.

.10 Once construction reaches site property line, vertical separation of water and sewer pipes is no longer required, however, water service invert must never be installed lower than the sewer service invert.

3.4 PIPE BEDDING

.1 Select native material free of stones and large lumps of deleterious material can be used for initial backfill to 150mm above the pipe.

.2 Bedding material shall be placed evenly around the pipe to prevent movement of the pipe.

.3 If select material is not available, bedding sand shall be used and placed to a minimum of 150mm above the pipe.

.4 Compact using hand or mechanical methods.

3.5 HEAT TRACING CABLE

.1 As pipe is joined, pull heat tracing cable through the factory installed trace conduit on pipe sections.

.2 Install heat tracing cable continuously along the length of the pipe, including fittings, according to manufacturer's instructions.

.3 Install sensors at proper locations in accordance with manufacturers recommendations.

.4 Ensure trace conduits are positioned on the bottom quadrant of the sewer pipe for heat transfer efficiency.

.5 Use manufacturer approved accessory kits for splicing and terminating cable.

.6 Leave adequate length of heat trace cable to allow heat trace to be run to the underside of the detachment and housing unit floor structures. Coordinate length with on-site mechanical contractor.

.7 Heat trace cable shall be run continuously to SS MH3 so the system can operate from the controller in the detachment building.

3.6 INSULATED HALF SHELL COVERS FOR FITTINGS

.1 Install insulated half shell covers on all fittings according to manufacturer's instructions. Ensure a snug fit with the mating of the two halves, trimming ends where necessary.

.2 Notch insulated half shell covers where heat tracing cable rests against the pipe to prevent cable from being pinched between the pipe and the insulation.

.3 When a proper fit is achieved, caulk the mating surfaces with silicone caulking and mate the insulated half shell covers. Fasten with stainless steel bands and gear clamps provided with the covers. Tighten clamps until caulking begins to ooze from seams.

.4 Seal seams with heat shrink sleeves.

3.7 HEAT SHRINK SLEEVES

.1 Before lowering into trench, install heat shrink sleeves on all pipe joints and insulated fittings according to manufacturer's instructions.

.2 Backfill with material free of sharp edges and large particles that may damage the sleeve backing.

3.8 ELECTRONIC THERMOSTAT

.1 Install thermostat complete with power feed to heat tracing cable according to manufacturer's instructions.

.2 Thermostat with power feed connection to be located in the Detachment's Mechanical Room for all mainlines. Co-ordinate installation of controllers with Mechanical and Electrical.

.3 Thermostat with power feed connection to be located in the Housing units for all service lines. Co-ordinate installation of controllers with Mechanical and Electrical.

3.9 CONNECTION TO EXISTING SANITARY SEWER MANHOLE

.1 Notify authorities a minimum of 48 hours prior to connecting to existing mains. Provide temporary pumping as required.

.2 Locate existing sanitary sewer manhole at Poplar Avenue and Boneleye Drive.

.3 Expose manhole and core through barrel. Install new sewer pipe into the manhole at the required line and elevation.

.4 Patch and grout the hole in the manhole wall. Re-grout the benching in the bottom of the manhole. Do not allow construction debris to enter the pipeline.

3.10 SERVICE CONNECTIONS

.1 Coordinate service locations with building contractor to ensure service is placed within 300mm of required location.

.2 Install long sweep bends at vertical deflections to bring pipes vertical at service connection locations beneath the buildings as required.

.3 Stub sanitary services 150mm above finished grade at each building. Install cap on service riser and secure in place.

3.11 INFILTRATION

.1 Infiltration shall not exceed 170 litres per day per mm diameter of pipe per km of pipe. If required, infiltration tests shall be carried out by the Contractor at his expense.

.2 The Contractor shall, where the actual leakage on a section of pipe exceeded the allowable, repair and/or replace the section and then retest the section until the actual leakage no longer exceeds the allowable.

3.12 CLEAN-UP

.1 The Contractor shall clean up the site as work progresses.

.2 The Contractor shall remove all equipment, plant, tools and surplus material from the site of the finished work and shall repair and restore all drainage facilities which have been blocked or damaged as a result of the Contractor's operations.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

.1 This Section describes the work required for the supply and installation of new culverts and the reinstallation or replacement of existing culverts.

1.2 MAINTENANCE

.1 Defects or misalignment of any part of the work caused by settlement or faulty workmanship and materials during the maintenance period shall be corrected by the Contractor at his expense.

1.3 PROTECTION OF PROPERTY

.1 All work shall be executed in such a manner as to protect private property, fences, utility poles, survey pins and markers, manholes, valve boxes and other utility appurtenances. Any of these items which are damaged or removed by the Contractor in the performance of his work shall be repaired or replaced to their original condition at the expense of the Contractor.

Part 2 Products

2.1 CULVERTS

.1 Culverts shall be 600mm corrugated steel pipe (CSP) conforming to CSA Standards. Minimum wall thickness shall be 1.6 mm.

.2 Couplers shall be galvanized steel, wedge type.

2.2 GRANULAR BEDDING

.1 Granular bedding shall be aggregate base course consisting of crushed gravel or stone, sand and clay binder. It shall be uniform in quality and consist of hard, strong, durable pieces.

Part 3 Execution

3.1 CULVERTS

.1 Culverts shall be installed at locations and grades as shown on the Drawings. Upstream invert of culverts will be installed as to not impede positive drainage.

.2 Minimum depth of cover over culverts shall be 300mm.

.3 Culverts shall be placed on in a trench which shall be shaped to uniformly support the lower quadrant of the culvert pipe.

.4 Install non-woven geotextile and rip rap on both upstream and downstream ends of all culverts installed to minimize erosion to an area of a minimum of 1 metre all around.

3.2 REINSTALLATION OF EXISTING CULVERTS

.1 Following the installation of the water and sewer pipelines, reinstall the existing culvert at Boneleye Road and Highway No. 964 to the lines and grades as shown on the Drawings.

.2 Culvert inverts shall be 50mm below existing ditch elevations.

.3 If required, repair existing culvert and replace existing couplers.

.4 If required, existing culvert shall be replaced with new culvert at the Contractor's expense.

.5 Install non-woven geotextile and rip rap on both upstream and downstream ends of all culverts installed to minimize erosion to an area of a minimum of 1 metre all around.

3.3 GRANULAR BEDDING & BACKFILL

.1 A levelling course consisting of 50mm of compacted granular material shall be placed beneath all culverts for their entire length and around and up to the springline of the pipe.

.2 Select backfill material shall be placed above culverts and in layers not exceeding 150mm in depth.

.3 Mechanical or pneumatic compaction equipment shall be used to compact bedding and backfill material. All bedding and backfill shall be compacted to 98% of Standard Proctor Density.

.4 Unsuitable foundation material shall be removed, disposed and replaced with suitable material.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Environmental Assessment Act, 2012

.2 Canadian Environmental Protection Act, 1999 with reference to the following Regulations;

- .1 Federal Halocarbon Regulations, 2003 (SOR/2003-289)
- .2 Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations, 2008 (SOR/2008-197)
- .3 Canadian Council of Ministers of the Environment, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products, 2003.

.3 American National Standards Institute (ANSI).

- .1 ANSI/NFPA-329-99, Handling Underground Releases of Flammable and Combustible Liquids.
- .2 ANSI/API 650-2000, Welded Steel Tanks for Oil Storage.

.4 American Petroleum Institute (API).

- .1 API RP 651-1997, Cathodic Protection of Aboveground Petroleum Storage Tanks.
- .2 API STD 653-R01, Tank Inspection, Repair, Alteration, and Reconstruction.

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

- .1 ASTM C618-01, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.6 Canadian Council of Ministers of the Environment (CCME).

- .1 CCME-PN1326-2004, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.

.7 Department of Justice Canada (Jus).

- .1 Canadian Environmental Protection Act, 1999 (CEPA).

.8 Canadian Standards Association (CSA)/CSA International.

- .1 CAN/CSA-B139-00, Installation Code for Oil Burning Equipment.

.9 The Master Painters Institute (MPI).

- .1 Architectural Painting Specification Manual - September 2002.

.10 National Research Council/Institute for Research in Construction.

- .1 NRCC 38727, National Fire Code of Canada (NFC)-1995.

.11 Transport Canada (TC).

- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.12 Underwriters' Laboratories of Canada (ULC).

- .1 ULC/ORD-C58.9-97, Secondary Containment Liners for Underground and Aboveground Tanks.
- .2 ULC/ORD-C58.12-92, Leak Detection Devices (Volumetric Type) for Underground Storage Tanks.
- .3 ULC/ORD-C58.14-92, Leak Detection Devices (Non-Volumetric Type) for Underground Storage Tanks.
- .4 ULC/ORD-C58.15-92, Overfill Protection Devices for Underground Tanks.
- .5 ULC/ORD-C107.4-92, Ducted Flexible Underground Piping Systems for Flammable and Combustible Liquids.
- .6 ULC/ORD-C107.7-93, Glass-Fibre Reinforced Plastic Pipe and Fittings.
- .7 ULC/ORD-C107.19-92, Secondary Containment of Underground Piping.
- .8 ULC/ORD-C142.23-91, Aboveground Waste Oil Tanks.

.9 ULC-S601-2000, Aboveground Horizontal Shop Fabricated Steel Tanks.
.10 CAN/ULC-S602-92, Aboveground Steel Tanks for Fuel Oil and Lubricating Oil.
.11 CAN/ULC-S603.1-92, Galvanic Corrosion Protection Systems for Steel Underground Tanks.
.12 ULC-S630-93, Aboveground Vertical Shop Fabricated Steel Tanks.
.13 ULC-S652-93, Tank Assemblies for Collection of Used Oil.

1.3 QUALITY ASSURANCE

.1 All works and materials shall meet the requirements of the standards referenced herein, the Quality Assurance Instructions, and specific requirements outlined in the following sub-sections.

.2 Submit shop drawings of tank and appurtenances for review by Departmental Representative prior to manufacturing.

.3 Tanks for oil burning equipment to be supplied and installed in accordance with CSA B139-09.

.4 Installation shall be in accordance with the following Legislation and Codes of Practice: Canadian Environmental Assessment Act, Canadian Council of Ministers of the Environment Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products, Canadian Environmental Protection Act (CEPA), - Storage Tank Systems for Petroleum and Allied Petroleum Products Regulations, and Federal Halocarbon Regulations.

.5 CEPA Regulations requires all Storage Tank installations to be completed by a certified petroleum installer registered in the Province of Saskatchewan or supervised by a Professional Engineer.

.6 The Contractor shall provide the Departmental Representative with a current version of the Environment Canada (EC) Storage Tank System Identification Form with section IV completed, as soon as possible, after the tank is ordered. This information is required to obtain a tank identification number from Environment Canada for each tank. The new tank must be labelled with the Environment Canada tank ID number prior to product being delivered and prior to commissioning. Refer to Section 01 35 26 Environmental Protection, and 01 35 43 Environmental Procedures for procedures and Commissioning Section 01 91 33.

.7 In accordance with federal regulations, the General Contractor shall provide the following documentation before system can be commissioned and/or filled (tanks 2500L or less that serve emergency generators are exempt from this requirement):
1. Copy of stamped permit drawings,
2. Copy of tank shop drawings, stamped as verified by manufacturer representative,
3. As-built survey drawing of the Storage Tank System, stamped by professional surveyor (professional engineer or geo-scientist). The general contractor is required to hire the surveyor and provide the as-built drawings, which must include the minimum following information: outline of all tanks, centerline of all piping, centerline of all underground electrical power and monitor sensor conduits, building foundation outlines, property lines, and the secondary containment (ie the concrete well, fill pad, and berm locations).

1.4 SUBMITTALS

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

.2 Indicate details of construction.

.3 Shop drawings to detail and indicate following as applicable to project requirements. Submit manufacturer's product data to supplement shop drawings.

- .1 Size, materials and locations of ladders, ladder cages, catwalks and lifting lugs.
- .2 Tanks capacity.
- .3 Size and location of fittings.
- .4 Environmental compliance package accessories.
- .5 Decals, type size and location.
- .6 Accessories: provide details and manufacturers product data.
- .7 Size, material and location of manholes.
- .8 Size, materials and locations of railings, stairs, ladders and walkways.
- .9 Finishes.
- .10 Electronic accessories: provide details and manufacturers product data.
- .11 Insulation types, locations and RSI values.
- .12 Identification, name, address and phone numbers of corrosion expert where applicable. Note: Grading drawings to be stamped by licenced corrosion expert.
- .13 Piping, values and fittings: type, materials, sizes, piping connection details, valve shut-off type and location, cathodic protection system complete with stamp of corrosion expert indicating that design complies with standards, Federal and Provincial regulations.
- .14 Spill containment: provide description of methods and show sizes, materials and locations for collecting spills at connection point between storage tank system and delivery truck, rail car, or vessel.
- .15 Tank heaters: provide details and manufacturers product data.
- .16 Thermometers: provide details and manufacturers product data.
- .17 Anchors: description, material, size and locations.
- .18 Concrete: type, composition and strength.
- .19 Size and location of site pads.
- .20 Level gauging: type and locations, include:
  - .1 Reporting systems, types of reports and report frequency.
  - .2 Maximum number of tanks to be monitored.
  - .3 Number of probes required and sizes.
  - .4 Provide details and manufacturer's product data.
- .21 Ancillary devices: provide details and manufacturer's product data.
- .22 Leak detection system, type and locations, and alarm system.
- .23 Grounding and bonding: provide details of design, type, materials and locations.
- .24 Corrosion protection: provide details of design, type, materials and locations.
- .25 Field-erected AST overfill-protection systems: provide details of design, type, materials and locations.
- .26 Containment system for spills, overfills and storm runoff water: provide details, materials used, and locations.

.4 Provide maintenance data for tank appurtenances and leakage detection system for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 ABOVE GROUND GAS STORAGE TANK AND DISPENSING SYSTEM

.1 General

- .1 Refer to equipment schedule and drawings for performance and dimensions.
- .2 Horizontal double wall cylindrical steel tank and integral dispensing system complete with all specified options and accessories factory mounted and tested with single point electrical connection. Unit to be shipped fully operation to site on a skid for mounting in place.
- .3 CAN/ULC-S601-14 labeled as per standard.
- .4 Unit to have the following options:
  - .1 Double-walled with vacuum monitored interstitial space.
  - .2 Dipsticks and charts to be included with tank (cm).
  - .3 Gasoline - pressure/vacuum vent 2 oz pressure/½ oz vacuum vent.
  - .4 Fill spill box c/w lockable hinged lid and drain valve.
  - .5 Water Draw-Off with male tight fill connector, dust cap and drop pipe.
  - .6 Dipping port with male tight fill connector and dust cap.
  - .7 Gasoline - High Pressure Overfill Prevention Valve c/w 50Ø tight fill connection.
  - .8 Overfill Prevention Valve shall be set to shut off at 95% of tank capacity.
  - .9 Clock gauge with metric face plate (cm), c/w integral high level alarm and annunciator.
  - .10 Tank mounted pump complete with dispensing pipe to a tank mounted dispensing cabinet.
  - .11 Tank mounted dispensing cabinet complete with retraction hose reel, hose, and auto shutoff nozzle.
  - .12 Skid base packaged with unit and factory mounted.
- .5 Surface preparation: - SSPC - SP 10, Commercial Blast Clean.
- .6 Coatings: 1 coat Hi-Build Epoxy primer (5-6 mils dft) to SSPC-PA2 and Polyurethane (2-3 mils dft) finish surface coat, colour “WHITE”.
- .7 Two grounding tabs shall be provided (one on each end of the tank shell). Each tab shall have a 15 mmØ (1/2”) hole for attachment of cable lugs to tank.
- .8 Lifting lugs shall be provided such that the tank and support can be lifted together as a unit.
- .9 The tank shall be marked in conformance with CPPI as well as requirements of the National Fire Code and ULC CAN-S601. The shell of the tank (on the fill piping side) and each end shall be stenciled (in 100mm tall black letters):

  GASOLINE
  CAPACITY _,___ LITRES
  MAXIMUM FILL _,___ LITRES
  SAFE FILL HEIGHT _____

  Tank level at “Safe Fill Height” shall equal 90% of volumetric capacity of the tank in centimeters.
- .10 Access step shall be provided for the tank. Stair treads shall be galvanized and bolted to stringers. Stringers and other structural steel elements shall be prepared and coated as per the tank specification. The step shall conform to the National Building Code and Saskatchewan Workers’ Compensation Board (WCB) standards in all respects.

.2 Tank Manufacturing Codes and Standards

.1 The tanks shall be manufactured to Underwriters Laboratories of Canada (ULC) Standard S601-14 “Standard for Shop Fabricated Steel Aboveground Horizontal Tanks for Flammable and Combustible Liquids”.

.2 The tanks shall be double wall with vacuum monitoring of the interstitial space to meet ULC Standard S601-14 requirements for double wall tanks.

.3 The tank will be fitted with manual fueling equipment to meet ULC/ORD-C142.19 “Spill Containment Devices for Aboveground Flammable and Combustible Liquid Storage Tanks”.

.4 The Steel Structure Painting Council Standards for Surface Preparation and Paint Applications as noted in this specification.

.5 The tanks shall be supported on saddles, seismic restraint brackets, and bolts to meet the requirements of the National Building Code of Canada. Shop drawings shall be delivered to the Departmental Representative prior to start of fabrication.

.6 Tank appurtenances to be supplied with the tank shall meet the requirements of CCME PN 1326, CEPA, NFCC, NBC, CSA, CEC, and B31.3, latest editions.

.7 1 – Wood gauging stick (calibrated in cm) c/w plastic coated gauge chart.

.8 Grounding lugs as required.

.9 Tanks to have ULC and manufacturer’s labels affixed to the shell plate.

.3 Dispensing Cabinet

.1 8ga steel fuel cabinet, 750high x 1200mm wide by 750 deep.

.2 Base of cabinet, minimum 1000 above grade.

.3 Cabinet to be complete with hinged lockable access doors labelled “Fuel Dispenser”

.4 Provide retraction fuel dispensing hose reel with 6.0m of 20mm arctic fuel hose and auto shutoff nozzle with swivel breakaway.

.5 Hose reel to be complete with nozzle drip cradle with drain and isolation drain valve.

.6 Cabinet to be vented in accordance with codes and regulations, minimum of two vents.

.7 Cabinet arrangement to have space allocated to mount wall hung 40 B:C fire extinguisher. Fire extinguisher to be supplied by contractor not tank supplier.

.8 Provide static grounding reel in cabinet.

.9 Cabinet base to be sealed with minimum 50mm spill containment.

.10 Cabinet to be frame mount and factory mounted to tank.

.9 Provide all wiring and controls for connection to pumps with pump switch located in cabinet. Wiring and all electrical to be in accordance with NFPA 30A and Article 514 of NEC 2011.

.4 Fuel Pump

.1 20 GPM, 115 V fuel pump with meter mounted on tank and piped to dispensing system.

.2 Piping to dispensing system to be completed in the factory.

2.2 ABOVE GROUND FUEL OIL STORAGE TANK

.1 General

.1 Refer to equipment schedule and drawings for performance and dimensions.

.2 Vertical double wall steel storage tank with 110% containment.

.3 CAN/ULC-S630 labeled as per standard.

.4 Unit to have the following options:
- .1 Double-walled with vacuum monitored interstitial space.
- .2 top connections complete with vent assembly
- .3 fill box with spill containment sleeve
- .4 water-tight lockable cover and overfill protection valve
- .5 internal wear plates for corrosion protection
- .6 service access ladder
- .7 anti-siphon device on outlet
- .8 leak detection monitor
- .9 Dipsticks and charts to be included with tank (cm).

.5 Surface preparation: - SSPC - SP 10, Commercial Blast Clean.

.6 Coatings: 1 coat Epoxy primer (2.5-3.5 mils dft) to SSPC-SP6 and Polyurethane (3-5 mils dft) finish surface coat, colour "WHITE".

.7 Two grounding tabs shall be provided. Each tab shall have a 15 mmØ (1/2") hole for attachment of cable lugs to tank.

.8 Lifting lugs shall be provided such that the tank and support can be lifted together as a unit.

.9 The tank shall be marked in conformance with CPPI as well as requirements of the National Fire Code and ULC CAN-S601. The shell of the tank (on the fill piping side) and each end shall be stenciled (in 100mm tall black letters):

FUEL OIL
CAPACITY _,___ LITRES
MAXIMUM FILL _,___ LITRES
SAFE FILL HEIGHT _____
Tank level at "Safe Fill Height" shall equal 90% of volumetric capacity of the tank in centimeters.

.10 Access step shall be provided for the tank. Stair treads shall be galvanized and bolted to stringers. Stringers and other structural steel elements shall be prepared and coated as per the tank specification. The step shall conform to the National Building Code and Saskatchewan Workers' Compensation Board (WCB) standards in all respects.

.2 Tank Manufacturing Codes and Standards
- .1 The tanks shall be manufactured to Underwriters Laboratories of Canada (ULC) Standard S630 "Standard for Shop Fabricated Steel Aboveground Vertical Tanks for Flammable and Combustible Liquids".
- .2 The tanks shall be double wall with vacuum monitoring of the interstitial space to meet ULC Standard S601-14 requirements for double wall tanks.
- .3 The tank will be fitted with manual fueling equipment to meet ULC/ORD-C142.19 "Spill Containment Devices for Aboveground Flammable and Combustible Liquid Storage Tanks".
- .4 The Steel Structure Painting Council Standards for Surface Preparation and Paint Applications as noted in this specification.
- .5 The tanks shall be supported on saddles, seismic restraint brackets, and bolts to meet the requirements of the National Building Code of Canada. Shop drawings shall be delivered to the Departmental Representative prior to start of fabrication.
- .6 Tank appurtenances to be supplied with the tank shall meet the requirements of CCME PN 1326, CEPA, NFCC, NBC, CSA, CEC, and B31.3, latest editions.
- .7 Grounding lugs as required.
- .8 Tanks to have ULC and manufacturer's labels affixed to the shell plate.

Part 3 Execution

3.1 TANK MANUFACTURING AND INSTALLATION SPECIFICATIONS

.1 Tank to be supplied and installed by the Contractor.

3.2 CONDITION OF SERVICE

.1 Above ground gas storage tank for gasoline fuel dispensing.

.2 Above ground fuel oil tank for diesel generator.

.3 Environment is Northern Saskatchewan weather conditions.

3.3 TANK INSTALLATION

.1 The tank shall be visually inspected over the entire surface before and after shipping. Special attention should be given to locations of shipping cradles and attachment straps. If any damage is present the tank shall not be installed until inspected by the owner and repaired if necessary by the manufacturer's representative.

.2 Inspect for the following defects before and after shipping:

.1 Visible damage to shell plate or nozzles; i.e. dents, appurtenance nozzles out of alignment, stress bends or deformation of shell plates and/or saddle supports and paint scrapes.

.2 Read and record vacuum gauge reading before off-loading including an annotation of the ambient temperature at the time of the readings. Record the vacuum gauge readings after the tanks are set on concrete slab. The Contractor will be provided with the vacuum gauge readings for the tank(s) recorded before shipping and the two readings shall be compared before off-loading at the site. Any readings varying more than 2" Hg less than the recorded vacuum at the plant site must be reported immediately to the Manufacturer before off-loading the tank.

.3 The Contractor shall immediately report all other defects to the Departmental Representative. The report of damage to the departmental Representative shall include photographs signed and dated by the contractor's on-site foreman.

END OF SECTION