

PART 1 GENERAL

1.1 SUMMARY OF WORK

- .1 Title and description of Work: City of Winnipeg, Public Works Department, Renovations for Pavement Marking Operations Facility.
- .2 Contract method: stipulated price contract.
- .3 Work by others: Testing for soil contamination following removal of existing tanks.
- .4 Future Work: There is potential for additional work involving removal and disposal of contaminated soil if found. This work would be extra to the contract.
- .5 The City's occupancy: The The City will occupy the premises over the course of the work. Existing operations are not to be interrupted except for short periods of time when tie-ins are performed; times for performing tie-ins will be specified by the contract administrator and are likely to occur during off shifts. Time duration for tie-ins not to exceed 6 hours each unless otherwise agreed to by the City.

1.2 CODES AND STANDARDS

- .1 Perform Work in accordance with National Building Code of Canada (NBC) and any other code of provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and references documents.
 - .3 Workers'/Workmens' Compensation Board and municipal authority
 - .4 Requirements of FCC No. 30.1-Standard for Construction Operations, June 1982, issued by Fire Commissioner of Canada.
 - .5 Falsework design and construction in accordance with CSA S269.1-1975.
 - .6 Workplace Hazardous Materials Information System (WHMIS).

1.3 WORK RESTRICTIONS

- .1 Existing Services:
 - .1 Notify Contract Administrator and utility companies of intended interruption of services and obtain required permission.
 - .2 Where Work involves breaking into or connecting to existing services, give Contract Administrator 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants.
 - .3 Construct barriers as required to meet safety requirements

1.4 PROJECT COORDINATION

- .1 Coordinate progress of the Work, progress schedules, submittals, use of site, temporary utilities and construction facilities and controls.
- .2 Maintain at job site, one copy each of the following:
 - .1 Contract drawings and specifications.
 - .2 Addenda.
 - .3 Reviewed shop drawings.
 - .4 Change Orders/Instructions.
 - .5 Other modifications to Contract.
 - .6 Field test reports.
 - .7 Approved work schedule.
 - .8 Manufacturer's installation and application instructions.
 - .9 Safety Program

1.5 CUTTING AND PATCHING

- .1 Approvals
 - .1 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of any element of Project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of The City or separate contractor.
- .2 Inspection
 - .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
 - .2 After uncovering, inspect conditions affecting performance of work.
 - .3 Beginning of cutting or patching means acceptance of existing conditions.
- .3 Execution
 - .1 Perform cutting, fitting, and patching including excavation and fill, to complete the Work.
 - .2 Remove and replace defective and nonconforming work.
 - .3 Provide openings in nonstructural elements of Work for penetrations of mechanical and electrical work.
 - .4 Perform work to avoid damage to other work.
 - .5 Prepare proper surfaces to receive patching and finishing.
 - .6 Cut rigid materials using power saw or core drill. Pneumatic or impact tools not allowed.
 - .7 Restore work with new products in accordance with Contract Documents.

- .8 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces. Penetrations through exterior walls to be flashed and sealed water tight.
- .9 At penetration of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-rated material, full thickness of construction element.
- .10 Refinish surfaces to match adjacent finishes.

1.6 FIELD ENGINEERING

- .1 Qualifications of Surveyor
 - .1 Qualified Surveyor, acceptable to The City.
- .2 Survey Requirements
 - .1 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
 - .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Records
 - .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .4 Setting Out
 - .1 Establish all lines and levels required for construction of the Work, from existing buildings. Provide all lines and stakes and provide required instruments and labour for placing and maintenance of such lines and stakes.
- .5 Toxic and Hazardous Substances and Materials
 - .1 Asbestos discovery: Demolition of spray or trowel-applied asbestos can be hazardous to health. Should material resembling spray or trowel-applied asbestos be encountered in the course of demolition work, stop work and notify Contract Administrator immediately. Do not proceed until written instructions have been received from the Contract Administrator.

1.7 PROJECT MEETINGS

- .1 Preconstruction Meeting
 - .1 A preconstruction meeting will be held with the Contractor and his subtrade representatives and the The City. The meeting will be scheduled by the Contract Administrator after Contract Award and prior to commencement of construction.
- .2 Construction Meetings
 - .1 Contract Administrator will Schedule and administer project progress meetings throughout progress of work.
 - .2 Contractor shall Provide physical space and make arrangements for meetings.
 - .3 Contract Administrator will Record minutes and include significant proceedings and decisions and identify "action by" parties.

1.8 SUBMITTALS

- .1 Administrative
 - .1 Submit to Contract Administrator submittals listed for review. Submit with reasonable promptness and in an orderly sequence so as to not cause delay in the Work.
 - .2 To ensure prompt attention, address all submittals to the Contract Administrator.
 - .3 Work affected by submittals shall not proceed until review is complete.
 - .4 Review submittals prior to submission to Contract Administrator. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of the Work and Contract Documents.
 - .5 Verify field measurements and affected adjacent Work are coordinated.
- .2 Shop Drawings and Product Data
 - .1 Shop Drawings shall carry the stamp of a Professional Engineer licensed to practice in the Province of Manitoba where called for.
 - .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connection, explanatory notes and other information necessary for completion of Work.
 - .3 Adjustments made on shop drawings by Contract Administrator are not intended to change Contract Price.
 - .4 Make changes in shop drawings as Contract Administrator may require. Contract Administrator will require 10 working days for review of shop drawings.
 - .5 Submit shop drawings (numbers as indicated below) for review to Contract Administrator for all items requested in the specification and as Contract Administrator may reasonably request where shop drawings will not be prepared due to standardized manufacture of product:
 - .1 Letter sizes: 210 mm x 280 mm 6 copies
 - .2 Other than above: 6 copies
 - .6 Identify all shop drawings in lower right-hand corner as follows:
 - .1 Name of Project
 - .2 The City project number (if applicable)
 - .3 Contract Administrator project number
 - .4 Title of shop drawing
 - .5 Specification section number
 - .6 Date (revised for each submission)
 - .7 Submissions shall include:
 - .1 Name and address of:
 - .1 Subcontractor (if applicable)
 - .2 Supplier (if applicable)
 - .3 Manufacturer (if applicable)

- .2 Contractor's review stamp, signed by an authorized representative certifying approval of submission, verification of field measurements and compliance with Contract Documents.
- .3 Details of appropriate portions of work as applicable indicating:
 - .1 Fabrication.
 - .2 Layout; showing dimensions, including identified field dimensions and clearance.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Relationship to adjacent work.
- .3 Operating and Maintenance Manuals
 - .1 Two weeks prior to the anticipated date of Substantial Performance of the Work, submit to Contract Administrator, 1 copy of operating and maintenance manuals for review. Upon receipt of final comments from Contract Administrator, revise manuals as required and submit 3 copies of manuals to Contract Administrator.
 - .2 Manuals to contain operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules and similar maintenance information.
 - .3 Bind contents in a three-ring, hard covered, plastic -jacketed binder. Organize contents into applicable categories of work, parallel to specifications sections.
- .4 Record Drawings
 - .1 After award of Contract, Contract Administrator will provide 1 set of prints for purpose of maintaining record drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by Contract Administrator.
 - .2 Record locations of concealed components of mechanical and electrical services.
 - .3 Identify drawings as "Project Record Copy". Maintain in new condition and make available for inspection on site by Contract Administrator.
 - .4 On completion of Work and prior to final inspection, submit record documents to Contract Administrator.

1.9 TIME

- .1 Time is of the essence for this Work.

1.10 SCHEDULE

- .1 Schedules Required
 - .1 Construction Progress Schedule.
 - .2 Submittal Schedule for Shop Drawings, etc.
- .2 Format
 - .1 Indicate the following:
 - .1 Anticipated delivery dates for equipment.

- .2 Commencement and completion of work of each section of the specification conforming to the Project milestones.
- .3 Final completion date within time period required by Contract Documents.
- .3 Submission
 - .1 Submit initial schedules within 15 days after award of Contract.
 - .2 Submit one opaque reproduction, plus 2 copies to be retained by Contract Administrator.
 - .3 Contract Administrator will review schedule and return reviewed copy within 10 days after receipt.
 - .4 Resubmit finalized schedule within 7 days after return of reviewed copy.

1.11 QUALITY CONTROL

- .1 Inspection
 - .1 Refer to General Conditions, C11, INSPECTION.
- .2 Independent Inspection Agencies
 - .1 Independent Inspection/Testing Agencies will be engaged by Contractor for purpose of inspecting and/or testing portions of Work. Work to be tested includes backfill compaction and concrete quality/strength.
 - .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Reports
 - .1 Submit 4 copies of inspection and test reports promptly to Contract Administrator.
 - .2 Provide copies to Subcontractor of work being inspected/tested.

1.12 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

- .1 Installation/Removal
 - .1 Provide construction facilities and temporary controls in order to execute work expeditiously.
 - .2 Remove from site all such facilities after use.
- .2 Scaffolding
 - .1 Provide and maintain scaffolding, ramps, ladders, and platforms.
 - .2 Design and construct scaffolding in accordance with CSA S269.2-M87(R1998).
- .3 Hoisting
 - .1 Provide, operate and maintain hoists and cranes required for moving of equipment and materials.
 - .2 Hoists and cranes shall be operated by qualified operator.
- .4 Guard Rails and Barricades
 - .1 Provide as required by governing authorities, secure, rigid guard railings and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

- .5 Dewatering
 - .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.
- .6 Sanitary Facilities
 - .1 Provide sufficient sanitary facilities for workers in accordance with local health authorities.
- .8 Water Supply
 - .1 The City will provide a continuous supply of potable water for construction use. Provide connections from designated takeoff points.
 - .2 The City assumes no responsibility for inconvenience or costs incurred due to loss of water or interruptions.
- .9 Temporary Power and Lighting
 - .1 The City will pay for temporary power required during construction for temporary lighting and operating of power tools, to maximum supply of 230 volts 30 amps.
 - .2 Provide connections from designated take-off points.
 - .3 Provide and maintain temporary lighting throughout the Project. The level of illumination on all work areas shall be not less than 30-foot candles; walkways shall be not less than 5-foot candles.
 - .4 Temporary power for electric cranes and other equipment requiring a supply in excess of above shall be the responsibility of the Contractor.
 - .5 Pay for damage to existing plant if caused by Contractor negligence.
 - .6 The City assumes no responsibility for inconvenience or costs incurred due to loss of power or interruptions.
- .10 Construction Offices
 - .1 Provide and maintain in clean condition during progress of Work, adequately lighted, heated and ventilated Contractor's office with space for filing and layout of Contract Documents and Contractor's normal site office staff.
 - .2 Provide adequate required first aid facilities.
 - .3 Subcontractors may provide their own offices as necessary. Direct the locations of these offices.
- .11 Equipment/Tool/Materials Storage
 - .1 If required Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
 - .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.
- .12 Construction Parking
 - .1 Parking as directed by The City will be permitted on site provided it does not disrupt the performance of Work.

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- 13 Project Cleanliness
- .1 Maintain the Work in tidy condition, free from accumulation of waste products and debris.

1.13 MATERIAL AND EQUIPMENT

- .1 Product and Material Quality
 - .1 Products, materials, equipment and articles (referred to as Products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
 - .2 Defective Products, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
 - .3 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Contract Administrator based upon requirements of Contract Documents.
- .2 Storage, Handling and Protection
 - .1 Handle and store Products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
 - .2 Store products subject to damage from weather in weatherproof enclosures.
- .3 Manufacturer's Instructions
 - .1 Unless otherwise indicated in specifications, install or erect Products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.
 - .2 Notify Contract Administrator in writing, of conflicts between specifications and manufacturer's instructions, so that Contract Administrator may establish course of action.
- .4 Workmanship
 - .1 Workmanship shall be best quality, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Contract Administrator if required Work is such as to make it impractical to produce required results.
 - .2 Decisions as to quality or fitness of workmanship in cases of dispute rest solely with Contract Administrator, whose decision is final.

1.14 PROJECT CLOSEOUT

- .1 Final Cleaning
 - .1 Remove waste materials and debris from site at regularly scheduled times or dispose of as directed by Contract Administrator. Do not burn waste materials on site.
 - .2 Leave work broom clean before inspection process commences.
 - .3 Broom clean and wash exterior walks, steps and surfaces.
 - .4 Remove dirt and other disfigurations from exterior surfaces.
- .2 Systems Demonstration

- .1 Prior to final inspection, demonstrate operation of each system to The City and Contract Administrator.
- .2 Instruct personnel in operation, adjustment, and maintenance of equipment and systems, using provided operation and maintenance data as basis for instruction.
- .3 Documents
 - .1 Collect reviewed submittals and assemble documents executed by Subcontractors, suppliers, and manufacturers.
 - .2 Submit material prior to final Application for Payment.
 - .3 Submit operation and maintenance data, record (as-built) drawings.
 - .4 Provide warranties and bonds fully executed and notarized.
 - .5 Execute transition of Performance and Labour and Materials Payment Bond to warranty period requirements.

1.15 PAINTING

- .1 Paint all piping, supports, equipment, etc. Provide finish painting for equipment supplied with primer only (e.g. fan).
- .2 Stainless steel, galvanized, copper and factory finish painted surfaces do not require painting.
- .3 Painting to conform to MPI requirements.
- .4 Colours to be advised by the Contract Administrator.

1.16 CONTROLS

- .1 Contractor to provide fully functional controls for the ventilation system and sewage lift station including alarms. Refer also to the electrical drawings.
- .2 Ventilation controls to operate in accordance with the following sequence of operation:
 - .1 AHU-1

The outside air intake for AHU-1 shall provide 100% outside air for free cooling in the summer. The outside air damper minimum position setting during winter shall be 600 cfm. SCR controlled 20 kW electric heating coil shall heat the outside air in winter. Heater control shall be from discharge air temperature.
 - .2 AHU-2

The outside air intake for AHU-2 shall provide 100% outside air for free cooling in the summer. The outside air damper minimum position setting during winter shall be 1500 cfm. SCR controlled 50 kW electric heating coil shall heat the outside air in winter. Heater control shall be from unit discharge air temperature. A space combustible gas sensor shall be provided to detect the presence of combustible gases. The sensor / monitor shall be Armstrong Monitoring Corporation 1A series gas monitor. The unit will alarm at a level 25% of the lower combustible limit and at the same time the existing exhaust fan shall be activated and AHU-2 shall switch to 1500 cfm minimum outside air damper position. The existing roof mounted exhaust fan shall be balanced to handle a minimum of 1500 cfm.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 References

- .1 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) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts
- .2 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 1999).
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-M88(R2000), Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S702-1997, Thermal Insulation, Mineral Fibre, for Buildings

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 defined herein.
- .2 TIAC ss:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.4 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 0001 – General Requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

1.5 Qualifications

- .1 Installer to be specialist in performing Work of this Section, and have at least 3 years successful experience in this size and type of project, member of TIAC.

PART 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, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702.

2.3 Insulation Securement

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.4 Cement

- .1 Thermal insulating and finishing cement:
 - .1 Air drying on mineral wool, to ASTM C449/C449M.

2.5 Vapour Retarder Lap Adhesive

- .1 Water based, fire retardant type, compatible with insulation.

2.6 Indoor Vapour Retarder Finish

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 Jackets

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.

- .2 Colours: by Contract Administrator.
- .3 Minimum service temperatures: -20°C.
- .4 Maximum service temperature: 65°C.
- .5 Moisture vapour transmission: 0.02 perm.
- .6 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Pressure sensitive vinyl tape of matching colour.
- .2 Canvas:
 - .1 120 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921. Use only where use of PVC Jacket is impractical.
 - .2 Lagging adhesive: Compatible with insulation.

PART 3 EXECUTION

3.1 Pre- Installation Requirement

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

3.2 Installation

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .4 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.3 Piping Insulation Schedules

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 Forcemain and building water service piping entering or leaving the building and external to the building shall be insulated with 50 mm thick insulation from the building wall to 2.5 meters minimum below grade. Insulation below grade shall be waterproof foamglass or urethane.
- .3 TIAC Code: A-3.
 - .1 Securements: SS Wire Bands Tape at 300 mm oc.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.

- .3 Installation: TIAC Code: 1501-C.
- .4 Thickness of insulation to be 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.

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic water with vapour retarder		A-3	25	25	25	25	25	25

- .5 Finishes:
 - .1 Exposed indoors: Canvas PVC jacket.
 - .2 Exposed in mechanical rooms: Canvas PVC jacket.
 - .3 Exposed outdoors: Stainless steel sheet metal jacketing.
 - .4 Concealed, indoors: canvas on valves, fittings. No further finish.
 - .5 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
 - .6 Installation: To appropriate TIAC code CRF/1 through CPF/5.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for plumbing pumps.
- .2 Related Sections:
 - .1 Section 01 0001 – General Requirements.

1.2 SUBMITTALS

- .1 Product Data:
 - .1 Submit the manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.
- .2 Shop Drawings.
 - .1 Submit shop drawings to indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
 - .2 Wiring and schematic diagrams.
 - .3 Dimensions and recommended installation.
 - .4 Pump performance and efficiency curves.
- .3 Certificates: submit certificates signed by the manufacturer certifying that materials comply with the specified performance characteristics and physical properties.
- .4 Instructions: submit manufacturer's installation instructions.
- .5 Closeout submittals: submit maintenance and engineering data for incorporation into the manual include:
 - .1 Manufacturers name, type, model year, capacity and serial number.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list with names and addresses.

PART 2 PRODUCTS

2.1 PSP-1 PORTABLE SUBMERSIBLE PUMP

- .1 Capacity: 1.9 L/s at 30 kPa head with NPS 40Ø discharge.
- .2 Construction: CSA approved, permanently lubricated motor, stainless steel motor casing, 303 stainless steel shaft, glass-filled thermoplastic impeller and volute.
- .3 Motor: 1/3 hp permanent-split-capacitor type, Class F insulation, built-in thermal overload protection with automatic reset.
- .4 Control: manually controlled.

2.2 LS-1 PACKAGED LIFT STATION

- .1 Capacity: 2.8 L/s at 75 kPa head with NPS 75Ø discharge.
- .2 Pump Construction: duplex CSA approved, housing epoxy coated cast iron, stainless steel, stainless steel shaft, non-clog bronze impeller, mechanical shaft seal.
- .3 Motor: 1.7 hp hermetically sealed, with automatic overload protection.
- .4 Control: four (4) mercury float switches and duplex control box.
- .5 Basin: heavy duty fibreglass construction c/w 50Ø discharge and 100Ø inlet hubs, 50Ø vent connection, and an air tight cover.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Make piping and electrical connections to pump and motor assembly and controls as indicated.
- .2 Ensure pump and motor assembly do not support piping.
- .3 Align vertical pit mounted pump assembly after mounting and securing cover plate.
- .4 Place 150 mm sand under sump pit tank.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

- .1 Materials and installation for copper domestic water service used in the following:
 - .1 Hard drawn copper domestic cold water services inside building.

1.2 References

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
 - .1 ANSI/ASME B16.15-02, 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 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A307-03, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM B88M-03, Standard Specification for Seamless Copper Water Tube (Metric).
 - .3 ASTM F492-95, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.
- .3 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-80-03, Bronze Gate, Globe, Angle and Check Valves.
- .4 National Research Council (NRC)/Institute for Research in Construction.
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC) - 1995.

1.3 Submittals

- .1 Submit shop drawings for the following: valves.
- .2 Provide maintenance data for incorporation into manual.

PART 2 PRODUCTS

2.1 Piping

- .1 Domestic hot and cold, within building.
 - .1 Above ground: copper tube, hard drawn, type K, M: to ASTM B88M.

2.2 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.

2.3 Joints

- .1 Rubber gaskets, 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy.
- .4 Teflon tape: for threaded joints.
- .5 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.4 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.

2.5 Globe Valves

- .1 NPS2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.
 - .2 Lockshield handles.

2.6 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.

2.7 Ball Valves

- .1 NPS 2 and under, screwed:
 - .1 Class 150.
 - .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle.
- .2 NPS 2 and under, soldered:
 - .1 To ANSI/ASME B16.18, Class 150.
 - .2 Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors.

PART 3 EXECUTION

3.1 Installation

- .1 Install in accordance with the NPC, Province(s) Plumbing Code and local authority having jurisdiction.
- .2 Assemble piping using fittings manufactured to ANSI standards.
- .3 Connect to fixtures and equipment in accordance with the manufacturer's written instructions unless otherwise indicated.

3.2 Valves

- .1 Isolate equipment, fixtures and branches with ball valves.

3.3 Pressure Tests

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

3.4 Flushing and Cleaning

- .1 Flush entire system.

3.5 Pre-start-up Inspections

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.

3.6 Disinfection

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.
- .2 Upon completion, provide laboratory test reports on water quality for Contract Administrator approval.

3.7 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.
- .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.
- .4 Rectify start-up deficiencies.

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DOMESTIC WATER PIPING - COPPER

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END OF SECTION

PART 1 GENERAL

1.1 Summary

.1 Section Includes:

.1 The installation of drainage waste and vent piping - plastic.

1.2 References

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

.1 ASTM D2235-01, Specification for Solvent Cement for Acrylonitrille-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

.2 ASTM D2564-02, Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.3 ASTM D1784-08 Specification for Rigid (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

.2 Canadian Standards Association (CSA International).

.1 CSA-Series B1800-02, Plastic Non-pressure 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.

.4 CSA-B137.3-05, Rigid Polyvinylchloride (PVC) Pipe and Fittings for Pressure Applications.

PART 2 PRODUCTS

2.1 Piping And Fittings

.1 For pumped sanitary waste piping to:

1. Type 1 Grade 1 PVC Schedule 40 to ASTM D1784.

.2 For buried and 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.

.2 Solvent weld for ABS: to ASTM D2235.

.3 Solvent weld for Schedule 40 PVC: to ASTM D1784

PART 3 EXECUTION

3.1 Installation

- .1 Install in accordance with the NPC, Manitoba Plumbing Code, local authority having jurisdiction, and as indicated.
- .2 Install PVC pipes, fittings and valves in accordance with the manufacturer's instructions.

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 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .4 Affix applicable label (sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 References

- .1 Canadian Standards Association (CSA International)
 - .1 CSA B51-97, Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CAN/CSA C22.2No.110-94(R1999), Construction and Test of Electric Storage Tank Water Heaters.
 - .3 CAN/CSA-C191 Series-00, Performance of Electric Storage Tank Water Heaters for Household Service.
 - .4 CAN/CSA-C309-M90(R1998), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 001 – General Requirements.
- .2 Indicate:
 - .1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

PART 2 PRODUCTS

2.1 Electric

- .1 To CAN/CSA C22.2 No.110, CAN/CSA-C191 and CAN/CSA-C309 for glass-lined storage tanks, with immersion type heating elements, surface mounted type adjustable thermostat with an integral, manual reset and high limit control.
- .2 Tank: Glass lined steel, rigid polyurethane foam insulation, enamelled steel jacket, 3 year warranty certificate.
- .3 Acceptable material: Rheem-Ruud.

2.2 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 Factory installed magnesium anodes adequate for 20 years of operation and located for easy replacement.

PART 3 EXECUTION

3.1 Installation

- .1 Install in accordance with the manufacturer's recommendations and the authority having jurisdiction.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for plumbing specialties and accessories.
- .2 Related Sections:
 - .1 Section 01 0001 – General Requirements.

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 American Water Works Association (AWWA).
 - .1 AWWA C700-02, Cold Water Meters-Displacement Type, Bronze Main Case.
 - .2 AWWA C701-02, Cold Water Meters-Turbine Type for Customer Service.
 - .3 AWWA C702-1-01, Cold Water Meters-Compound Type.
- .3 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.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 0001 – General Requirements.
- .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 and finish.
- .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.

PART 2 PRODUCTS

2.1 CLEANOUTS

- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Access Covers:
 - .1 Wall Access: face or wall type, polished nickel bronzeround 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: nickel bronze, round, 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 nickel 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.

2.2 NON-FREEZE WALL HYDRANTS

- .1 Recessed with integral vacuum breaker, NPS 20Ø hose outlet, removable operating key, and bronze box with chrome plated face finish.

2.3 WATER METERS

- .1 Displacement type to AWWA C700.
- .2 Capacity: flow rate – 1.0 l/s, pressure drop - 22 kPa, pipe connections NPS - 25Ø.

PART 3 INSTALLATION

3.1 CLEANOUTS

- .1 Install cleanouts at base of soil and waste stacks, at locations required 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.

3.2 NON-FREEZE WALL HYDRANTS

- .1 Install 600 mm above finished grade unless otherwise indicated.

3.3 WATER METERS

- .1 Install water meter provided by the local water authority.
- .2 Install water meter as indicated.

3.4 TESTING AND ADJUSTING

- .1 Cleanouts:
 - .1 Verify covers are gas-tight, secure, yet readily removable.
- .2 Non-freeze wall hydrants:
 - .1 Verify complete drainage, freeze protection.
 - .2 Verify operation of vacuum breakers.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 References

- .1 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-B45 Series-0], Plumbing Fixtures.
 - .2 CAN/CSA-B125[0], Plumbing Fittings.
 - .3 CAN/CSA-B651-95(R2001), Barrier-Free Design.

1.3 Submittals

- .1 Submit shop drawings for the following: service sink.

PART 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.
- .7 Service sinks:
 - .1 Sink: acid-resisting vitreous china, roll rim, with plain back. Size: 559 x 483 x 330mm.
 - .2 Supply fitting: with vacuum breaker, indexed cross handles, heavy cast brass spout with pail hook, aerator, brace to wall, integral stop valves. Provide accessories to limit maximum flow rate to 8.35 l/minute at 413 kPa.
 - .3 Waste fitting: chrome plated outlet strainer, enamelled cast iron trap standard with brass cleanout.
 - .4 Rim guard: stainless steel, continuous on three sides.
- .8 Fixture piping:
 - .1 Hot and cold water supplies to each fixture:
 - .1 Chrome plated rigid supply pipes each with handwheel stop, reducers, escutcheon.
 - .2 Waste:
 - .1 Cast iron P trap with clean out on each fixture not having integral trap.

- .9 Chair carriers:
 - .1 Factory manufactured floor-mounted carrier systems for all wall-mounted fixtures.

PART 3 EXECUTION

3.1 Installation

- .1 Mounting heights:
 - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
 - .2 Wall-hung fixtures: as indicated, measured from finished floor.
 - .3 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

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 shop drawings for the following: water closet, lavatory, and service sink.
- .2 Indicate fixtures and trim:
 - .1 Dimensions, construction details, roughing-in dimensions.
 - .2 Factory-set water consumption per flush at recommended pressure.
 - .3 (For water closets, urinals): minimum pressure required for flushing.

PART 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 the product of one manufacturer and of the same type.
- .6 Trim in any one location to be the product of one manufacturer and of the same type.
- .7 Water closets:
 - .1 WC-1 : floor-mounted, flush tank.
 - .1 Bowl: vitreous china, siphon jet, elongated front, back outlet, two-piece toilet combination, bowl and bolt caps.
 - .2 Closet tank: vitreous china with dual flush type : 4.0 liters/flush – low flush and 6.0 liters/flush – high flush, water pressure range of 138 kPa to 552 kPa.

- .8 Water Closet Seats.
 - .1 Seat: white, elongated, open front, moulded solid plastic, less cover, stainless steel check hinges, stainless steel insert post.
- .9 Washroom Lavatories:
 - .1 LAV-1 : Wall-hung, rectangular basin, ledge back:
 - .1 Vitreous china, with splash lip, soap depressions, supply openings on 102 mm centres, front overflow.
- .10 Washroom Lavatory Trim:
 - .1 Chrome plated brass, single handed mixing faucet, mixing spout, washerless, aerator, handle.
 - .1 Provide accessories to limit the maximum flow rate to 5.68 l/minute at 413 kPa.
 - .2 Waste fitting: Pop-up.
- .11 Fixture piping:
 - .1 Hot and cold water supplies to fixtures:
 - .1 Stainless steel flexible supply pipes with handwheel stop, reducers, escutcheon.
 - .2 Waste:
 - .1 Brass P trap with clean out on fixtures not having integral trap.
 - .2 Chrome plated in exposed places.
- .12 Chair carriers:
 - .1 Factory manufactured floor-mounted lavatory carrier systems with concealed arms for wall-mounted fixtures.

PART 3 EXECUTION

3.1 Installation

- .1 Mounting heights:
 - .1 Standard: to comply with the manufacturer's recommendations unless otherwise indicated or specified.
 - .2 Wall-hung fixtures: as indicated, measured from finished floor.
 - .3 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

3.2 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 Water closets: flushing action.
 - .2 Aerators: operation, cleanliness.
 - .3 Vacuum breakers, backflow preventers: operation under all conditions.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 References

- .1 Air-Conditioning and Refrigeration Institute (ARI).
 - .1 ARI 1010-02, Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.
- .2 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-B45 Series-02, CSA Standards on Plumbing Fixtures.
 - .2 CAN/CSA-B125-01, Plumbing Fittings.
 - .3 CAN/CSA-B651-95(R2001), Barrier-Free Design.

1.3 Submittals

- .1 Submit shop drawings in accordance with Section 01 0001 – General Requirements.
- .2 Provide maintenance data for incorporation into manual.

PART 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 Drinking fountains:
 - .1 DF-1 : recessed stainless steel with elevated bubbler base, integral strainer, wall screws with washers and cap nuts.
 - .1 Trim: angle stream anti-squirt bubbler with automatic stream regulator, self-closing valve, screwdriver stop, waste tailpiece, trap.
 - .2 Refrigeration system: packaged hermetic R134a unit with pre-cooler, insulated double wall chiller, storage tank, air-cooled condenser, thermostatically controlled.
 - .3 Capacity: 30 L/h from 27 degrees C to 10 degrees C, with 32 degrees C ambient air. In accordance with ARI 1010.
 - .4 Electrical: grounded electrical cord with plug: 120 V, 60 Hz. CSA certified.
 - .2 Cold water supplies to each fixture:

- .1 Chrome plated rigid or flexible supply pipes with screwdriver stop, reducers, escutcheon.
- .3 Waste:
 - .1 Brass P trap with cleanout on each fixture not having integral trap.
 - .2 Chrome plated in all exposed places.

PART 3 EXECUTION

3.1 Installation

- .1 Mounting heights:
 - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 REFERENCES

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1-04, Power Piping.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 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.
- .4 Underwriter's Laboratories of Canada (ULC)

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to the 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 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.
 - .4 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

1.4 SUBMITTALS

- .1 Submit shop drawings for following items:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized painted with zinc-rich paint after manufacture.
 - .2 Ensure steel hangers in contact with copper piping are copper plated epoxy coated.
- .2 Shop and field-fabricated assemblies:
 - .1 Trapeze hanger assemblies.
 - .2 Steel brackets.
- .3 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.
- .4 Pipe attachments: material to MSS SP58:
 - .1 Attachments for steel piping: carbon steel galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Oversize pipe hangers and supports.
- .5 Adjustable clevis: material to MSS SP69 UL listed FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for riveting to insulation shields.
- .6 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: galvanized.
 - .2 Finishes for copper pipework: galvanized, with formed portion plastic coated.

2.3 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m³ density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

2.4 HOUSE-KEEPING PADS

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.

2.5 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with the 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 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.3 HANGER SPACING

- .1 Plumbing piping: to Canadian Plumbing Code authority having jurisdiction.
- .2 Copper piping: up to NPS 1/2: every 1.5 m.
- .3 Within 300 m of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m

3.4 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 the manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and requirements for the identification of piping systems, valves and controllers, including the installation and location of identification systems.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 0001 – General Requirements.
- .2 Product data to include paint colour chips, nameplates, labels, tags, lists of proposed legends.

PART 2 PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by the manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
 - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

Size # mm	Conform to following table: 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

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

- .1 Terminal cabinets, control panels: use size # 5.
- .2 Equipment in Mechanical Rooms: use size # 7.

2.3 EXISTING IDENTIFICATION SYSTEMS

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified in this section.
- .3 Before starting work, obtain written approval of identification system from the Contract Administrator

2.4 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:
 - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
 - .1 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 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 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.
- .7 Colours and Legends:
 - .1 Where not listed, obtain direction from the Contract Administrator.
 - .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:

<u>Contents</u>	<u>Background Color Marking</u>	<u>Legend</u>
Domestic cold water supply	Green	Dom CWS
Domestic hot water supply	Green	Dom HW Supply
Sanitary Drain	Green	SAN
Plumbing Vent	Green	SAN VENT

2.5 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm stamped identification data filled with black paint.
- .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. Provide copy of flow diagram in the Operating and Maintenance Manual.

2.6 CONTROLS COMPONENTS IDENTIFICATION

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

2.7 LANGUAGE

- .1 Identification in English

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

- .1 Provide identification only after painting has been completed.

3.3 INSTALLATION

- .1 Perform Work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and or CSA registration plates as required by the respective agency.

3.4 NAMEPLATES

- .1 Locations:
 - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
 - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
 - .1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING SYSTEMS

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 At beginning and end points of each run and at each piece of equipment in run.
- .7 At point immediately upstream of major manually operated or automatically controlled valves. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .8 Identification easily and accurately readable from usual operating areas and from access points.

- .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 CLEANING

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

END OF SECTION

PART 1 GENERAL

1.1 General

- .1 TAB means to test, adjust and balance to perform in accordance with the requirements of Contract Documents and to do other work as specified in this section.

1.2 Qualifications Of Tab Personnel

- .1 Names of personnel it is proposed to perform TAB to be submitted to and approved by the Contract Administrator.
- .2 Provide documentation confirming qualifications, successful experience.

1.3 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 so as 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.

1.4 Co-ordination

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as 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.

1.5 Pre-tab Review

- .1 Review contract documents before project construction is started and confirm in writing to the Contract Administrator adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to the Contract Administrator in writing all proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.6 Start-up

- .1 Follow start-up procedures as recommended by the equipment manufacturer unless specified otherwise

1.7 Operation Of Systems During Tab

- .1 Operate systems for length of time required for TAB and as required by the Contract Administrator for verification of TAB reports.

1.8 Start Of Tab

- .1 Notify the Contract Administrator 7 days prior to the start of TAB.
- .2 Start TAB when HVAC System is essentially completed, including:
- .3 All provisions for TAB installed and operational.
- .4 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 Duct systems clean.
 - .2 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .3 Correct fan rotation.
 - .4 Fire, smoke, volume control dampers installed and open.
 - .5 Access doors, installed, closed.
 - .6 Outlets installed, volume control dampers open.

1.9 Application Tolerances

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: plus 10 %, minus 0 %.

1.10 Accuracy Tolerances

- .1 Measured values to be accurate to within plus or minus 2 % of actual values.

1.11 Instruments

- .1 Prior to TAB, submit to the Contract Administrator list of instruments to be used together with serial numbers.
- .2 Calibrate in accordance with the 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 the Contract Administrator.

1.12 Preliminary Tab Report

- .1 Submit for checking and approval of the Contract Administrator, 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 Calculation procedures.
- .4 Summaries.

1.13 Tab Report

- .1 Format to be in accordance with the referenced standard.
- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit 6 copies of TAB Report to the Contract Administrator for verification and approval, in English in D-ring binders, complete with index tabs.

1.14 Verification

- .1 Reported results subject to verification by the Contract Administrator
- .2 Provide manpower and instrumentation to verify up to 30 % of reported results.
- .3 Number and location of verified results to be at the discretion of the Contract Administrator.
- .4 Bear costs to repeat TAB as required to the satisfaction of the Contract Administrator

1.15 Settings

- .1 After TAB is completed to the satisfaction of the Contract Administrator, 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. Markings not to be eradicated or covered in any way.

1.16 Completion Of Tab

- .1 TAB to be considered complete when final TAB Report received and approved by the Contract Administrator.

1.17 Air Systems

- .1 Standard: TAB to be to most stringent of this section or TAB standards of AABC SMACNA ASHRAE.
- .2 Do TAB of following systems, equipment, components, controls:
 - .1 Maintenance area and paint storage area ventilation system.
- .3 Qualifications: personnel performing TAB to be current member in good standing of AABC qualified to standards of AABC.
- .4 Quality assurance: Perform TAB under the direction of the supervisor qualified to standards of AABC.

- .5 Measurements: to include, but not limited to, following 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.
- .6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
 - .1 Inlet and outlet of dampers, filter, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts and main branch. Take measurements for full F.A. and minimum F.A. (600 cfm and 1500 cfm) conditions.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used.

PART 3 EXECUTION

3.1 Not Used

- .1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipmentfeet.

1.2 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 C553-00, Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .2 ASTM C612-00a, Specification for Mineral Fiber Block and Board 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.
 - .4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (R1999).
 - .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-M88 (R2000), Surface Burning Characteristics of Building Materials and Assemblies.

1.3 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.

1.4 Qualifications

- .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, member of TIAC..

1.5 Delivery, Storage And Handling

- .1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.

PART 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°C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

2.3 Jackets

- .1 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: Compatible with insulation.

2.4 Accessories

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
 - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .5 Contact adhesive: quick-setting
- .6 Canvas adhesive: washable.
- .7 Tie wire: 1.5 mm stainless steel.

- .8 Banding: 19 mm wide, 0.5 mm thick stainless steel.
- .9 Fasteners: 2 mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

PART 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 the manufacturer's instructions and as indicated.
- .3 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .4 Supports, Hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .5 Fasteners: At 300 mm oc in horizontal and vertical directions, minimum two rows each side.

3.3 Ductwork Insulation Schedule

- .1 Insulation types and thicknesses: Conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature F.A. intake air ducts to return damper & fan.	C-1	Yes	50
Exhaust duct from fan to exterior wall	C-1	Yes	50
Acoustically lined ducts (where indicated)	None	No	25

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A653/A653M-03, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 National Fire Protection Association (NFPA).
 - .1 NFPA 90A-02, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-02, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
 - .3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.

PART 2 PRODUCTS

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
250	C
125	C

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

2.2 SEALANT

- .1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant.
Temperature range of minus 30 degrees C to plus 93 degrees Celsius.

2.3 TAPE

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

2.4 DUCT LEAKAGE

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

2.5 FITTINGS

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
 - .1 Rectangular. Centreline radius: 1.5 times width of duct.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single thickness turning vanes.
 - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct or 45 degrees entry on branch.
- .5 Transitions:
 - .1 Diverging: 20 degrees maximum included angle.
 - .2 Converging: 30degrees maximum included angle.
- .6 Offsets:
 - .1 Full radiused elbows as indicated.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation.
- .2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.

2.8 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500.

.2 Hanger configuration: to ASHRAE and SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA 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

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp steel plate washer.

.3 For steel beams: manufactured beam clamps:

PART 3 EXECUTION

3.1 GENERAL

.1 Do work in accordance with NFPA 90A NFPA 90B ASHRAE SMACNA.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct.

.3 Install breakaway joints in ductwork on sides of fire separation.

.4 Manufacture duct in lengths to accommodate installation of acoustic duct lining. Duct size to be increased to offset thickness of liner. Duct sizes shown to be duct inside dimension.

3.2 HANGERS

.1 Strap 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 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 Fresh air intake.

- .2 Form bottom of horizontal duct without longitudinal seams.
 - .1 Solder joints of bottom and side sheets.
 - .2 Seal other joints with duct sealer.
- .3 Fit base of riser with 50 mm deep drain sump and 32 mm drain connected, with deep seal and discharging as indicated.

3.4 SEALING AND TAPING

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

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for duct accessories including flexible connections, access doors, vanes and collars.

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 95.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material:
 - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m².

2.3 ACCESS DOORS IN DUCTS

- .1 Non-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.
- .2 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.
- .3 Gaskets: neoprene.
- .4 Hardware:
 - .1 300 mm x 300 mm: two sash locks.

2.4 TURNING VANES

- .1 Factory or shop fabricated single thickness and double thickness with trailing edge, to the recommendations of SMACNA and as indicated.

2.5 SPIN-IN COLLARS

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Flexible Connections:
 - .1 Install in following locations:
 - .1 Inlets and outlets to supply air units and fans.
 - .2 Inlets and outlets of exhaust and return air fans.
 - .2 Length of connection: 100 mm.
 - .3 Minimum distance between metal parts when system in operation: 75 mm.
 - .4 Install in accordance with the 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.
- .2 Access Doors:
 - .1 Size:
 - .1 300 mm x 300 mm for servicing entry.
 - .2 Locations:
 - .1 Fire dampers.
- .3 Turning vanes:
 - .1 Install in accordance with the recommendations of SMACNA and as indicated.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 653M- 95, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

1.3 Product Data

- .1 Submit shop drawings in accordance with Section 01 0001 – General Requirements.
- .2 Indicate the following:
 - .1 Performance data.
 - .2 Actuator details.

1.4 Closeout Submittals

- .1 Provide maintenance data for incorporation into the maintenance manual.

1.5 Certification Of Ratings

- .1 Catalogue or published ratings shall be those obtained from tests carried out by the manufacturer or those ordered by him from an independent testing agency.

PART 2 PRODUCTS

2.1 Multi-leaf Dampers

- .1 Opposed blade type as indicated.
- .2 Extruded aluminum , interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, and extruded aluminum frame.
- .3 Pressure fit self-lubricated bronze bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Performance:
 - .1 Leakage: in closed position to be less than 2% of rated air flow at 125 Pa differential across damper.
 - .2 Pressure drop: at full open position to be less than 20 Pa differential across damper at 7.6 m/s.
- .6 Insulated aluminum dampers:

- .1 Frames: insulated with extruded polystyrene foam with R factor of 5.0.
- .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 5.0.

2.2 Relief Dampers

- .1 Automatic multi-leaf aluminum dampers with ball bearing centre pivoted and counter-weights set to open at 15 Pa static pressure.

PART 3 EXECUTION

3.1 Installation

- .1 Install where indicated.
- .2 Install in accordance with the recommendations of SMACNA and manufacturer's instructions.
- .3 Install access door adjacent to each damper.
- .4 Ensure dampers are observable and accessible.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 References

- .1 American National Standards Institute/National Fire Protection Association (ANSI/NFPA)
 - .1 ANSI/NFPA 90A- [1989] , Installation of Air Conditioning and Ventilating Systems.
 - .2 Underwriters Laboratories of Canada (ULC)
 - .1 CAN4-S112- M82(R1987) , Fire Test of Fire Damper Assemblies.
 - .2 CAN4-S112.2- M84, Fire Test of Ceiling Firestop Flap Assemblies.
 - .3 ULC-S505- 1974, Fusible Links for Fire Protection Service.

1.3 Product Data

- .1 Submit shop drawings for the following: fire damper
- .2 Provide maintenance data for incorporation into manual.

PART 2 PRODUCTS

2.1 Fire Dampers

- .1 Fire dampers: arrangement Type B, listed and bear label of ULC, meet requirements of the provincial fire authority, NFPA 90A and authorities having jurisdiction. Fire damper assemblies to be fire tested in accordance with CAN4-S112.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
- .3 Top hinged: curtain type; sized to maintain full duct cross section as indicated.
- .4 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.
- .5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper on both sides of fire separation being pierced.
- .6 Acceptable material: Ruskin.

PART 3 EXECUTION

3.1 Installation

- .1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from the authority having jurisdiction.
- .4 Install access door adjacent to each damper.
- .5 Coordinate with installer of firestopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 References

- .1 AMCA 99-1986, Standards Handbook.
- .2 ANSI/AMCA 210-1985, Laboratory Methods of Testing Fans for Rating.
- .3 AMCA 300-1985 Revised 1987, Reverberant Room Method for Sound Testing of Fans.
- .4 AMCA 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .5 ANSI/ASHRAE 51- 1985, Laboratory Methods of Testing Fans for Rating.
- .6 CGSB 1-GP-181M-77, Coating, Zinc Rich, Organic, Ready Mixed.

1.3 Shop Drawings And Product Data

- .1 Provide:
 - .1 Fan performance curves showing point of operation, BHP and efficiency.
 - .2 Sound rating data at point of operation.
- .2 Indicate:
 - .1 Motors, sheaves, bearings, shaft details.

1.4 Closeout Submittals

- .1 Provide operation and maintenance data for incorporation into maintenance manual.

1.5 Extra Materials

- .1 Provide maintenance materials as follow:
 - .1 Spare parts to include:
 - .1 Matched sets of belts.
- .2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, and for placement into operating manual.

PART 2 PRODUCTS

2.1 Fans General

- .1 Capacity: flow rate, total pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
- .2 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
- .3 Sound ratings: comply with AMCA 301, tested to AMCA 300. Unit shall bear AMCA certified sound rating seal.
- .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.
- .5 Motors:
 - .1 Sizes as specified.
- .6 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards.
- .7 Factory primed before assembly in colour standard to the manufacturer.
- .8 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .9 Vibration isolation: install spring vibration isolators in fan hanger rods.
- .10 Flexible connections: provide flexible connection at fan inlet and outlet.

2.2 Centrifugal Fans

- .1 Fan wheels:
 - .1 Welded steel construction.
 - .2 Maximum operating speed of centrifugal fans not more than 50% of first critical speed.
 - .3 Backward inclined blades as indicated.
- .2 Bearings: heavy duty grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 100,000.
- .3 Housings:
 - .1 Volute with inlet cones: fabricated steel, braced, and with welded supports.
- .4 Acceptable material: Greenheck.

2.3 Utility Sets

- .1 Characteristics and construction: for centrifugal fans.

- .2 Preassemble single width centrifugal fan with removable protective hood with vents.
- .3 Provide belt driven sets with adjustable motor bed plate and variable pitch driver sheave.
- .4 Acceptable material: Greenheck.

PART 3 EXECUTION

3.1 Fan Installation

- .1 Install fans as indicated, complete with resilient mountings.
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 Product Data

- .1 Submit shop drawings in accordance with Section 01 0001 – General Requirements.
- .2 Indicate the following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.

PART 2 PRODUCTS

2.1 General

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board at all locations and as specified.
 - .3 Concealed fasteners.
- .3 Colour: as directed by the Contract Administrator.
- .4 Acceptable material: Greenheck.

2.2 Manufactured Units

- .1 Grilles, registers and diffusers of same generic type shall be the product of one manufacturer.

2.3 Supply Grilles

- .1 General: surface mount.
- .2 Type B: steel, 32 mm border, with two sets of fully adjustable double deflection blades, vertical face and horizontal rear bars, and steel damper. Finish: powder coat. Model: 520D.

2.4 Exhaust Grilles

- .1 General: surface mount.

- .2 Type D: aluminum, 32 mm border, 13 x 13 mm aluminum grid core, egg crate type face bars. Finish: powder coat. Model: 80.

2.5 Diffusers

- .1 General: volume control dampers with flow straightening devices and gaskets.
- .2 Type A: steel, round type, having adjustable pattern, surface mounted. Finish: powder coat. Model: RID.
- .3 Type C: steel, square type, perforated face, having curved blade air deflector modules, surface mounted. Finish: powder coat. Model: PDN.

PART 3 EXECUTION

3.1 Installation

- .1 Install in accordance with the manufacturer's instructions.
- .2 Install with oval head screws in countersunk holes where fastenings are visible.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 References

- .1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)
 - .1 ANSI/NFPA 96-01, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
 - .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM E90-99, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 Society of Automotive Engineers (SAE)

1.3 Product Data

- .1 Submit shop drawings in accordance with Section 01 001 – General Requirements.
- .2 Indicate the following:
 - .1 Pressure drop.
 - .2 Face area.
 - .3 Free area.

PART 2 PRODUCTS

2.1 Fixed Louvres - Aluminum

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: storm-proof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.
- .4 Frame, head, sill and jamb: 100 mm deep one piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.
- .5 Mullions: at 1500 mm maximum centres.
- .6 Fastenings: stainless steel (Society of Automotive Engineers) 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: 19 mm mesh, 2 mm dia. wire aluminum birdscreen on inside face of louvres in formed U-frame.

- .8 Finish: factory applied enamel, anodized. Colour: to Contract Administrator's approval.
- .9 Acceptable material: Ruskin.

PART 3 EXECUTION

3.1 Installation

- .1 In accordance with the manufacturer's and SMACNA recommendations.
- .2 Reinforce and brace as indicated.
- .3 Anchor securely into opening. Seal with caulking around to ensure weather tightness.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 References

- .1 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)
 - .1 ANSI/ARI 430-99, Central Station Air Handling Units.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.3 Shop Drawings And Product Data

- .1 Submit shop drawings and product data.
- .2 Indicate the following: fan, fan curves showing point of operation, motor drive, bearings, filters, mixing box, dampers, heating coil; and including performance data.

1.4 Closeout Submittals

- .1 Provide maintenance data for incorporation into manual.
- .2 Include following: fan, bearings, motor, damper, air volume, electric heating.

1.5 Extra Materials

- .1 Provide maintenance materials.
- .2 Provide list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.
- .3 Spare filters: in addition to filters installed immediately prior to acceptance by the Contract Administrator, supply one complete set of filters for each filter unit or filter bank.

PART 2 PRODUCTS

2.1 General

- .1 Factory assembled components to form units supplying air at designed conditions, as indicated.
- .2 Certify ratings: to ARI 430 with ARI seal.

- .3 Horizontal and vertical type, as indicated, having air tight modular components, consisting of casing, fan section with motor and drive, filter section, dampers, electric heating section, and mixing box.

2.2 Air Handling Unit

.1 AHU-1

1. Indoor ventilation unit, 1885 L/s supply and 283 L/s outside air at 125 Pa ESP, 15.8°C temperature rise, 20 kW electric heating coil, 2.0 HP 1800 RPM ODP motor, horizontal discharge (return air at bottom), mixing box with outside air and return air dampers c/w two position operators (dampers to be TAMCO 9000 on outside air and TAMCO 1000 on return air), internally isolated blowers/motors, pillow block bearings, and flat filter section c/w 50 mm MERV 7 filters. Unit casing shall be 18 Ga. construction with 50 mm 1-1/2# insulation throughout, and hinged access doors with camlock fasteners.
2. Heater elements shall be installed a minimum of 300mm downstream from air filters. Insulation in heating section shall be fiber reinforced foil faced. Heater element wiring shall terminate in a full height enclosure at one end of the heater. All internal wiring shall terminate on clearly identified terminal blocks. Heaters shall be equipped with an automatic reset disc type thermal cut-out. Heater elements shall be open type nickel-chromium construction (60% Ni, 16% Cr, 24% Fe). Coil terminal pins shall be mechanically secured and insulated from the frame by means of non-rotating ceramic bushings. Provide SCR control complete with solid state discharge air controller. Provide a remote panel with heat and fan switches and lights.

.2 AHU-2

1. Indoor ventilation unit, 1885 L/s supply and 707 L/s outside air at 125 Pa ESP, 39.5°C temperature rise, 50 kW electric heating coil, 2.0 HP 1800 RPM ODP motor, horizontal discharge (return air side), mixing box with outside air and return air dampers c/w two position operators (dampers to be TAMCO 9000 on outside air and TAMCO 1000 on return air), internally isolated blowers/motors, pillow block bearings, and flat filter sections (with winter filter) c/w 50 mm MERV 7 filters. Unit casing shall be 18 Ga. construction with 50 mm 1-1/2# insulation throughout, and hinged access doors with camlock fasteners.
2. Heater elements shall be installed a minimum of 300mm downstream from air filters. Insulation in heating section shall be fiber reinforced foil faced. Heater element wiring shall terminate in a full height enclosure at one end of the heater. All internal wiring shall terminate on clearly identified terminal blocks. Heaters shall be equipped with an automatic reset disc type thermal cut-out. Heater elements shall be open type nickel-chromium construction (60% Ni, 16% Cr, 24% Fe). Coil terminal pins shall be mechanically secured and insulated from the frame by means of non-rotating ceramic bushings. Provide SCR control complete with solid state discharge air controller. Provide a remote panel with heat and fan switches and lights.

PART 3 EXECUTION

3.1 Installation

- .1 Provide appropriate protection apparatus.
- .2 Install units in accordance with the manufacturer's instructions and as indicated.
- .3 Ensure adequate clearance for servicing and maintenance.

3.2 Fans

- .1 Install fan sheaves required for final air balance.
- .2 Install flexible connections at fan inlet and fan outlets.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 References

- .1 Air-Conditioning and Refrigeration Institute (ARI)
 - .1 ARI 520-97, Positive Displacement Condensing Units.
- .2 Environment Canada, (EC)/Environmental Protection Services (EPS)
 - .1 EPS 1/RA/2-1996, Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems.

1.3 Shop Drawings and Product Data

- .1 Submit shop drawings and product data in accordance with Section 01 001 – General Requirements.
- .2 Submit product data sheets for unit ventilators. 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 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.

1.4 Closeout Submittals

- .1 Provide operation and maintenance data for unit ventilators for incorporation into the manual.

PART 2 PRODUCTS

2.1 Unit Ventilators - Through The Wall Type Room Airconditioner

- .1 Acceptable manufacturers:
 - .1 Carrier.
- .2 Provide through-the-wall room air conditioner, with slide-out chassis, cooling capacity of 2.22 kw, electro-mechanical control dials, air flow and fan speed control, R-22 hermetic compressor, easy access washable filter and metal wall sleeve.

PART 3 EXECUTION

3.1 Installation

- .1 Locate level and make secure.
- .2 Install in accordance with the manufacturer's instructions.
- .3 Pipe drain connections to the nearest drain line.
- .4 Check final location with the Contract Administrator prior to installation.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 References

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.46-M1988, Electric Air-Heaters.
- .2 Underwriters' Laboratories (UL) Inc.
 - .1 UL 1042-1994, Electric Baseboard Heating Equipment.

1.3 Product Data

- .1 Submit shop drawings in accordance with Section 01 001 – General Requirements.
- .2 Submit product data sheets for baseboard convectors. 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 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.

PART 2 PRODUCTS

2.1 Manufacturers

- .1 Acceptable products:
 - .1 Chromalox.

2.2 Baseboard Convectors

- .1 Heaters: to CSA C22.2 No.46 and UL 1042 standard wattage density as indicated and with connection box on both ends.
 - .1 Heating element shall be heavy duty, corrosion resistant, stainless steel sheath, enclosing a nickel chromium element embedded in compacted mineral insulation. Aluminum fins shall be positively staked to the surface and provide superior heat transfer.
- .2 Element shall be located in a floating suspension system to eliminate expansion noise.

- .3 Cabinet: to CSA C22.2 No.46 UL 1042, pre-drilled back for securing to wall. Integral air diffusion reflector with wireway at bottom.
 - .1 Bottom inlet/top outlet.
 - .2 Panel: constructed of extruded aluminum equivalent in strength to 14 gauge steel. Cabinet back and bottom shall be fabricated from satin coat steel.
 - .3 Finish: hybrid polyester epoxy powder coat process, Almond colour.

2.3 Controls

- .1 Integral thermostat 1 or 2 pole to control load as indicated.

PART 3 EXECUTION

3.1 Installation

- .1 Install baseboard convector heaters, blank sections and controls.
- .2 When wireway is used, remove knock-outs and insert insulating bushing between units.
- .3 Install grounding wire to maintain ground integrity between heating, blank, and auxiliary sections.
- .4 Make power and control connections.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 001 – General Requirements.

1.2 References

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.46-M1988, Electric Air-Heaters.

1.3 Shop Drawings and Product Data

- .1 Submit shop drawings 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.
- .2 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, and cleaning procedures.

1.4 Closeout Submittals

- .1 Provide operation and maintenance data for unit heaters for incorporation into manual.

PART 2 PRODUCTS

2.1 Manufacturers

- .1 Acceptable manufacturers:
 - .1 Chromalox.

2.2 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 Fan motor: totally enclosed, permanently lubricated ball bearing type with resilient mount.
 - .1 Built-in fan motor thermal overload protection.
- .4 Hangers: as indicated.

- .5 Heating elements: metal tubular sheath fused with spiral steel fins, contains a high quality nickel-chromium wire, encased in solidly packed magnesium oxide insulation.
- .6 Cabinet: die formed steel, 18 gauge thick, fitted with brackets for rod or wall mounting.
 - .1 Hybrid polyester epoxy powder coat paint, finish in almond colour.

2.3 Controls

- .1 Built in adjustable thermostat and support controls.

PART 3 EXECUTION

3.1 Installation

- .1 Suspend unit heaters from ceiling or mount on wall as indicated.
- .2 Make power and control connections.

END OF SECTION

PART 1 GENERAL

1.1 General

- .1 This Section covers items common to Sections of Division 26. This section supplements requirements of Division 1.

1.2 Codes and Standards

- .1 Do complete installation in accordance with the latest edition of CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1-M1987 except where specified otherwise.
- .3 All installations shall be in accordance with all provincial, municipal and City codes and bylaws except where specified otherwise.

1.3 Care, Operation and Start-up

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

1.4 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.

1.5 Permits, Fees and Inspection

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay associated fees.
- .3 Contract Administrator will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
- .4 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

- .5 Furnish Certificates of Acceptance from Electrical Inspection Department on completion of work to Contract Administrator.

1.6 Materials and Equipment

- .1 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.
- .2 Factory assemble control panels and component assemblies.

1.7 Electric Motors, Equipment and Controls

- .1 Supplier and installer responsibility as indicated on the drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
- .2 Control wiring and conduit is specified in Division 16 except for conduit, wiring and connections below 50 V which are related to control systems shown on mechanical drawings.

1.8 Finishes

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.
 - .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.
- .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.

1.9 Equipment Identification

- .1 Identify electrical equipment with nameplates as follows:
- .2 Nameplates:
 - .1 Lamicaid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws.

NAMEPLATE SIZES

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

- .3 Wording on nameplates to be approved by Contract Administrator prior to manufacture.
- .4 Allow for average of twenty-five (25) letters per nameplate.
- .5 Identification to be English.
- .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

1.10 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.

1.11 Conduit and Cable Identification

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Other Security Systems	Red	Yellow

1.12 Wiring Terminations

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

1.13 Manufacturers and CSA Labels

- .1 Visible and legible, after equipment is installed.

1.14 Warning Signs

- .1 To meet requirements of Electrical Inspection Department and Contract Administrator.

1.15 Single Line Electrical Diagrams

- .1 Provide single line electrical diagram in glazed frame in main electrical room.
- .2 Drawings: 600 x 600 mm minimum size.

1.16 Location of Outlets

- .1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .3 Locate light switches on latch side of doors. Locate disconnect devices in mechanical areas on latch side of access.

1.17 Mounting Heights

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1400 mm.
 - .2 Wall receptacles:
 - .1 General: 1400 mm.
 - .2 Above top of continuous baseboard heater: 200 mm.
 - .3 Above top of counters or counter splash backs: 175 mm.
 - .4 In mechanical rooms: 1400 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and computer outlets: 1400 mm.

1.18 Load Balance

- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 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.

1.19 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.

1.20 Field Quality Control

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Master Electrical contractor license as issued by the Province that the work is being constructed in.
- .3 Conduct and pay for following tests:
 - .1 Power distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Systems: voice and data communications.
- .4 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.
- .5 Insulation resistance testing.
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .6 Carry out tests in presence of Contract Administrator.
- .7 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .8 Submit test results for Contract Administrator's review.

1.21 Co-ordination of Protective Devices

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings to withstand ultimate fault current at the panel point of connection.

PART 2 PRODUCTS

2.1 Not Used
.1 Not Used.

PART 3 EXECUTION

3.1 Not Used
.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

- .1 Materials and installation for wire and box connectors.

1.2 References

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2No.65, Wire Connectors.
- .2 National Electrical Manufacturers Association (NEMA)

PART 2 PRODUCTS

2.1 Materials

- .1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Clamps or connectors for armoured cable and aluminum sheathed cable as required to: CAN/CSA-C22.2No.18.

PART 3 EXECUTION

3.1 Installation

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

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

1.2 References

- .1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
- .2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

PART 2 PRODUCTS

2.1 Building Wires

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 for above ground conductors.
- .3 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RWU90 for underground conductors.

2.2 Teck Cable

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, minimum size: 12 AWG.
- .3 Insulation:
 - .1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: polyvinyl chloride.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 Watertight, approved for TECK cable.

2.3 Control Cables

- .1 Type LVT: 2 soft annealed copper conductors, sized as required, with thermoplastic insulation, outer covering of thermoplastic jacket.

PART 3 EXECUTION

3.1 Installation of Building Wires

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.
 - .2 In underground ducts in accordance with Section 26 05 44.
 - .3 In trenches in accordance with Section 26 05 44.

3.2 Installation of Teck Cable 0 -1000 V

- .1 Install cables.
 - .1 Group cables wherever possible on channels.
- .2 Install cable in trenches in accordance with Section 26 05 44.
- .3 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.

3.3 Installation of Control Cables

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

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 26 05 01 - Common Work Results - Electrical.

1.2 References

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE).
- .2 Canadian Standards Association, (CSA International).

PART 2 PRODUCTS

2.1 Equipment

- .1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2 Rod electrodes: copper clad steel 19 mm dia by 3 m long. If required.
- .3 Grounding conductors: bare stranded copper, soft annealed, size per CEC.
- .4 Insulated grounding conductors: green.
- .5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.

PART 3 EXECUTION

3.1 Installation General

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process, permanent mechanical connectors, or inspectable wrought copper compression connectors to ANSI/IEEE 837.

- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Connect new building structural steel and metal siding to ground.
- .9 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.2 Electrodes

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install rod electrodes and make grounding connections.
- .4 Bond separate, multiple electrodes together.
- .5 Use copper conductors, sized as per CEC, for connections to electrodes.
- .6 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 System and Circuit Grounding

- .1 Install system and circuit grounding connections to neutral of secondary 208 V system.

3.4 Equipment Grounding

- .1 Install grounding connections to typical equipment including: service equipment, transformers, switchgear, frames of motors, starters, control panels, building steel work, distribution panels, outdoor lighting.

3.5 Communication Systems

- .1 Install grounding connections for communication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .2 Data systems as per the requirements and to the satisfaction of the The City's representative.

3.6 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Contract Administrator and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

END OF SECTION

PART 1 PRODUCTS

1.1 Splitters

- .1 Not used.

1.2 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.

1.3 Cabinets

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.

PART 2 EXECUTION

2.1 Splitter Installation

- .1 Not Used.

2.2 Junction, Pull Boxes and Cabinets Installation

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

2.3 Identification

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

END OF SECTION

PART 1 GENERAL

1.1 References

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

PART 2 PRODUCTS

2.1 Outlet and Conduit Boxes General

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

2.2 Sheet Steel Outlet Boxes

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished walls.

2.3 Concrete Boxes

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

2.4 Floor Boxes

- .1 Not used.

2.5 Conduit Boxes

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

2.6 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. Reducing washers are not allowed.

END OF SECTION

PART 1 GENERAL

1.1 References

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .3 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

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.

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.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 Conduit Fittings

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

2.4 Fish Cord

- .1 Polypropylene.

PART 3 EXECUTION

3.1 Installation

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Conceal conduits except in unfinished areas.
- .3 Use rigid pvc conduit underground and in concrete.
- .4 Use flexible metal conduit for connection to motors in dry areas.

- .5 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .6 Minimum conduit size for lighting and power circuits: 19 mm.
- .7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 19 mm dia.
- .9 Install fish cord in empty conduits.
- .10 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .11 Dry conduits out before installing wire.

3.2 Surface Conduits

- .1 Run parallel or perpendicular to building lines.
- .2 Group conduits wherever possible on suspended or surface channels.
- .3 Do not pass conduits through structural members except as indicated.
- .4 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.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 26 05 01 - Common Work Results - Electrical.

1.2 References

- .1 Canadian Standards Association, (CSA International)
- .2 Insulated Cable Engineers Association, Inc. (ICEA)

PART 2 PRODUCTS

2.1 Cable Protection

- .1 38 x 140 mm planks pressure treated with water repellent preservative. Where surface has been disturbed during installation of cables.

PART 3 EXECUTION

3.1 Direct Burial of Cables

- .1 After 150 mm sand bed is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.
- .2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.
- .3 Underground cable splices not acceptable.
- .4 Minimum permitted radius at cable bends for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
- .5 Cable separation:
 - .1 Maintain 75 mm minimum separation between cables of different circuits.
 - .2 Maintain 300 mm horizontal separation between low and high voltage cables.
 - .3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.
 - .4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.
 - .5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
 - .6 Install treated planks on lower cables 0.6 m in each direction at crossings.
- .6 After 150 mm sand protective cover is in place, install continuous row of 38 x 140 mm pressure treated planks as indicated to cover length of run.

3.2 Cable Installation in Ducts

- .1 Install cables as indicated in ducts.
 - .1 Do not pull spliced cables inside ducts.
- .2 Install multiple cables in duct simultaneously.
- .3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .6 After installation of cables, seal duct ends with duct sealing compound.

3.3 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Perform tests using qualified personnel. Provide necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Acceptance Tests
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing in accordance with manufacturer's recommendations.
 - .4 Leakage Current Testing.
 - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
 - .2 Hold maximum voltage for specified time period by manufacturer.
 - .3 Record leakage current at each step.
- .6 Provide Contract Administrator with list of test results showing location at which each test was made, circuit tested and result of each test.
- .7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

- .1 Materials and installation for standard and custom breaker type panelboards.

1.2 Related Sections

- .1 Section 26 05 01 - Common Work Results - Electrical.

1.3 References

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2No.29, Panelboards and enclosed Panelboards.

1.4 Shop Drawings

- .1 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity, interrupting capacity rating and enclosure dimensions.

PART 2 PRODUCTS

2.1 Panelboards

- .1 Panelboards: product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements, manufacturer's nameplate must show fault current that panel, including breakers, has been built to withstand.
- .2 250 and 600 V panelboards: bus and breakers rated for 10,000 A (symmetrical) interrupting capacity or as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Two keys for each panelboard and key panelboards alike.
- .6 Copper bus with neutral of same ampere rating as mains.
- .7 Mains: suitable for bolt-on breakers.
- .8 Trim with concealed front bolts and hinges.
- .9 Trim and door finish: baked grey enamel.

2.2 Custom Built Panelboard Assemblies

- .1 Not used.

2.3 Breakers

- .1 Breakers with thermal and magnetic tripping.
- .2 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .3 Lock-on devices for 10% of 15 A breakers installed as indicated. Turn over unused lock-on devices to The City.
- .4 Lock-on devices for emergency, exit and night light circuits.

2.4 Equipment Identification

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4.
- .3 Nameplate for each circuit in distribution panelboards size 2.
- .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 19mm painted plywood. Where practical, group panelboards on common backboard. Paint backboards to suit panel color specification.
- .3 Mount panelboards to height specified in Section 26 05 01 - Common Work Results - Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus.

END OF SECTION

PART 1 GENERAL

1.1 References

- .1 The Munsell System of Colour Notation.

PART 2 PRODUCTS

2.1 Materials

- .1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish, Munsell Notation 7.5GY3.5/1.5, size as indicated.
- .2 Entire enclosure capable of withstanding maximum impact force of 86 MN/m² area without rupture of material.
- .3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.
- .4 Enclosure equipped with hot dipped galvanized mounting rails 1 m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.
 - .1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.
 - .2 Holes in side panel flanges in 60 mm increments for vertical adjustment.
- .5 Cover: tamperproof, bolt-on, domed to shed water.
- .6 Door: minimum 1 m wide, hinged, 3 point latching, with padlocking means.
- .7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, vermin.
- .8 Enclosure construction such as to allow any configuration of single or ganged enclosures.
- .9 Enclosure capable of being shipped in knocked-down condition.

PART 3 EXECUTION

3.1 Installation

- .1 Assemble enclosure in accordance with manufacturer's instructions.
- .2 Mount enclosure as specified. Mount equipment in enclosure.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

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

1.2 Related Sections

- .1 Section 26 05 01 - Common Work Results - Electrical.

1.3 References

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55, Special Use Switches.
 - .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

PART 2 PRODUCTS

2.1 Switches

- .1 15 A, 120 V, single pole regular, three and four-way switches to: CSA-C22.2
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 Ivory toggle.
- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 Premium specification grade.
- .5 Switches of one manufacturer throughout project.

2.2 Receptacles

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 Ivory urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.

- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and rivetted grounding contacts.
- .2 Other receptacles with ampacity and voltage as indicated.
- .3 Premium specification grade.
- .4 Receptacles of one manufacturer throughout project.
- .5 Ground Fault Circuit Interrupter where indicated.

2.3 Cover Plates

- .1 Cover plates from one manufacturer throughout project.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Stainless steel 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.
- .4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

PART 3 EXECUTION

3.1 Installation

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .3 Cover plates:
 - .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

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END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 26 05 01 - Common Work Results - Electrical.

PART 2 PRODUCTS

2.1 Disconnect Switches

- .1 Non-fusible disconnect switch in NEMA 4X CSA Enclosure unless otherwise indicated, size as indicated.
- .2 Provision for padlocking in on-off switch position.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Quick-make, quick-break action.

2.2 Equipment Identification

- .1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

PART 3 EXECUTION

3.1 Installation

- .1 Install disconnect switches as indicated.

END OF SECTION

PART 1 GENERAL

1.1 References

- .1 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.
- .2 United States of America, Federal Communications Commission (FCC)
 - .1 FCC (CFR47) EM and RF Interference Suppression.

1.2 Shop Drawings and Product Data

- .1 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Contract Administrator.
- .2 Photometric data to include: spacing criterion.

PART 2 PRODUCTS

2.1 Lamps

- .1 Provide lamps as indicated in Luminaire Schedule.

2.2 Ballasts

- .1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic and IC electronic dimmable design.
 - .1 Rating: voltage as indicated, for use with T8 lamps.
 - .2 RFI/EMI suppression circuit to: FCC (CFR47) Part 18, sub-part C, Class A and Part 15, sub-part B, Class B.
 - .3 Totally encased and designed for 40 EC ambient temperature.
 - .4 Power factor: minimum 95 % with 95% of rated lamp lumens.
 - .5 Crest factor: 1.5 maximum current, 2.0 maximum voltage.
 - .6 Capacitor: thermally protected.
 - .7 Thermal protection: on coil.
 - .8 Harmonics: 10 % maximum THD.
 - .9 Operating frequency of electronic ballast: 21 khz minimum.
 - .10 Ballast Factor: greater than 0.90.
 - .11 Sound rated: Class A.
 - .12 Mounting: integral with luminaire.
- .2 Metal halide ballast:
 - .1 Rating: voltage as indicated.
 - .2 Totally encased and designed for 40 EC ambient temperature.

- .3 Power factor: minimum 95 % with 95% of rated lamp lumens.
- .4 Input voltage range: plus or minus 10% of nominal.
- .5 Minimum starting temperature: minus 29 degrees C at 90% line voltage.
- .6 Mounting: integral with luminaire.
- .7 Crest factor: 1.8 maximum current, 2.0 maximum voltage.

2.3 Luminaires

- .1 As indicated Luminaire Schedule.

PART 3 EXECUTION

3.1 Installation

- .1 Locate and install luminaires as indicated.

3.2 Wiring

- .1 Connect luminaires to lighting circuits.

3.3 Luminaire Supports

- .1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 Luminaire Alignment

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 26 05 01 - Common Work Results - Electrical.

1.2 References

- .1 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.
 - .4 CSA-C22.1-06 Section 56, Optical Fibre Cables
 - .5 CSA-C22.2 No.232-M1988 (R2004), Optical Fibre Cables
- .2 Telecommunications Industry Association (TIA)
 - .1 TIA-EIA-568, Commercial Building Telecommunications Cabling Standards Set.
 - .2 TIA-EIA-455-30, FOTP-30 Frequency Domain Measurement of Multimode Optical Fiber Information Transmission Capacity
 - .3 TIA-EIA-455-51, FOTP-51 Pulse Distortion Measurement of Multimode Glass Optical Fiber Information Transmission Capacity
 - .4 TIA-EIA-455-61, FOTP-61 Measurement of Fiber or Cable Attenuation Using an OTDR
 - .5 TIA-EIA-4720000-A, Generic Specification for Fibre Optic Cable

1.3 System Description

- .1 Structured system of telecommunications cables (copper) installed within buildings for distributing voice and data (including video) signals.
- .2 Telecommunications linked to central equipment room by backbone cable or fibre.

PART 2 PRODUCTS

2.1 Horizontal Distribution Cable

- .1 4-pair, 24 AWG, Category 6 cable with insulated copper conductor in separate outer jacket: to C22.2 No. 214.
- .2 Voice-grade electrical transmission requirements: to CSA T529 and TIA-EIA-568.
- .3 Data-grade electrical transmission requirements to: CSA T529 and TIA-EIA-568.

2.2 Backbone Cable

- .1 50 micron type, 6 strand multi-mode fibre optic cable: to CAN/CSA C22.2 No. 214 and CSA C22.2 No. 232.
- .2 Voice-grade electrical transmission requirements: to CSA T529 and TIA-EIA-568.
- .3 Data-grade electrical transmission requirements to: CSA T529 and TIA-EIA-568.
- .4 The attenuation shall be measured in accordance with TIA-EIA-455-61. The bandwidth shall be measure in accordance with TIA-EIA-455-30 or TIA-EIA-455-51.

PART 3 EXECUTION

3.1 Installation of Horizontal Distribution Cables

- .1 Install horizontal cables, as indicated in conduits from termination on telecommunications rack to outlets.
- .2 Terminate 2 workstation cables per work station terminated in accordance with CAN/CSA C22.2 No. 182.4 and CSA-T529.

3.2 Installation of Backbone Cables

- .1 Install backbone cable, as indicated in conduit from termination in each telecommunications rack. Termination: to CSA-T529.
- .2 Terminate cables with SC connectors in accordance with CSA-T529 on patch panels.

3.3 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.
- .2 Test UTP cable installations for:
 - .1 Continuity: including open/short, polarity, and pair transpositions.
 - .2 DC loop resistance.
 - .3 Length using TDR.
 - .4 Noise.
 - .5 Attenuation.
- .3 Manufacturer's fibre optic cable test results and certification for specified tests shall be submitted. Fibre optic cables shall be tested for end-to-end continuity, power level, and loss evaluations. In addition, the following tests shall be performed:
 - .1 Verification that factory packaging is undamaged and intact.
 - .2 Verification of continuity, attenuation and absence of anomaly for each reel.
 - .3 Inspection of the appearances of each end of each installed unspliced cable run.
 - .4 Optical time-domain reflectometer (OTDR) test of each splice.

- .5 Continuity and attenuation for each fiber in each terminal-to-terminal link, tested in both directions.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 26 05 01 - Common Work Results - Electrical.

1.2 References

- .1 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).
- .2 Electronic Industries Alliance (EIA) / Telecommunications Industries Association (TIA)
 - .1 TIA/EIA-568, Commercial Building Telecommunications Cabling Standards Set.

1.3 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) cables.

PART 2 PRODUCTS

2.1 Terminations and Cross-connection System for Unshielded-Twisted-Pair (UTP) Cable

- .1 Cross-connection and termination system of wiring, insulation-displacement-contact (IDC) type. Terminate cables to CAN/CSA-C22.2 No.182.4 and CSA T529. System components include:
 - .1 Module or block, employing IDC-type terminations for terminating 24AWG copper conductors and supporting cross-connection using 'RJ-45' jacks, wiring: to CSA T529 for terminating patch cords equipped with 'RJ-45'-compatible plugs, terminations and connectors: to CSA T529 and TIA/EIA-568, jumpers and patch cords: to CSA T529 and TIA/EIA-568.
 - .2 Module for terminating 22AWG copper conductors from 25-pair cable module.

PART 3 EXECUTION

3.1 Installation

- .1 Install building communications terminating and cross-connecting systems in racks in accordance with manufacturer's instructions.

3.2 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical.

END OF SECTION