

E2. GENERAL REQUIREMENTS

- a) The specification covering the General Conditions of the Contract, Supplementary Conditions, General and Safety Requirements, Instructions to Bidders, and all sections form an integral part of this specification and shall be read in conjunction herewith.
- b) Division 22, 23 and 25 shall comply with the general requirements listed herein.

E2.1 SCOPE

- a) Provide all materials, labour, plant and equipment required for a complete and working installation as herein specified and as shown on the drawings.
- b) The installation shall be in accordance with the current edition of the Provincial and Municipal codes and regulations.
- c) All equipment supplied under this Contract shall be new and C.S.A. approved.
- d) Arrange for, and coordinate, rough-in and final inspections with inspection authority and Consultant.
- e) In the event of conflict between contract documents and Codes, the more stringent requirement shall be adhered to at no additional cost.
- f) Contract Administrator Site Reviews: Contractor's Work shall be periodically reviewed by the Contract Administrator for determining general quality of installation. Guidance will be offered as to interpretation of contract documents and to assist in performing the installation. Inspections, reviews and directives issued in no way relieve the Contractor, his agents, employees or subtrades from contractual obligations, conformance to codes or safe and recognized practices.
- g) Apply for and pay for all required permits, licenses, inspections and fees.
- h) Indicate all permit numbers on all progress draws.
- i) Where no permit was applied for indicate same on progress draw.

E2.2 REQUEST FOR INFORMATION

- a) Allow ten (10) full working days for the Contract Administrator. to respond to all requests for information.
- b) Trade Contractor shall review and approve all requests for information (RFI's) from sub-contractors prior to submission.
- c) Contractor shall review and approve all RFI's prior to submittal to ensure information is not already included in contract documents or cannot be reasonably inferred from contract documents.

E2.3 SHOP DRAWINGS

- a) Submit electronic Shop Drawings for review by the Contract Administrator prior to ordering equipment and commencing Work. Shop Drawings shall be specific to the equipment and materials for this project. Changes to location and arrangement shall be reviewed prior to installation. Review of Shop Drawings by the Contract Administrator is for the sole purpose of ascertaining conformance to design intent. Contractor retains responsibility for all aspects of installation, performance and coordination.
- b) Shop Drawing Procedures are as follows:
 - a) Contractor and SubContractor shall review, approve and stamp submittals prior to sending to Contract Administrator for review. Submittals without contractor stamps will be rejected.
 - b) A transmittal listing each item of equipment shall accompany each submission.
 - c) Equipment must be labeled appropriately. Each item of equipment must bear the identifier used on the drawings.
 - d) Data sheets must clearly indicate model and options being utilized. All information that does not apply must be crossed off.
 - e) Allow Contract Administrator. ten (10) full working days to review all shop drawings.
 - f) Send electronic Shop Drawing submittals (.PDF only) to wpg.shopdrawings@mcw.com only; please do not copy staff members directly.
 - g) All deviations from specified equipment shall be highlighted by contractor.

E2.4 ACCURACY OF DATA

- a) Drawings are schematic; exact locations, distances, levels and other dimensions shall be governed by the Contract Administrator Design Drawings.
- b) Devices or equipment shall be moved to any point within a 3m (10'-0") radius for coordination purposes or when the Contract Administrator requests relocation before the Work has been substantially completed, without additional cost.
- c) Provide a typical mock-up of one area, if requested.
- d) Drawings and Specifications establish scope of Work only and are not detailed installation instructions. Follow manufacturer's recommendations and adhere to all current and applicable Codes.
- e) The Contract Administrator shall have the final say in matters of interpretation.

E2.5 EXAMINATION

- a) Examine entire contract document package to ensure that the work under this Contract can be satisfactorily carried out. Report any discrepancies to the Contract Administrator prior to submission of tender.
- b) Examine the site, local conditions and all existing apparatus if any to be re-used and verify that the condition of this equipment is suitable for its intended use in the new construction.

E2.6 WORKMANSHIP

- a) Install equipment in a workmanlike manner to present a neat appearance to the satisfaction of the Contract Administrator. Install equipment parallel and perpendicular to building lines. Install neatly and group to present a tidy appearance.
- b) Install equipment and apparatus including but not limited to junction boxes, valves and balancing dampers requiring maintenance, adjustment or eventual replacement with adequate clearances and accessibility for same. Accessibility is deemed to be within 600mm (24") of accessible drywall ceiling opening and no more than 1m (39") above ACT.
- c) Include in the Work, all requirements shown on the Shop Drawings or manufacturers' installation instructions.
- d) Replace Work unsatisfactory to the Contract Administrator without extra cost.
- e) Equipment exposed to exterior weather and / or moisture shall be corrosion and UV protected.
- f) Only skilled and qualified licensed tradesperson shall perform the work. Tradesperson shall provide proof of registered status when requested.
- g) Contractor is responsible to carefully examine conditions at the intended place of work. Verify all services, connection points, and all access openings to permit installation of new equipment.

E2.7 COORDINATION

- a) Contractor shall co-ordinate all aspects of the installation with all other subcontractors. There shall be no change notices issued nor changes to the building design (i.e. lowering ceiling heights) due to routing conflicts amongst subcontractors or lack of coordination. When required, discuss the proposed routing with the Contract Administrator prior to installation. Final responsibility remains with the Contractor.
- b) Connect to equipment specified in other sections, installed by other Contractors or the City.
- c) Supply access doors or rated doors to match fire rating, at all service points for equipment. Indicate on project record documents the location of all access doors.
- d) Openings shall be coordinated with the Contractor. Opening sizes shall be kept to a minimum
- e) Contractor shall pay for professional trade to patch openings and install all finishing materials (i.e. drywall, brick, etc.). Openings with potential to compromise the structure shall be approved by a licensed Contract Administrator prior to starting the opening. The contractor shall contact the Contract Administrator for instructions prior to cutting or coring. Contractor is to scan structure before making openings and advise Contractor and Contract Administrator of any obstructions found prior to cutting or coring.
- f) Electric motors equipped with variable speed controller as supplied by mechanical subcontractor shall be installed, wired and connected by electrical subcontractor.
- g) Variable Frequency Drives (VFD) - Electric motors and cabling shall be compatible with variable frequency drives.

- h) Direct Drives - Electric motors shall be equipped with variable speed controller capable of infinite modulation between 30% to 100%.

E2.8 SUPERVISION

- a) Supervise the work at all times through a responsible and competent qualified tradesperson.
- b) Full co-operation shall be shown with other trades to facilitate installations and to avoid delays in carrying out the work.
- c) Replace site supervisor and/or foreman when requested by Contract Administrator.

E2.9 CHANGE TO CONTRACT

- a) Contractor change pricing shall include a complete breakdown of items of material, labour hours, labour rates and markups. This review period will start when all information indicated above is received.
- b) Contractor shall review and approve all contractor change pricing and credits prior to submitting to consultant. Submission to the Contract Administrator indicates Contractor believes the pricing is fair and reasonable.

E2.10 PROGRESS CLAIMS

- a) Contractor progress claims will only be reviewed if they provide a complete breakdown by contractor and subcontractor and list all major equipment and labour complete with costs.

E2.11 PROJECT CLOSE OUT

- a) PROJECT RECORD DOCUMENTS
 - a) Maintain accurate project record documents and current on Site and same shall be present for review at each Site review. Submit these project record documents in electronic format of same program and version of original contract documents and PDF for review at the completion of the project. Note that changes to Contract Administrator floor plans must be included.
 - b) A minimum of \$1,000.00 per drawing shall be held-back until all project record documents are submitted and deemed complete.
 - c) Transfer changes to electronic disc AutoCAD file. Submit disc and hard copy for final review and submission to the City.
 - d) After acceptance of project record documents by the Contract Administrator, provide one (1) complete set of AutoCAD and PDF project record documents on three (3) USB Flash Drives and one (1) set of hard copy design prints and one (1) set of hard copy red line contractor markups.
 - a) Mechanical shall include:
 - a) Routing of equipment;
 - b) Locations of valves;
 - c) Concealed equipment and access panels; and
 - d) Accurate locations for in or under slab items. (ie. drains, piping routing, duct routing)
 - e) Contract Administrator can complete the project record documents from contractor's red-lined markups for a fee of \$250.00 per drawing, with a project minimum of \$1,000.00.
 - f) The use of white out (liquid or tape) shall be used for correcting contractor red line errors ONLY.
 - g) DO NOT use white out to delete original contract drawings deleted items shall be crossed out in red ink.
 - h) ME Schedules and sheets shall bear a watermark, indicating "REFER TO O&M".
- b) OPERATION AND MAINTENANCE MANUALS
 - a) Prior to requesting any substantial performance site review, all aspects of the installed system shall be complete and operational. Testing and balancing shall be complete along with device and equipment identification, equipment start-ups.
 - b) At the completion of work submit three (3) electronic media storage device and one (1) hard covered loose leaf binder showing all major components and divided by trade sections. Manuals shall be complete with all warranty information, instructions for operation, maintenance, and replacement parts as required. Include copies of reviewed shop drawings, Contract Administrator's contact information, Contractor and Sub-contractor information. Include copies of valve tag lists, all inspection certificates, and

balancing reports. The Contract Administrator may not perform final inspections nor certify for occupancy until the O&M Manuals are received, reviewed and approved.

- a) Include performance curves, detailed drawings, part lists, supplier information and any other pertinent data.
 - b) Provide manufacturers start-up reports and letters of certification that the following mechanical equipment and systems are started, commissioned and working correctly:
 - a) Pumps.
 - c) Each of the Contractors shall instruct the City's Operating Staff on the operation, maintenance, and adjustment of equipment and/or system that they have installed or set. Provide sign off sheets for training indicating who was trained and number of hours of training.
 - d) Spare Parts:
 1. Provide one (1) set of special tools required to service equipment as recommended by manufacturer. Provide a receipt signed by the City's representative for each tool in each copy of the O&M Manual.
- c) CERTIFICATION REQUIREMENTS
- a) The installation shall be completely tested demonstrating that the equipment and systems installed perform in the manner intended.
 - b) Prior to mechanical final inspection or certification provide the following:
 - a) Copies of manufacturer's startup or certification reports;
 - b) TAB reports;
 - c) Distribution system pressure test reports;
 - d) Training sign off sheets;
 - e) Copy of the Mechanical Permit; and
 - f) Receipts or transmittals indicating owner has received all special tools and spare parts.

E2.12 WARRANTY

- a) The satisfactory operation of all Work and equipment shall be warranted for a minimum of twelve (12) calendar months after substantial completion, unless otherwise noted.

E2.13 REQUEST FOR EQUALS

- a) Request for approval of material as equals to that specified shall be submitted to the Contract Administrator with performance specifications two (2) full working days before last Addendum. Samples shall be provided on request.
- b) Approvals shall be transmitted electronically. Include all pertinent information for a complete review by the Contract Administrator.

E2.14 ACCEPTABLE MANUFACTURERS

- a) Standard of Material & Equipment:
- a) Where a Manufacturer's name is mentioned in the contract documents, it is for the purpose of setting a standard of quality, performance, capacity, appearance and serviceability. Manufacturers shown below are pre-approved providing their products are equal or exceed the performance of the specified product. Where Equal manufacturer's products have been included in the specifications or added by addendum, the contractor is responsible for all changes required by different weights, sizes, electrical requirements, connection locations, and all other differences at no cost to the owner. Where any equals require changes to other building elements this is also the responsibility of the contractor, must be paid for by the contractor, and must be reviewed and approved by the consultant prior to implementation.
 - b) All Equals are required to meet or exceed all of the performance requirements indicated in the equipment schedules.
 - c) Where products listed below comply with the criteria contained in these specifications they may be used in the preparation of the tender. Where no equals have been approved, provide the exact make specified. Requests for approval of equals must be submitted to the Contract Administrator not less than three days prior to closing date of the tender and submissions must be approved in writing by the engineer in an addendum, no exceptions. Approval as an equal does not absolve the supplier and Contractor of the obligation to meet all clauses of this specification

b) Description:

a) Plumbing and Drainage Approved List

<u>Equipment</u>	<u>Acceptable Manufacturers</u>
Hangers and Supports	Myatt, Tyco, Taylor Insuguard.
Shock Absorbers	Ancon, Smith, Zurn, PPP, Watts
Gauges and Thermometers (swivel)	Dresser, Trerice, Weiss, Dwyer
Hose Bibbs	Crane, Watts, Smith, Mifab
Pumps	Armstrong, Bell & Gossett, ITT, Wilo, Xylem

b) Controls Approved List

<u>Equipment</u>	<u>Acceptable Manufacturers</u>
Variable Speed Drives	ABB, Square D, Toshiba, Danfoss

E2.15 PIPING and FITTINGS

- a) Provide isolation valves at all fixtures, appliances and equipment.
- b) Provide check stops at all mixing valves.
- c) Allow for thermal expansion on all piping systems conveying hot or cold vapour or liquid.
- d) Tag all major zone and shut off valves with 38mm (1½") diameter brass tags. Index and list valves, insert list in each O&M Manual also frame and mount copy of list in a conspicuous area of the mechanical Room.
- e) Identify all equipment with black lamacoid tags 100mm x 25mm (4"x1") with white lettering. Mechanically affix tags to equipment. Equipment names and number to match those listed on contract documents.
- f) Identify all piping with stenciled lettering and directional arrows at intervals no greater than 6m (20') and at every change in direction. Labeling and identification to either the City's standard or the CSA standard. Confirm system with the City prior to tender.
- g) Wherever pipes of dis-similar metals are joined the piping systems shall be protected and isolated by use of dielectric unions or brass valves.
- h) Provide and install union or flange connections at all equipment and devices to allow for ease of service or future replacement.
- i) Piping Systems:
 - a) Domestic Cold Water: Type L copper with wrought copper fittings and lead free solder; CPVC Dr11 Pipe and fittings as permitted by the 2010 NPC. PEX as permitted by the 2010 NPC.
- j) Valves:
 - a) Isolate all serviceable equipment, using ball and butterfly valves where possible.
 - b) All valves shall have a minimum certified rating of 150 psi.
 - c) All drain valves shall be complete with cap and chain.
 - d) Install ¼ turn ball valves prior to all pressure gauge devices.
 - e) PVC ball valves, double backing with union ends, solvent weld, pressure rated at 230 psi (1580kPa) at 79°F (23°C).
- k) Hangers and Supports:
 - a) All hangers shall be of same material as piping system, or shall be isolated from the pipe.
 - b) Provide adjustable clevis hangers equal to pipe size and of same material as piping system.
 - c) Provide oversized hangers on all cold water piping conveying liquid less than 21°C (70°F).
 - d) Use only factory made inserts, coach screw rods, c-clamps, beam clamps and expansion shields rated for the intended load.
 - e) "Caddy" clip or tension clip rod supports are not allowed on this project.
- l) Provide and install sleeves of suitable material where piping and duct systems pass through any and all separations.
- m) Supply and install thermostats and gauges at all major pieces of equipment and where indicated on the drawings. (Note PSN-B Snubbers required at all gauges.) Mount all gauges and thermostats vertically and place so that ease of reading is ensured. Pressure and temperature ranges shall be suitable for the application.
- n) Primer paint all miscellaneous metal supports channels and angle iron prior to installation.

- o) Pipe all water discharge from relief valves and equipment drains to nearest floor drain or suitable receptacle. Confirm locations with Contract Administrator prior to installation. Pipe all methanol and glycol discharge from relief valves back to fill tank.
- p) Install all valves, strainers, equipment, specialties, filters and the like to permit ease of operation and full access.
- q) Acceptable joining systems include mechanical joints (sanitary) soldering, silver soldering, threaded joints, welding, grooved Victaulic (black) and grooved copper Victaulic. NOTE: Tee drilling and Press-fit systems are not acceptable on this project.
- r) Test all systems to 1½ times working pressure for a minimum of two hours. All tests shall be recorded and independently witnessed. Submit recorded data for Contract Administrator's review prior to substantial completion and include in O&M Manuals.

E2.16 INSULATION

- a) Definitions:
- a) The word “exposed” where used in this Section means any work, which is not concealed in wall, shaft, or ceiling cavities or spaces. Work in mechanical rooms, utility spaces, behind doors in closets or cupboards or under counters is considered exposed.
- b) Pre-molded Pipe Insulation (PPI):
- a) Provide ULC listed sectional fiberglass pipe insulation in compliance with ASTM C335-84 in pre-molded sections 900mm (36”) long, split and ready for application with a minimum Thermal Conductivity of 0.033 W/m deg C at 24°C (75°F) mean temperature and be capable of use on service from -40°C to 260°C (-40°F to 500°F) and with factory applied vapour seal jacket of vinyl coated foil Kraft laminate with reinforcing of open mesh glass fibre.

APPLICATION SCHEDULE

Piping (Provide canvas finish where exposed):	Thickness	Type	Finish
a) Domestic cold water	38mm (1½”)	All PPI	

E2.17 TESTING AND BALANCING (TAB)

- a) Contractor shall be members of AABC.
- b) The reports to contain recorded data and schematics and be formatted as per AABC.
- c) TAB report shall include pump curves on all balanced pumps.
- d) Allow for an additional site review and adjustments at the request of the Contract Administrator after submission of final report.

E2.18 PLUMBING

- a) Supply and install fixtures indicated under contract documents to provide a complete and functional plumbing system.
- b) Use only lead free solders when joining piping components.

E2.19 CONTROLS

- a) All controls shall be supplied by this section. Provide all wiring diagrams for line voltage wiring by Division 26 Electrical SubContractor. Coordinate all requirements of Division 26 with Electrical SubContractor prior to submitting bid. Controls wiring shall be in conduit.
- b) System shall be complete with all necessary wiring, interlocks, devices and software necessary to ensure a complete and operational system.
- c) Set, operate and co-ordinate all devices for fully functional system.
- d) All wiring to meet Division 27 Specification Requirements.
- e) Sequence of operations:
 - a) Pump speed: The variable speed drive (VSD) shall be manually adjustable via its on-board controls, to allow the user to set the pump's flow rate to achieve the desired visual effect of the fountain.
 - b) High-level float: The high level float control device shall enable the automatic fill (solenoid) valve. When the float drops below set-point, the valve shall modulate open to permit make-up water into the system. Once the float control device reaches set-point the valve shall modulate closed.
 - c) Low-level float: The low level float shall monitor the water level of the wet pit, which is normally level with that of the lower basin. When the low-level float indicates a low water level, the pump shall be de-energized.
 - d) Unit heater: The unit heater shall maintain the space temperature of the dry pit at set-point, as set on its built-in thermostat.
 - e) Heat trace cable: The heat trace cable shall be self-regulating (refer to electrical).

END OF SECTION

E2 GENERAL REQUIREMENTS

- a) The Specification covering the General Conditions of the Contract, Supplementary Conditions, General and Safety Requirements, Instructions to Bidders, and all Sections form an integral part of this Specification and shall be read in conjunction herewith.

E2.1 SCOPE

- a) Provide all Materials, labour, plant and equipment required for a complete and working installation as herein specified and as shown on the Drawings.
- b) The installation shall be in accordance with the current edition of the Provincial and Municipal codes and regulations.
- c) All equipment supplied under this Contract shall be new and C.S.A. approved.
- d) Arrange for, and coordinate, rough-in and final inspections with inspection authority and Contract Administrator.
- e) In the event of conflict between contract documents and Codes, the more stringent requirement shall be adhered to at no additional cost.
- f) Contract Administrator's Site Reviews: Contractor's work shall be periodically reviewed by the Contract Administrator for determining general quality of installation. Guidance will be offered as to interpretation of contract documents and to assist in performing the installation. Inspections, reviews and directives issued in no way relieve the Contractor, his agents, employees or subtrades from contractual obligations, conformance to codes or safe and recognized practices.
- g) Apply for and pay for all required permits, licenses, inspections and fees.
- h) Indicate all permit numbers on all progress draws.

E2.2 SHOP DRAWINGS

- a) Submit electronic shop drawings for review by the Contract Administrator prior to ordering equipment and commencing work. Shop Drawings shall be specific to the equipment and Materials for this project. Changes to location and arrangement shall be reviewed prior to installation. Review of Shop Drawings by the Contract Administrator is for the sole purpose of ascertaining conformance to design intent. Contractor retains responsibility for all aspects of installation, performance and coordination.
- b) Shop Drawing Procedures are as follows:
 - a) Contractor and SubContractor shall review, approve and stamp submittals prior to sending to Contract Administrator Ltd for review. Submittals without contractor stamps will be rejected.
 - b) A transmittal listing each item of equipment shall accompany each submission.
 - c) Equipment must be labeled appropriately. Each item of equipment must bear the identifier used on the drawings.
 - d) Data sheets must clearly indicate model and options being utilized. All information that does not apply must be crossed off.
 - e) Allow Contract Administrator ten (10) full working days to review all shop drawings.
 - f) Send electronic shop drawing submittals (.PDF only) to wpg.shopdrawings@mcw.com only; please do not copy staff members directly.
 - g) All deviations from specified equipment shall be highlighted by contractor.

E2.3 ACCURACY OF DATA

- a) Drawings are schematic; exact locations, distances, levels and other dimensions shall be governed by the architectural and/or interior design drawings.
- b) Devices or equipment shall be moved to any point within a 3m (10'-0") radius for coordination purposes or when the Consultant requests relocation before the work has been Substantially Performed, without additional cost.
- c) Provide a typical mock-up of one area, if requested.
- d) Drawings and Specifications establish scope of work only and are not detailed installation instructions. Follow manufacturer's recommendations and adhere to all current and applicable Codes.
- e) The Contract Administrator shall have the final say in matters of interpretation.
- f) Branch circuit wiring shall be installed with circuits arranged exactly as shown on the drawings. Conduit and cable runs shall be modified to suit the installation.

E2.4 EXAMINATION

- a) Examine entire contract document package to ensure that the work under this Contract can be satisfactorily carried out. Report any discrepancies to the Contract Administrator prior to submission of tender.
- b) Examine the Site, local conditions and all existing apparatus if any to be re-used and verify that the condition of this equipment is suitable for its intended use in the new construction.

E2.5 WORKMANSHIP

- a) Install equipment in a workmanlike manner to present a neat appearance to the satisfaction of the Contract Administrator. Install equipment parallel and perpendicular to building lines. Install neatly and group to present a tidy appearance.
- b) Install equipment and apparatus including but not limited to junction boxes, adjustment or eventual replacement with adequate clearances and accessibility for same.
- c) Include in the Work, all requirements shown on the Shop Drawings or manufacturers' installation instructions.
- d) Replace Work unsatisfactory to the Contract Administrator without extra cost.
- e) Equipment exposed to exterior weather and / or moisture shall be corrosion and UV protected.
- f) Only skilled and qualified licensed subconsultant shall perform the Work. Subconsultant shall provide proof of registered status when requested.
- g) Contractor is responsible to carefully examine conditions at the intended place of work. Verify all services, connection points, and all access openings to permit installation of new equipment.
- h) All conduits shall be clipped to structure by means of anchors or supported by unistrut hangers as close to underside of structure as possible. Tie wraps for wire hanging and fastening or perforated strapping is not acceptable.
- i) All support material for all luminaires, outlet boxes, junction boxes, etc. shall be of non-combustible material.

E2.6 COORDINATION

- a) Contractor shall co-ordinate all aspects of the installation with all other trades. There shall be no change notices issued due to routing conflicts amongst trades or lack of coordination. When required, discuss the proposed routing with the Contract Administrator prior to installation. Final responsibility remains with the Contractor.
- b) Connect to equipment specified in other Sections, installed by other SubContractors or the City.
- c) Openings shall be coordinated with the Contractor. Opening sizes shall be kept to a minimum
- d) Contractor shall pay for professional trade to patch openings and install all finishing materials (i.e. drywall, brick, etc.). Openings with potential to compromise the structure shall be approved by a licensed Contract Administrator prior to starting the opening. The contractor shall contact the Contract Administrator for instructions prior to cutting or coring. Contractor is to scan structure before making openings and advise Contractor and Contract Administrator of any obstructions found prior to cutting or coring.
- e) Electric motors equipped with variable speed controller as supplied by mechanical subcontractor shall be installed, wired and connected by electrical subcontractor.
- f) Variable Frequency Drives (VFD) - Electric motors and cabling shall be compatible with variable frequency drives.

E2.7 SUPERVISION

- a) Supervise the work at all times through a responsible and competent qualified subcontractor.
- b) Full co-operation shall be shown with other subcontractors to facilitate installations and to avoid delays in carrying out the Work.
- c) Replace Site supervisor and/or foreman when requested by Contract Administrator.

E2.8 WORK IN EXISTING BUILDING

- a) Should any connections be required to maintain services during work in the existing building, supply and install all necessary material and equipment and provide all labour at no extra

- cost. Should any existing system be damaged, make full repairs without extra cost, and to the satisfaction of the City.
- b) Contractor shall ensure that any coring of holes through the deck floors, walls and grade beams, etc. will not penetrate existing conduits, cables or mechanical equipment in or under the concrete. Contractor shall be responsible to take any and all action as deemed necessary by the City and Contract Administrator to correct any such penetrations at his cost. No coring shall be undertaken unless permission is given by the City and Contract Administrator.
 - c) The Drawings indicate major items of equipment to be deleted or relocated but do not indicate every item of equipment to be deleted or relocated. Be responsible for determining which existing equipment is to be deleted or relocated by examining the site and construction documents. Reflect information on project record documents.
 - d) Existing junction boxes shall remain accessible.
 - e) Refer to contract documents for phasing and staging of work and adhere to that program. Comply with instructions regarding working hours necessary to maintain the building in operation.
 - f) All existing cables and conduits required to remain in an area of renovation must be repaired, re-secured or clipped to meet Specification and CEC standards.

E2.9 BASIC MATERIAL AND METHODS

- a) Grounding
 - a) The entire installation shall be grounded in accordance with the Canadian Electrical Code.
- b) Test
 - a) The electrical installation shall be completely tested demonstrating that the equipment and systems installed perform in the manner intended.
- c) Identification Of Equipment
 - a) All equipment shall be identified with engraved lamacoid nameplates secured with self-adhesive backing. Lamacoid shall identify equipment designation, voltage, phasing and fed from.
 - b) The utilization of Dynamo Rhino Industrial 6000, P-Touch is acceptable for receptacles.
 - c) Wording for coverplates shall be confirmed by Contract Administrator.
 - d) All coverplates and junction boxes shall be identified with system and/or Panel/Voltage on cover.
- d) Use Of Equipment Before Occupancy By Owners
 - a) The Contractor may operate equipment for testing and balancing only. The use of equipment for any other purpose must be approved by the City in writing prior to use. Approval must indicate who is paying for utilities used.
 - b) Any equipment that is placed in use for any reason prior to the beginning of the guarantee period shall be cleaned and provided with maintenance and repairs as required, to ensure conditions are equal to that of new equipment, or shall be replaced, at no cost to the City.
- e) Wiring Methods
 - a) Unless otherwise shown on the drawings, all wires shall be copper, minimum #12 AWG with 90°C x-link insulation. Wiring shall be installed in conduit.
 - b) Wiring in concrete or masonry construction shall be in steel electrical metallic tubing (EMT). Provide a separate grounding conductor in EMT conduit runs embedded in concrete slabs. Conduits installed in areas exposed to moisture shall have watertight fittings.
 - c) Conduit and wiring shall be grouped where possible and clipped in a neat and workmanlike manner.
 - d) Liquid tight flexible metal conduit or Teck cable shall be utilized for all motor and transformer connections with approved Teck connectors.

- e) The use of electrical non-metallic tubing (ENT) shall be limited to in-slab installations only.
- f) Mounting
 - a) Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicate otherwise.
 - b) Mounting height of equipment shall be as per Elevations. Where elevations are not indicated, the following shall apply:
 - a) Outlets above counters: (6) 150mm; splashbacks: 100mm.
 - b) General receptacles, telephone and television outlets: 500mm.
 - c) Receptacles in mechanical and shop areas: 1025mm.
 - d) Switches, dimmers, push buttons, Luxo bracket: (45) 1150mm.
 - e) Branch circuit panels, control panels, annunciators, etc.: (72) 1825mm.
To top of panel.

E2.10 OUTLET BOXES

- a) Outlet, junction and switch boxes shall be galvanized pressed steel of size and type to suit each individual application.
- b) All outlet boxes exposed to damp locations shall be sealed FS/FD or RAB style.
- c) Sectional boxes shall not be utilized.
- d) Surface mounted outlet boxes accessible to public spaces shall be completely sealed free of knock outs. Use of surface mounted outlet boxes must be approved by Contract Administrator prior to installation.

E2.11 MECHANICAL EQUIPMENT WIRING

- a) Provide starters and wiring for all heating, ventilating and plumbing equipment unless specified otherwise.
- b) All control wiring for mechanical equipment shall be performed by Electrical Subcontractor except for temperature/humidity control systems. Electrical Subcontractor shall provide 120V circuit in locations designated by Controls Subcontractor.
- c) Electrical Subcontractor to provide all control wiring for the City supplied equipment and as designed on Drawing.
- d) Refer to the mechanical Drawings for the exact location of mechanical equipment requiring an electrical connection.
- e) Electrical Subcontractor shall report any discrepancies in voltage and control wiring specifications.
- f) Provide a means of disconnect for all mechanical equipment.

E2.12 MISCELLANEOUES APPARATUS AND APPLIANCES

- a) General
 - a) Provide all required electrical devices, components, conduits, fittings, wiring, disconnects, and miscellaneous equipment to make all connections to equipment.
 - b) Be familiar with the apparatus being supplied and carefully coordinate and cooperate with the supplier/installer to ensure a proper and complete installation.
- b) Receptacles
 - a) Where equipment has line cord and plug, ensure cap is compatible with receptacle. Provide cord sets to equipment where required.
- c) Heat Tracing Cables
 - a) Heat/tracing cable for pipes to be self-limiting type rated at 10 watts/foot.
 - b) Voltage and length as indicated.
 - c) Provide cold lead connection kit and locate as indicated.
 - d) Electrical Subcontractor shall supply and install cables to manufacturer's recommendations.

- e) Provide GFI rated breaker complete with 30 mA trip level.
- f) Acceptable manufacturer: Raychem.

E2.13 PANELBOARDS

- a) New panelboards shall match the existing. Load centres are not acceptable. Panels shall be complete with panel trim having concealed hinges and trim mounting screws, locking door with flush catch.
- b) Panelboards: to CSA C22.2 No. 29-M1989.
- c) Panelboards shall be product of one manufacturer throughout project.
- d) Where breakers are installed in existing distribution and the KAIC rating of the equipment is unknown, KAIC ratings of new breaker shall match the highest rated breaker installed in the panel.
- e) Sequence phase bussing such that circuit breakers shall be numbered vertically in consecutive order. Each breaker shall be identified by permanent number identification as to circuit number.
- f) Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- g) Two keys for each panelboard and key panelboards alike.
 - a) Copper bus with full size neutral.
 - b) Flush or surface-mounted tubs as shown.
 - c) Finish trim and door baked grey enamel.
 - d) All panelboards shall have "sprinklerproof" enclosures.
- h) Affix typewritten directory to the inside of the panelboard indicating loads controlled by each circuit.
- i) Panelboards to be surface or recessed mounted as indicated. All surface mounted panelboards in sprinklered buildings must be sprinkler proof.

E2.14 INCOMING SERVICE DISTRIBUTION

- a) Disconnect existing equipment and terminate cables or remove cables as indicated on the drawings.
- b) Main distribution to incorporate main breaker, complete with enclosure and utility metering transformer cabinet. Arrangements of components to be shown on the Drawings.
- c) Submit Shop Drawings and product data.
- d) Provide data for incorporation into Maintenance Manual.
- e) Materials:
 - a) Molded case circuit breakers: to CSA C22.2 No. 5.
- f) Power Supply:
 - a) Power supply; 120/208-volt, 3 phase, 4 wire, grounded neutral.
 - b) Minimum interrupting rating to be 42,000 amps symmetrical.
- g) Main Disconnect:
 - a) The main service disconnect to be a circuit breaker as indicated.
 - b) The main circuit breaker shall be a manually operable, fixed mounted, molded case type mounted in an EEMAC '3R' enclosure. Ampere rating to be as indicated.
- h) Hydro Utility Metering Cabinet:
 - a) Separate compartment for exclusive use of utility company metering transformers.
 - b) Provide mounting and wiring for the following:
 - a) Potential transformers (600 volt supply only)
 - b) Current transformers
 - c) Hydro utility metering transformers to be supplied by the Hydro
 - d) Utility and factory installed by the cabinet manufacturer.
- i) Finishes:
 - a) Apply finishes as follows:
 - a) Distribution equipment finish to be interior gray.
 - b) Supply two (2) spray cans touch-up enamel.
 - c) Treated to inhibit rusting.

- j) Equipment Identification:
 - a) Provide equipment identification as follows:
 - a) Nameplates: Black plate, white letters, size 7, to indicate voltage, amp rating and designation.
 - b) Main disconnect: labelled "Main Breaker".
 - c) Sub-breakers: labelled to indicate panel or equipment fed.
- k) Manufacturers:
 - a) Acceptable manufacturers: Eaton, Group Schneider, Square D & Siemens.
- l) Grounding:
 - a) Bond the non-current parts of the distribution equipment to the main ground point in the distribution.
 - b) Bond the neutral point of the main disconnect to the main building ground electrode in accordance with the requirements of the local inspection authorities.
- m) Installation:
 - a) Locate service entrance equipment as indicated.
 - b) Connect main secondary service entrance cables to line terminals of main disconnect.
 - c) Connect load terminals of distribution breakers to outgoing feeders as indicated.
 - d) Check factory-made connections for mechanical security and electrical continuity.
 - e) Run one (1) #6, bare copper, grounding conductor in 1" (25mm) conduit from ground point to the City side of the main water meter.

E2.15 WIRING DEVICES

- a) Colours of receptacles, switches, outlets and coverplates shall be confirmed Contract Administrator.
- b) Receptacles shall be 15 ampere, 125 VAC, ivory, parallel slot, U-ground, side and back wiring screw terminate. Approved manufacturers are: Hubbell No. 5262, Arrow Hart No. 5262, Bryant No. 5262 or equal.
- c) Provide stainless steel coverplates.
- d) Wet location covers shall be equal to Cooper, Metal WeatherBox While-In-Use protective covers, WIUMV-1 for vertical mounting and WIUMH-1 for horizontal mounting. Plastic covers will not be accepted.

E2.16 LIGHTING

- a) Supply and install all luminaires complete with lamps. All new luminaires shall be provided with Driver or electronic ballast, Power Smart approved.
- b) All LED fixtures shall utilize Power Smart approved drivers.

E2.17 LIGHTING CONTROLS

- a) Switches shall be totally enclosed in moulded housing, 15AC1 or 20AC1 series, 15 amps or 20 amps, 125 VAC as indicated equal to Hubbell No. 1201, P & S No. 15AC1, or Bryant No. 4801.
- b) Screw in LED lamp dimmer controls shall be Lutron or Leviton and shall be rated to meet the requirement of the lamp.
- c) Hard wired dimmable LED luminaires shall be provided with 0-10V driver with compatible dimmer control. Approved dimmers are Lutron or Leviton.
- d) Provide a dedicated neutral for all electronic dimming and driver controls.
- e) Provide line voltage and control wiring in independent conduit systems as necessary for operational systems. Refer to Manufacturer's wiring diagrams.

END OF SECTION