

**APPENDIX E – BASIC ELECTRICAL REQUIREMENTS AND BASIC
MECHANICAL REQUIREMENTS**

Attachment E1 – Basic Electrical Requirements

Attachment E2 – Basic Mechanical Requirements

ATTACHMENT E1 – BASIC ELECTRICAL REQUIREMENTS

1. REQUIREMENTS OF APPLICABLE LAWS

- .1 Comply with *Safety Codes Act* and rules and regulations made pursuant thereto, including the *Canadian Electrical Code*.
- .2 Unless otherwise indicated, all references to "Canadian Electrical Code" or "CEC" shall mean the Canadian Electrical Code, Part I, CSA C22.1-06, (20th edition), Safety Standard for electrical installations and the variations made thereto by Alberta regulation, which are in force.
- .3 All electrical products shall be tested, certified and labeled in accordance with a certification program accredited by the Standards Council of Canada. Where a product is not so labeled, provide written approval by the authority having jurisdiction.
- .4 Submit to appropriate Governmental Authority or utility the necessary number of drawings and specifications for examination and approval prior to commencement of electrical work. Pay associated fees.
- .5 Submit to the Province a copy of electrical permits obtained from a Governmental Authority.
- .6 If a Governmental Authority conducts an electrical inspection, submit copy of certificate of acceptance provided by the Governmental Authority.

2. SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 Submit shop drawings, product data and samples, as specified, indicating details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment and materials.
- .2 Provide product data for the following:
 - .1 Panelboards.
 - .2 Luminaires.
 - .3 Motor control.
 - .4 Fire alarm panels and components.
 - .5 Control panels.
 - .6 Other items, as requested by the Province.

3. RECORD DRAWINGS

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.1 Record actual locations of all pull boxes, panelboards, luminaires, feeders, electrical equipment and electrical site services.

.2 Record any changes to circuit designations.

4. REFERENCE STANDARDS

.1 Comply with applicable Standards and Guidelines of following organizations:

.1 Electrical and Electronic Manufacturers Association of Canada (EEMAC).

.2 National Electrical Manufacturers Association. (NEMA).

.3 Institute of Electrical and Electronic Engineers (IEEE).

.4 Insulated Power Cable Engineers Association (IPCEA).

5. TESTING

.1 Prior to energizing any portion of the electrical system, perform megger tests on all parts of the distribution system. Results shall meet the requirements of the CEC, the applicable Governmental Authority and the Technical Requirements.

6. ELECTRICAL IDENTIFICATION

.1 Colour Identification of Equipment:

.1 Electrical equipment shall be prefinished in coded colours as follows:

.1 120/208V or 120/240V Line Voltage Equipment: grey.

.2 Fire Alarm System Equipment: red.

.3 Telephone Cabinets: green.

.4 Ballast Cabinets: green.

.2 Refer to Alberta Infrastructure and Transportation's *Colour Coding Requirements for Mechanical and Electrical Systems, June 1987* for specific paint colour numbers.

.3 Where impracticable to obtain equipment prefinished in coded colours, equipment may be site painted in coded colours.

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- .2 Nameplate Identification: Identify following equipment with lamicoid nameplates, 3 mm thick, black face, white core, mechanically attached, 20 mm high with 8 mm high letters:
 - .1 Panelboards.
 - .2 Disconnection switches, magnetic motor starters and contactors.
 - .3 Transformers.
 - .4 Wireways.
 - .5 Line voltage cabinets and enclosures.
 - .6 Low voltage cabinets and enclosures.
 - .7 Pull and junction box covers over 100 mm size.
- .3 Panelboard Directories: Identify loads controlled by each overcurrent protective device in each panelboard, by means of a typewritten panelboard directory.
- .4 Colour Identification of Conduit and Cable: Identify all systems, except line voltage, with paint or colour banding tape.
- .5 Identification of Pull and Junction Boxes: Identify boxes for all systems, except line voltage, as follows:
 - .1 Boxes over 100 mm size: Spray paint inside and outside of boxes in coded colours.
 - .2 Boxes 100 mm or less in size: Spray paint inside of boxes in coded colours. Apply permanent identifying markings directly to box covers using indelible black ink.
- .6 Colour Identification of Wiring:
 - .1 Identify No. 4/0 AWG wiring and smaller by continuous insulation colour.
 - .2 Identify wiring larger than No. 4/0 AWG by continuous insulation colour or by colour banding tape applied at each end and at splices.
 - .3 Colour coding shall be in accordance with Canadian Electrical Code.
 - .4 Maintain phase sequence and colour coding throughout each system.

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- .7 Name/Number Identification of Wiring:
 - .1 Identify No. 8 AWG wiring and smaller using one of the following materials:
 - .1 Heat shrink sleeves, blank.
 - .2 Clear plastic tape wrap-on strips with white writing section.
 - .3 Wrap-on strips, pre-numbered.
 - .4 Slip-on identification bead markers or sleeves, blank or pre-numbered.
 - .2 Type or print on blank wire identification materials using indelible black ink.
 - .3 Identify wiring at all pull boxes, junction boxes, and outlet boxes for all systems.
 - .4 Identify each conductor as to panel and circuit, terminal, terminal numbers, system number scheme, and polarization, as applicable.
- .8 Receptacles: Identify all receptacles as to panel and circuit number on plastic engraved lamicoid tag, permanently affixed to wall directly above device cover plate; the tag is to be the same width as cover plate.

ATTACHMENT E2 – BASIC MECHANICAL REQUIREMENTS

1. REQUIREMENTS OF APPLICABLE LAWS

- .1 All mechanical products shall be tested, certified and labeled in accordance with a certification program accredited by the Standards Council of Canada. Where a product is not so labeled, provide written approval by the appropriate Governmental Authority.
- .2 Submit to the appropriate Governmental Authority and utility the necessary number of drawings and specifications for examination and approval prior to commencement of mechanical work. Pay associated fees.
- .3 Submit to the Province copies of mechanical permits obtained from a Governmental Authority.
- .4 If a Governmental Authority conducts a mechanical inspection, submit copy of certificate of acceptance provided by Governmental Authority.

2. REFERENCE STANDARDS

- .1 Comply with the applicable Standards and Guidelines of the following organizations:
 - .1 General Mechanical Provisions to CSA, NEMA, MG1-98, ULC: Mechanical general requirements including general testing, fire stopping, equipment supports, housekeeping pads, access doors, spare parts, special tools, demonstration and operating instructions and requirements for operation and maintenance manuals and record drawings.
 - .2 Domestic Water Supply Piping – incoming water service to ASSI/AWWA, CSA 64.4, AWWA C900, ULC: AWWA C900 PVC pressure pipe and fittings, joints. Water service gate isolation valves and reduced pressure backflow preventers.
 - .3 Mechanical Identification to CAN/CGSB-24.3, ANSI/NFPA 13: Piping and duct identification systems. Mechanical equipment identification and valve controller tagging. Equipment location identifiers. All valve tagging and equipment identification to be by lamaroid labels and discs.

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- .4 Mechanical Systems Balancing to AABC, NEBB:
Specifications for total air balance services to be provided by AABC or NEBB personnel including report format and total air balance requirements. Balance points for air handling units and exhaust fans and locations for room sound power level measurements are provided.
- .5 Chemical Treatment and Procedures to ASME, Sec VIII:
Startup and testing of all mechanical systems including startup procedures for ventilation systems and building system startup.
- Hot water media and treatment specifications including molybdenum inhibitor, test coupons, side arm filters, hot water media and inhibitor test kits and all flush and clean and testing procedures.
- .6 Piping and Equipment Insulation to CAN/CGSB 51.9, ANSI/NFPA 90A, CAN/CGSB-51.2, CSA HA M1980:
Piping insulation for hot water, domestic water and humidification piping. Canvas jackets for exposed insulated piping in mechanical and electrical rooms, aluminum jackets for exterior piping. Insulated removable valve enclosures for hot water gate, butterfly and flow balancing valves.
- .7 Ductwork and Breeching Insulation to SMACNA, ASTM C423, CAN/CGSB-51.10, CAN/CGSB-51.11, ANSI/NFPA 90A, ANSI/NFPA 90B-1993:
Type D1 Rigid and D2 flexible insulation for supply air and exhaust air ducts and for radiant ceiling panels. Canvas jackets for exposed supply air and exhaust air ducts.
- Rigid and flexible acoustic duct lining and 22ga. perforated lining for specific rectangular and all round ducts. Acoustic lining is also used in lieu of thermal insulation on C/A ducts to act as the thermal barrier.
- Alumina silicate matt insulation for gas fired appliance breeching complete with aluminum alloy jackets.
- .8 Pipe and Pipe Fittings to ASTM 88M, ANSI B16.18, ANSI B16.22 B137.10 ASTM F128,1 ANSI/NSF 61, ANSI B306, CAN/CSA-B70, CSA B125, ASTM D 2564, CAN/CSA B181.2, CSA B181.12, CAN40S102.2, ASTM A53, CSA W47.1:
Plumbing: Hard drawn Type 'L' Domestic water piping, PEX-AI-PEX domestic water tubing and fittings. Domestic water fittings

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and connection methods installation instructions and domestic water systems flushing, cleaning and disinfecting.

Drainage: Copper tube and fittings and mechanical joint cast iron piping and fittings. Fire retardant PVC piping and fittings and directions on acceptability for use within the building.

Hydronic and Steam: Schedule 40 steel piping, fittings and joints for hydronic heating systems and steam humidification systems.

Natural Gas: Schedule 40 steel piping, fittings and joints for all natural gas-fired equipment and piping.

- .9 Pipe and Equipment Supports to ANSI B31.1, MSS SP-58:
Hanging and support systems for mechanical systems including hot water piping, Domestic water piping, drainage piping and natural gas piping, ducts and miscellaneous equipment. Section includes specifications for clevis hangers, rod hangers, Can-truss hangers and wall brackets, insulation shields and saddles, upper supports and riser clamps.
- .10 Pressure Gauges and Thermometers to ANSI/ASME-B40.1, CAN/CGSB-14.4 CAN/CGSB-14.5:
Thermometers including wells; pressure and vacuum gauges.
- .11 Expansion Compensation to ASTM A 53-90B, ASTM A 105/A 105M-02:
Braided stainless steel flexible connections equipment; guides and anchors for hot water systems; acoustic isolators for hot water systems; and inline expansion joints for hot water systems.
- .12 Mechanical Vibration Control to SMACNA, ASHRAE RP-812:
All vibration isolation equipment including inertia bases for larger pumps, acoustic barriers, elastomeric pads, floor and hanging spring isolators and spring isolated hanging systems.
- .13 Plumbing Specialties to ASTM A 126, CSA B79, ANSI/AWWA C700, CSA B64, ANSI Z359.1:
All plumbing accessories and specialty items including: floor drains, cleanouts, water hammer arrestors, hose bibs, strainers, vent flashing, domestic hot water expansion tank, domestic water valves, domestic water manifolds, backflow preventers, eyewash stations and showers, trap seal primers, vent flashings, thermostatic

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- and pressure mixing valves and gravity film shower heat recovery exchangers.
- .14 Domestic Water Heaters to CSA B51:
Domestic water tanks and heaters.
- .15 Plumbing Fixtures and Trim to CAN/CSA-B45, CSA B125:
Plumbing fixtures and trim include lavatories, hand sinks, mop sinks, water closets, urinals, and showers. Faucets will be with infrared control, all trim will be institutional cast brass. All lavatory faucets to be metered and include anti scald temperature stops. All shower mixing valves to be pressure balancing fixture supplies.
- .16 Coils to ANSI.ARI 410:
Duct mounted heating coils.
- .17 Packaged Heat Recovery Ventilators to CSA C22.2, ANSI/ARI 430, CAN/CGSB181:
Energy recovery ventilators specification including fan, coil and motor schedules, unit construction, finish, medium and high efficiency filters, energy wheels and trim. Inlet, discharge and radiated fan sound power level are also included.
- .18 Gas Fired Steam Humidifiers to CSA:
Water to steam humidifier and grid for connection to gas fired humidifiers and for installation in air handling units.
- .19 Fans to CSA C22.22, CAN/CGSB 1.181, ANSI/ASHRAE 51:
General fans including cabinet and inline exhaust air fans, transfer fans and cooling fans. All inline centrifugal fans are included with acoustic lined housings. Performance schedules for all fans including LwA or Sones sound criteria are included.
- .20 Ductwork to SMACNA, ASHRAE:
Low velocity ducts below 10m/s including proprietary joints, sealant, fitting, duct weights, hangers and supports to SMACNA and ASHRAE.
- .21 Ductwork Accessories SMACNA, ASHRAE:
Ventilation accessories including neoprene flexible connections, duct access doors, turning vanes and instrument test ports.
Single bladed and multi-bladed dampers balancing dampers.
Displacement ventilation dampers.
Aluminum insulated/thermally broken dampers for outdoor air and exhaust air dampers.

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Fire and smoke damper fabrication and installation instructions.

- .22 Breeching and Chimneys:
Listed all fuels pressure boiler chimneys and fabricated mild steel breeching and listed. Chimney accessories and flue barometric dampers.
- .23 Air Outlets and Inlets to SMACNA, ASTM E 90, AMCA:
Steel ceiling diffusers, steel wall and ceiling grilles, aluminum ceiling grilles. Displacement ventilators. A schedule of all diffusers is provided.
- Shop fabricated wall hoods, factory fabricated low profile roof hoods and factory fabricated extruded stationary aluminum louvres.
- .24 Air Filters to UCL-S111, CAN/CGSB 15.10, CAN/CGSB 15.18, ASHRAE 52:
Low efficiency filters, housings and magnehelic gauges for mechanical room cooling systems.
- .25 Silencers to ASTM C 423-90a, ASTM E 90-90, ASTM E 477-90:
Passive low and medium velocity silencers for supply and return air ducting at air handling units.
- .26 BMCS: General Requirements; Shop Drawings, Product Data and Review Process; Start-up and Check-out; Commissioning; Project Record Documents; Identification; Local Area Network (LAN); Operator Work Station (OWS); Building Controllers Family of Controllers; Field Control Devices; Field Installation; Site Requirements Applications and Systems Sequences of Operation to C-22.1 CEC:
General requirements for DDC base BMCS system.
Submittal requirements and procedures for DDC based BMCS system.
Start-up for DDC based BMCS system.
Procedures for DDC based BMCS commissioning including coordination issues for total building commissioning.
Procedures for DDC based BMCS record drawings and submissions.
Identification requirements for DDC based BMCS.
DDC based BMCS system networking, requirements.
DDC based BMCS system operating system including hardware, software, connectivity and display.

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DDC based BMCS system controllers including application specific controllers and network controllers.

DDC based BMCS system devices including AI/DIAOAI devices, low and line voltage devices and all ancillary control equipment and materials.

Installation specification for DDC based BMCS system.

DDC based BMCS system controls sequences for specific building systems controlled by BMCS.

3. SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

- .1 Provide shop drawings and comply with requirements of DBFM Agreement and Section 4 of Schedule 18.
- .2 Identify materials and equipment by manufacturer, trade name and model number. Include copies of applicable brochure or catalog material. Maintenance and operating manuals are not suitable submittal material.
- .3 Clearly mark submittal material using arrows, underlining or circling to show differences from specified, e.g. ratings, capacities and options being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pumps seals materials or painting.
- .4 Include dimensional and technical data sufficient to check if equipment meets requirements. Include wiring, piping, and service connection data and motor sizes.
- .5 Installed materials and equipment shall meet specified requirements regardless of whether or not shop drawings are reviewed by the Province.

4. MECHANICAL IDENTIFICATION

- .1 Comply with requirements of latest edition of Alberta Infrastructure's *Colour Coding Requirements for Mechanical and Electrical Systems, June 1987*.

5. TESTING

- .1 Equipment and mechanical systems shall be tested to determine compliance with specified Technical Requirements.

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- .2 Prior to starting any mechanical equipment and system, perform all the required testing. Results shall meet the Technical Requirements and the requirements of the appropriate Governmental Authority.

6. PROJECT RECORD DRAWINGS

- .1 As built record drawings must identify locations of fire dampers, major control lines, BMCS sensors, access doors, tagged valves and actual room names or numbers in addition to the record of changes to the Contractor's original detailed design drawings.