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HYDRONIC VALVES AND STRAINERS

1. GENERAL

1.1 Scope

- .1 Gate valves
- .2 Ball valves
- .3 Check valves
- .4 Butterfly valves
- .5 Drain valves
- .6 Strainers
- .7 Triple Duty Valves
- .8 Suction Diffusers

1.2 Manufacturer

- .1 Provide valves of the same type by the same manufacturer throughout.
- .2 Provide valves with Manufacturer's name and pressure rating clearly marked on outside of body.

1.3 Shop Drawings

- .1 Submit copies of valves "ordering schedule" for review before ordering valves.
- .2 Submit detailed Shop Drawings clearly indicating make, model, size, pressure rating, materials of construction and intended service.

2. PRODUCTS

2.1 Hot Water Heating, Glycol and Chilled Water and Condenser Water Systems

- .1 Ball Valves up to 50 mm: Brass body, chrome plated brass ball, threaded or solder ends, TFE seat and packing. 4134 kPa (600 psi) non-shock WOG rating. Threaded, Red-White Fig. 5044A. Solder joint, Red-White Fig. 5049A.

HYDRONIC VALVES AND STRAINERS

- .2 Butterfly Valves: Cast iron wafer full-lug body, 300 Series stainless steel shaft, bronze disc, replaceable EPDM seat, lever lock handle operator with multiple position lock plate for valve sizes to 100 mm, heavy duty gear handwheel operator with position indicator for valve sizes 150 mm and over. Minimum rating 1200 kPa (175 psi), 121°C (250°F). Keystone F1000, F1020.
- .3 Gate Valves up to 50 mm: Bronze body, inside screw, travelling stem, solid wedge, screw-in bonnet, threaded ends rating 860 kPa (125 psi) steam, solder ends rating 1380 kPa (200 psi) water. Threaded, Red-White Fig. 293. Solder ends, Red-White Fig. 299.

Gate Valves 65 mm and over: Cast iron body, bronze trim, OS&Y, rising stem, solid wedge, flanged ends, rating 860 kPa (125 psi) steam. Red-White Fig. 421.
- .4 Check Valves up to 50 mm: Swing type, bronze body, screw-in cap, replaceable disc, 860 kPa (125 psi) steam rating. Threaded, Red-White Fig. 236. Solder ends, Red-White Fig. 237.

Check Valves 65 mm and over: Silent, wafer style, cast iron body, 316 SS seat, plug, spring and bushing. ANSI Class 125. Val Matic, Series 1400.
- .5 Drain Valves up to 50 mm: Brass 2 piece body ball valve, blowout proof stem, Teflon seats, forged brass chrome plated ball, hose end connection with cap and chain by male IP, 4200 kPa (600 psi) water, oil, gas rating, Red-White Fig. 5046.

2.2 Strainers

- .1 Size 50 mm and under: Screwed brass or iron body, Y pattern with 0.75 mm (24 ga) stainless steel perforated screen.
- .2 Size 65 mm to 100 mm: Flanged iron body, Y pattern with 1 mm (20 ga) stainless steel perforated screen.
- .3 Size 125 mm and larger: Flanged iron body, Y pattern with 3 mm (11 ga) stainless steel perforated screen.
- .4 Screen free area shall be minimum three times area of inlet pipe.

2.3 Triple Duty Valve

- .1 For base mounted or inline pump discharge application, performs the functions of a nonslam check valve, throttling valve, shut-off valve and calibrated balancing valve. Equip with brass readout valves (with integral check valves) to read differential pressure across valve.
- .2 Cast iron, bronze seat, replaceable bronze disc with EPDM insert.
- .3 Up to 50 mm: NPT connections, 1200 kPa (175 psi) working pressure, brass stem, chatter preventing SS spring.
- .4 Over 50 mm: Flanged connections, 1200 kPa (175 psi) working pressure, stainless steel stem and chatter preventing spring.

HYDRONIC VALVES AND STRAINERS

2.4 Suction Diffuser

- .1 For base mounted or floor mounted vertical inline pumps.
- .2 Up to 50 mm: Cast iron construction, NPT connections.
- .3 Over 50 mm: cast iron straightening fitting, stainless steel combination diffuser - strainer - orifice cylinder with 4.8 mm (3/16 in) perforations, and permanent magnet. Provide complete with a 16 mesh bronze strainer.

3. EXECUTION

3.1 Installation and Application

- .1 Install valves with stem upright or horizontal, not inverted.
- .2 Provide threaded lug type butterfly valves for equipment isolation service. Provide wafer or threaded lug type valves for zone shut-off service.
- .3 Provide drain valves at main shut-off valves, low points of piping and apparatus and terminal units.
- .4 Size drain lines and drain valves equal to size of apparatus drain connection.
- .5 For pipe sizes 20 mm and over, minimum drain size to be 20 mm.
- .6 Provide hose thread connection with cap and chain for 20 mm drain valves located in ceiling and public areas.
- .7 Provide male NPT nipples with threaded pipe cap for drain sizes over 20 mm where not piped directly to floor drains.
- .8 Provide valved drain and hose connections off the bottom of all strainers.

END OF SECTION

COMMON WORK RESULTS FOR ELECTRICAL

1. GENERAL

1.1 Related Sections

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

1.2 References

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations except where specified otherwise.
 - .2 CSA C22.3 No. 1, Overhead Systems.
 - .3 CSA C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC Y1-2, Performance Specification for Finishing Systems for Outdoor Electrical Equipment
 - .2 EEMAC 2Y-1, CEMA Light Gray Colour for Indoor Switch Gear.
- .3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE 100, The Authoritative Dictionary of IEEE Standards Terms.

1.3 Definitions

- .1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these Specifications, and on Drawings, are those defined by IEEE 100.

1.4 Design Requirements

- .1 Operating voltages: to CSA C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

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.

COMMON WORK RESULTS FOR ELECTRICAL

- .4 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.
- .5 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Contract Administrator.

1.6 Submittals

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit Drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure coordinated installation.
 - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
 - .4 Indicate on Drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .5 If changes are required, notify Contract Administrator of these changes before they are made.
- .3 Quality Control:
 - .1 Provide CSA certified equipment and material.
 - .2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.
 - .3 Submit test results of installed electrical systems and instrumentation.
 - .4 Permits and fees: in accordance with General Conditions of Contract.
 - .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.
- .4 Manufacturer's Field Reports: submit to Contract Administrator, Manufacturer's written report, within three (3) days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in Part 3 – Field Quality Control.

1.7 Quality Assurance

- .1 Qualifications: electrical Work to be carried out by qualified, licensed electricians as per the conditions of Provincial Act respecting manpower vocational training and qualification.

COMMON WORK RESULTS FOR ELECTRICAL

- .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
- .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

1.8 System Start-up

- .1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Provide these services for such period to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.9 Operating Instructions

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

2. PRODUCTS

2.1 Materials and Equipment

- .1 Equipment to be CSA certified. Where CSA certified equipment is not available, obtain special approval from Electrical Inspection Department before delivery to site and submit such approval as described in Part 1 - Submittals.
- .2 Factory assemble control panels and component assemblies.

2.2 Electric Motors and Equipment

- .1 Verify installation and co-ordination responsibilities related to motors and equipment, as indicated.

COMMON WORK RESULTS FOR ELECTRICAL

2.3 Warning Signs

- .1 Warning Signs: in accordance with requirements of Electrical Inspection Department and Contract Administrator.
- .2 Decal signs, minimum size 175 x 250 mm.

2.4 Wiring Terminations

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 Equipment Identification

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

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
Size 8	80 x 150 mm	6 lines	8 mm high letters

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

2.6 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.

COMMON WORK RESULTS FOR ELECTRICAL

- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.7 Conduit and Cable Identification

- .1 Colour code conduits, boxes and metallic sheathed cables with vinyl label.
- .2 Code with label identifying system at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals for the following systems.
- .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
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

- .4 Standard of acceptance: Thomas & Betts.
- .5 Submit sample for approval.

2.8 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 Y1-2.
 - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

3. EXECUTION

3.1 Installation

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 Nameplates and Labels

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

COMMON WORK RESULTS FOR ELECTRICAL

3.3 Conduit and Cable Installation

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: schedule 40 steel pipe, plastic or sheet metal, 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 embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 Location of Outlets

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors.
 - .1 Locate disconnect devices in mechanical on latch side of floor.

3.5 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: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 400 mm.
 - .2 Above top of continuous baseboard heater: 300 mm.
 - .3 Above top of counters or counter splash backs: 175 mm.
 - .4 In mechanical rooms: 1200 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 300 mm.

COMMON WORK RESULTS FOR ELECTRICAL

- .5 Wall mounted telephone and interphone outlets: 1500 mm.
- .6 Fire alarm stations: 1200 mm.
- .7 Fire alarm bells: 2100 mm.
- .8 Television outlets: 300 mm.
- .9 Wall mounted speakers: 2100 mm.
- .10 Clocks: 2100 mm.
- .11 Door bell pushbuttons: 1200 mm.

3.6 Co-Ordination of Protective Devices

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 Field Quality Control

- .1 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 Provide upon completion of work, load balance report as directed in Part 1 - Submittals: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 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: fire alarm system.
 - .6 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

COMMON WORK RESULTS FOR ELECTRICAL

- .2 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Contract Administrator.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in Part 1 - Submittals.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in Part 1 – Quality Assurance.
- .6 Submit test results for Contract Administrator's review.

3.8 Cleaning

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

WIRE AND BOX CONNECTORS 0-1000 V

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 C22.2 No.18.1, Metallic Outlet Boxes.
 - .2 CSA C22.2 No.18.2, Nonmetallic Outlet Boxes
 - .3 CSA C22.2 No.65, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, CEMA Standard for Bushing Stud Connector and Aluminum Adapters (1200 Ampere Maximum Rating).

2. PRODUCTS

2.1 Materials

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: with current carrying parts of copper sized to fit conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded or round copper conductors.
 - .2 Clamp for stranded or round copper conductors.
 - .3 Bolts for copper conductors or bars.
- .4 Clamps or connectors for armoured cable, aluminum sheathed cable or flexible conduit as required.

3. EXECUTION

3.1 Installation

- .1 Remove insulation carefully from ends of conductors and:

WIRE AND BOX CONNECTORS 0-1000 V

- .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer.
- .2 Install fixture type connectors and tighten. Replace insulating cap.
- .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

WIRES AND CABLES (0-1000 V)

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.

1.3 Product Data

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

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 and 600V power circuit min. #12 AWG.
- .3 Copper conductors: size as indicated, with thermoplastic insulation type TWU rated at 600 V.

2.2 Teck Cable

- .1 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .2 Insulation:
 - .1 Type: ethylene propylene rubber.
 - .2 Chemically cross-linked thermosetting polyethylene rated type RW90.
- .3 Inner jacket: polyvinyl chloride material.
- .4 Armour: interlocking aluminum.
- .5 Overall covering: thermoplastic polyvinyl chloride material.

WIRES AND CABLES (0-1000 V)

.6 Fastenings:

- .1 One hole malleable iron 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 at 750 mm centers.
- .3 Threaded rods: 6 mm dia. to support suspended channels.

.7 Connectors:

- .1 Approved for Teck cable.

2.3 Armoured Cables

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 For use in partition drywall walls or fixture drops in T-bar ceilings.

2.4 Fire Alarm Cable

- .1 Non-metallic sheathed cable 300 V rated 4/c #18 AWG for smoke/heat detectors.
- .2 Non-metallic sheathed cable neoprene jacketed 300V rated 2/c minimum #12 AWG for signal devices.

2.5 Aluminum Sheathed Cable

- .1 Conductors: copper, size as indicated.
- .2 Insulation: rated 600V.
- .3 Sheath: aluminum applied to form continuous sheath.
- .4 Fastenings for aluminum sheathed cable:
 - .1 One hole aluminum straps to secure surface cables 25 mm and smaller. Two hole straps for cables larger than 25 mm.
 - .2 Threaded rods: 6 mm dia. to support suspended channels.

2.6 Non-Metallic Sheathed Cable

- .1 Non-metallic sheathed copper cable type, size as indicated.

WIRES AND CABLES (0-1000 V)

3. EXECUTION

3.1 Installation of Building Wires

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

3.2 Installation of Teck Cable 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels.

3.3 Installation of Armoured Cables

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors 0-1000 V.

3.4 Installation of Aluminum Sheathed Cable

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors 0-1000 V.

3.5 Installation of Non-Metallic Sheathed Cable

.1 Install cables.

.2 Install straps and box connectors to cables as required.

END OF SECTION

GROUNDING - SECONDARY

1. GENERAL

1.1 Related Sections

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 References

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA International)

2. PRODUCTS

2.1 Equipment

- .1 Clamps for grounding of conductor: size as required to Main Distribution ground.
- .2 System and circuit, equipment, grounding conductors: bare stranded copper, soft annealed, 6 AWG size.
- .3 Insulated grounding conductors: green, type RW90.
- .4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Thermit welded type conductor connectors.
 - .4 Bonding jumpers, straps.
 - .5 Pressure wire connectors.

3. EXECUTION

3.1 Installation General

- .1 Install complete permanent, continuous grounding system and circuit, equipment including, electrodes, conductors, connectors, accessories to conform to requirements of Contract Administrator, City, and local authority having jurisdiction over installation. Provide a ground wire in all conduit.
- .2 Install connectors in accordance with Manufacturer's instructions.

GROUNDING - SECONDARY

- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .8 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

3.2 Equipment Grounding

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.
- .2 Reconnect existing ground conductors to new equipment where possible.

3.3 Grounding Bus

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual insulated stranded copper connections size as shown.

3.4 Communication Systems

- .1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:
 - .1 Telephones: make telephone grounding system in accordance with telephone company's requirements.
 - .2 Sound, fire alarm, intercommunication systems as indicated.

3.5 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for 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.

GROUNDING - SECONDARY

- .4 Disconnect ground fault indicator during tests.

END OF SECTION

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1. GENERAL

1.1 Section Includes

- .1 Materials and installation for hangers and supports.

2. PRODUCTS

2.1 Support Channels

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted.

3. EXECUTION

3.1 Installation

- .1 Secure equipment to solid masonry, tile and plaster surfaces with adjustable anchors bolts.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole malleable iron or aluminum straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel or aluminum straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

OUTLET BOXES, CONDUIT BOXES AND FITTINGS

1. GENERAL

1.1 References

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1.

1.2 Submittals

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

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.
- .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 Galvanized Steel Outlet Boxes

- .1 One-piece electro-galvanized construction.
- .2 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.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 Masonry Boxes

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 Concrete Boxes

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

OUTLET BOXES, CONDUIT BOXES AND FITTINGS

2.5 Conduit Boxes

- .1 Cast aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.6 Outlet Boxes for Non-Metallic Sheathed Cable

- .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.7 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 35 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

2.8 Service Fittings

- .1 Pedestal type 'low tension' fitting made of 2 piece stainless steel or die cast aluminum with brushed aluminum or satin aluminum housing finish to accommodate two amphenol jack connectors.

3. EXECUTION

3.1 Installation

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

END OF SECTION

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

1. GENERAL

1.1 References

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18.1, Metallic Outlet Boxes.
 - .2 CSA C22.2 No.18.2, Nonmetallic Outlet Boxes
 - .3 CSA C22.2 No. 45.1, Electrical Rigid Metal Conduit - Steel.
 - .4 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .5 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .6 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
 - .7 CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT).

1.2 Submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

2. PRODUCTS

2.1 Cables and Reels

- .1 Provide cables on reels or coils.
 - .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2 Each coil or reel of cable to contain only one continuous cable without splices.
- .3 Identify cables for exclusively dc applications.

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

2.2 Conduits

- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .4 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.
- .6 Flexible pvc conduit: to CSA-C22.2 No. 227.3.

2.3 Conduit Fastenings

- .1 One hole malleable iron straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m on centre.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 Conduit Fittings

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.5 Fish Cord

- .1 Polypropylene.

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 datasheets.

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

3.2 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 mechanical and electrical service rooms.
- .3 Use rigid hot dipped galvanized steel threaded conduit except where specified otherwise.
- .4 Use electrical metallic tubing (EMT) except in cast concrete.
- .5 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without prewired outlet box, connection to surface or recessed fluorescent fixtures.
- .6 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
- .7 Use explosion proof flexible connection for connection to explosion proof motors.
- .8 Minimum conduit size for lighting and power circuits: 19 mm.
- .9 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .10 Mechanically bend steel conduit over 19 mm diameter.
- .11 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .12 Install fish cord in empty conduits.
- .13 Run 2- 25 mm spare conduits up to ceiling space and 2- 25 mm spare conduits down to ceiling space from each panel.
 - .1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.
- .14 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .15 Dry conduits out before installing wire.

3.3 Surface Conduits

- .1 Surface conduits in service spaces only (new and existing areas).
- .2 Run parallel or perpendicular to building lines.
- .3 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .4 Run conduits in flanged portion of structural steel.

CONDUITS, CONDUIT FASTENINGS AND CONDUIT FITTINGS

- .5 Group conduits wherever possible on suspended channels.
- .6 Do not pass conduits through structural members except as indicated.
- .7 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 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.

3.5 Conduits In Cast-In-Place Concrete

- .1 Locate to suit reinforcing steel.
 - .1 Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.
 - .1 Use cold mastic between sleeve and conduit.
- .5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

3.6 Cleaning

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

END OF SECTION

PANELBOARDS BREAKER TYPE

1. GENERAL

1.1 Section Includes

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

1.2 References

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

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.4 Plant Assembly

- .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. PRODUCTS

2.1 Panelboards

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250 V panelboards: bus and breakers rated for 42kA (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.

PANELBOARDS BREAKER TYPE

- .7 Trim with concealed front bolts and hinges.
- .8 Trim and door finish: baked grey enamel.
- .9 Panelboards shall have sprinkler hoods.
- .10 Panels shall have piano hinge front door covers and hinged front trim cover.

2.2 Breakers

- .1 Breakers: to 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Branch circuit breakers to be 15A single pole unless otherwise indicated on drawings.

2.3 Equipment Identification

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Nameplate for each panelboard size 5 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

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 plywood backboards in accordance with Section 06 10 10 - Rough Carpentry. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results for Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Locate all panelboards as shown on the drawings.
- .7 Wiring in panelboards shall be neat and organized. All neutral conductors shall be identified in the panel with their associated circuit numbers by means of Brady Markers.

PANELBOARDS BREAKER TYPE

- .8 All panelboards throughout the building shall be phased together such that the left-hand, centre and right-hand panelboard busses represent phases A, B and C respectively. All indicating meters shall be identified to this sequence.
- .9 All existing panelboards modified by this contract shall be supplied with new updated, typewritten panel schedules.

END OF SECTION

MOTOR CONTROL CENTRES

1. GENERAL

1.1 Submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit product data sheets for sills, busbars and compartments. Include product characteristics, physical size and finish.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence and cleaning procedures
- .4 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures.
- .5 Submit Shop Drawings and indicate:
 - .1 Outline dimensions.
 - .2 Configuration of identified compartments.
 - .3 Floor anchoring method and dimensioned foundation template.
 - .4 Cable entry and exit locations.
 - .5 Dimensioned position and size of busbars and details of provision for future extension.
 - .6 Schematic and wiring diagrams.
 - .7 Include data for each type and style of starter.

2. PRODUCTS

2.1 Supply Characteristics

- .1 208 V, 60Hz, wye connected, 3 phase, 4 wire, grounded.

2.2 General Description

- .1 Compartmentalized vertical sections with common power busbars.
- .2 Floor mounting, free standing, enclosed dead front.
- .3 Indoor NEMA 12 gasketed enclosure, front mounting.
- .4 Class I, Type B.

MOTOR CONTROL CENTRES

2.3 Vertical Section Construction

- .1 Independent vertical sections fabricated from rolled flat steel sheets bolted together to form rigid, completely enclosed assembly.
- .2 Each vertical section divided into compartment units, minimum 305 mm high, as indicated.
- .3 Each unit to have complete top and bottom steel plate for isolation between units.
- .4 Horizontal wireways, equipped with cable supports, across top and bottom, extending full width of motor control centre, isolated from busbars by steel barriers.
- .5 Vertical wireways complete with doors for load and control conductors extending full height of vertical sections, and equipped with cable tie supports. Installation wiring to units accessible with doors open and units in place.
- .6 Openings, with removable cover plates, in side of vertical sections for horizontal wiring between sections.
- .7 Incoming cables to enter at top as indicated.
- .8 Provision for outgoing cables to exit via top or bottom with terminals.
- .9 Removable lifting means.
- .10 Provision for future extension of both ends of motor control centre including busbars without need for further drilling, cutting or preparation in field.
- .11 Divide assembly for shipment to site, complete with hardware and instructions for re-assembly.

2.4 Sills

- .1 Continuous 38 mm channel iron floor sills for mounting bases with 19 mm diameter holes for bolts.

2.5 Busbars

- .1 Main horizontal and branch vertical, three phase and neutral high conductivity copper busbars in separate compartment self-cooled, extending entire width and height of motor control centre, supported on insulators and rated:
 - .1 Branch vertical busbars: 300 A as indicated.
- .2 Branch vertical busbars for distribution of power to units in vertical sections.
- .3 No other cables, wires, equipment in main and branch busbar compartments.
- .4 Brace buswork to withstand effects of short-circuit current of 42 kA rms symmetrical.
- .5 Bus supports: with high dielectric strength, low moisture absorption, high impact material and long creepage surface designed to discourage collection of dust.

MOTOR CONTROL CENTRES

2.6 Ground Bus

- .1 Copper ground bus extending entire width of motor control centre.
- .2 Vertical ground bus strap, full height of section, tied to horizontal ground bus, engaged by plug-in unit ground stab.

2.7 Motor Starters and Devices

- .1 Section 26 29 10 – Motor Starters to 600 V.

2.8 Starter Unit Compartments

- .1 Units EEMAC size 5 and smaller, circuit breaker units 225 A and smaller, plug-in type with self-disconnect. Guide rail supports for units to ensure that stabs make positive contact with vertical bus. Provision for units to be installed or removed, off load, while buses energized.
- .2 Unit mounting:
 - .1 Engaged position - unit stabbed into vertical bus.
 - .2 Withdrawn position - unit isolated from vertical bus but supported by structure. Terminal block accessible for electrical testing of starter.
 - .3 Provision for positive latching in either engaged or withdrawn position and padlocking in withdrawn position.
 - .4 Stab-on connectors free floating tin plated clips, self-aligning, backed up with steel springs.
- .3 External operating handle of circuit switch interlocked with door to prevent door opening with switch in "on" position. Provision for 3 padlocks to lock operating handle in "off" position and lock door closed.
- .4 Hinge unit doors on same side.
- .5 Overload relays manually reset from front with door closed.
- .6 Pushbuttons selector switches and mounted on door front.
- .7 Devices and components by one manufacturer to facilitate maintenance.
- .8 Pull-apart terminal blocks for power and control to allow removal of starter units without removal of field wiring.

2.9 Wiring Identification

- .1 Provide wiring identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

MOTOR CONTROL CENTRES

2.10 Equipment Identification

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
 - .1 Motor control centre main nameplate: size No. 7, engraved MCC-B, 208 V, 3 PH, 4 W.
 - .2 Individual compartment nameplates: size No. 5, engraved as indicated.

2.11 Finishes

- .1 Apply finishes in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Paint motor control centre exterior light gray and interiors white.

2.12 Source Quality Control

- .1 Provide manufacturer's type test certificates including short circuit fault damage certification up to short circuit values specified under bus bracing.
- .2 Contract Administrator to witness standard factory testing of complete motor control centre including operation of switches, circuit breakers, starters and controls.

2.13 Approved Manufacturer

- .1 MCC shall be as manufactured by Square D, Cutler-Hammer or Siemens.

3. EXECUTION

3.1 Installation

- .1 Set and secure motor control centre in place on channel bases, rigid, plumb and square to building floor and wall.
- .2 Make field power and control connections as indicated.
- .3 Ensure correct overload heater elements are installed.

3.2 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Ensure moving and working parts are lubricated where required.
- .3 Operate starters to prove satisfactory performance of motor control centre during 8 hour period.

END OF SECTION

MOULDED CASE CIRCUIT BREAKERS

1. GENERAL

1.1 Section Includes

- .1 Materials for moulded-case circuit breakers, circuit breakers.

1.2 Related Sections

- .1 Section 01 33 00 - Submittal Procedures.

1.3 References

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-C22.2 No. 5, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures.

1.4 Submittals

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

2. PRODUCTS

2.1 Breakers General

- .1 Moulded-case circuit breakers: to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3 to 10 times current rating.
- .5 Circuit breakers to have minimum 42 kA symmetrical rms interrupting capacity rating.

2.2 Thermal Magnetic Breakers

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

2.3 Magnetic Breakers

- .1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

MOULDED CASE CIRCUIT BREAKERS

2.4 Solid State Trip Breakers

- .1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and long time, short time, instantaneous tripping for phase, ground or fault short circuit protection.

3. EXECUTION

3.1 Installation

- .1 Install circuit breakers as indicated.

3.2 Manufacturers

- .1 Acceptable manufacturer: Square D, Cutler Hammer, Siemens.

END OF SECTION

DISCONNECT SWITCHES - FUSED AND NON-FUSED

1. GENERAL

1.1 Section Includes

- .1 Materials and installation for non-fused load break disconnect switches.

1.2 Related Sections

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 26 05 00 - Common Work Results for Electrical.

1.3 References

- .1 Canadian Standards Association (CSA International).
 - .1 CSA C22.2 No.4, Enclosed and Dead-Front Switches.
 - .2 CSA C22.2 No.39, Fuseholder Assemblies Industrial Products.

1.4 Submittals

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

2. PRODUCTS

2.1 Disconnect Switches

- .1 Non-fusible, horsepower rated disconnect switch in CSA Enclosure 1, 4X as shown, size as indicated.
- .2 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Quick-make, quick-break action.
- .5 ON-OFF switch position indication on switch enclosure cover.
- .6 Solid neutral block as required.
- .7 Acceptable Manufacturer: Square D Series CH.

2.2 Equipment Identification

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

DISCONNECT SWITCHES - FUSED AND NON-FUSED

3. EXECUTION

3.1 Installation

- .1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

MOTOR STARTERS TO 600 V

1. GENERAL

1.1 Related Sections

- .1 Section 26 05 00 - Common Work Results for Electrical.

1.2 References

- .1 International Electrotechnical Commission (IEC)/Dansk Standard (DS)
 - .1 DS DS/EN 60947-4-1, Part 4: Contactors and motor-starters.

1.3 Shop Drawings and Product Data

- .1 Submit Shop Drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate:
 - .1 Mounting method and dimensions.
 - .2 Starter size and type.
 - .3 Layout of identified internal and front panel components.
 - .4 Enclosure types.
 - .5 Wiring diagram for each type of starter.
 - .6 Interconnection diagrams.

1.4 Closeout Submittals

- .1 Include operation and maintenance data for each type and style of starter.

1.5 Extra Materials

- .1 Provide listed spare parts for each different size and type of starter:
 - .1 4 contacts, stationary.
 - .2 4 contacts, movable.
 - .3 2 contacts, auxiliary.
 - .4 2 control transformers.
 - .5 2 operating coil.
 - .6 10% indicating lamp bulbs used.
 - .7 1 HOA kit.

MOTOR STARTERS TO 600 V

1.6 Waste Management and Disposal

- .1 Place materials defined as hazardous or toxic waste in designated containers.
- .2 Ensure emptied containers are sealed and stored safely for disposal away from children.

2. PRODUCTS

2.1 Materials

- .1 Starters: to IEC/DS DS/EN 60947-4-1.
- .2 Starters: EEMAC E14-2.

2.2 Manual Motor Starters

- .1 Single and Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
 - .1 Switching mechanism, quick make and break.
 - .2 Overload heaters, manual reset, trip indicating handle.
- .2 Accessories:
 - .1 Toggle switch: labelled as indicated.
 - .2 Indicating light: type and colour as indicated.
 - .3 Locking tab to permit padlocking in "ON" or "OFF" position.
 - .4 Flush mounted type in public areas or as indicated.

2.3 Full Voltage Magnetic Starters

- .1 Combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
 - .1 Contactor solenoid operated, rapid action type.
 - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
 - .3 Wiring and schematic diagram inside starter enclosure in visible location.
 - .4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include circuit breaker with operating lever on outside of enclosure to control circuit breaker, and provision for:
 - .1 Locking in "OFF" position with up to 3 padlocks.

MOTOR STARTERS TO 600 V

- .2 Independent locking of enclosure door.
- .3 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:
 - .1 Selector switches: standard labelled as indicated.
 - .2 Indicating lights: standard type and color as indicated.
 - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.4 Control Transformer

- .1 Single phase, dry type, control transformer with primary voltage as indicated and 120 V secondary, complete with secondary fuse, installed in with starter as indicated.
- .2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 Finishes

- .1 Apply finishes to enclosure in accordance with Section 26 05 00 - Common Work Results for Electrical.

2.6 Equipment Identification

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.
- .3 Magnetic starter designation label, white plate, black letters, size 4 as indicated on drawing. Engraved as indicated.

3. EXECUTION

3.1 Installation

- .1 Install starters, connect power and control as indicated.
- .2 Ensure correct fuses and overload devices elements installed.

3.2 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical and Manufacturer's instructions.
- .2 Operate switches, contactors to verify correct functioning.
- .3 Perform starting and stopping sequences of contactors and relays.

MOTOR STARTERS TO 600 V

- .4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.
- .5 Ensure motor rotation corresponds with the direction required by the driven equipment.

END OF SECTION