PART 1 - GENERAL

1.1 Related Sections

.1 This section covers items common to sections of Division 26.

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.2 References

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

.2 CAN3-C235-83(R2000), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.2 EEMAC Y1-1-1955, Equipment Green Colour for Outdoor Electrical Equipment.

.3 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)

.1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

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 SP1122.

1.4 Design Requirements

.1 Operating voltages: to CAN3-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 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English.

1.5 Submittals

.1 Submittals: in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Submit for review single line electrical diagrams and locate under plexiglass as indicated.

.1 Electrical distribution system in main electrical room.

.3 Shop drawings in accordance with the City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Provinces 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 co-ordinated 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 of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit copies of 600 x 600 mm minimum size drawings and product data to authority having jurisdiction.

.6 If changes are required, notify Contract Administrator of these changes before they are made.

.4 Quality Control in accordance with the City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Permits and fees: in accordance with General Conditions of contract.

.4 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Contract Administrator.

.5 Manufacturer's Field Reports: submit to Contract Administrator manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.6 Quality Assurance

.1 Quality Assurance in accordance with the City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.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.

1.7 Delivery, Storage and Handling

.1 Material Delivery Schedule: provide Contract Administrator with schedule within 2 weeks after award of Contract.

1.8 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling.

.2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling.

.3 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Contract Administrator.

.4 Fold up metal banding, flatten and place in designated area for recycling.

.5 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.6 Place materials defined as hazardous or toxic waste in designated containers.

.7 Ensure emptied containers are sealed and stored safely for disposal away from children.

.8 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.9 Do not dispose of preservative treated wood through incineration.

.10 Do not dispose of preservative treated wood with other materials destined for recycling or reuse.

.11 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Contract Administrator.

.12 Disposal of flourescent lamps.

.13 Disposal of old PCB filled ballasts (if still existing) on renovation jobs.

1.9 Care, Operation and Startup

.1 Instruct Contract Administrator in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

1.10 Operating and Maintenance Manuals

.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 Service instructions: Including a list of spare parts and replacement parts and the names and addresses of all suppliers.

.3 Maintenance instructions: Including start up, proper adjustment, lubrication and shutdown procedures.

.4 Installation instructions.

.5 Operating instructions.

.6 Safety precautions.

.7 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.11 Potential Asbestos Hazard

.1 There is some asbestos content in some of the existing building materials. Coordinate with other trades on precautions taken during demolition of existing electrical equipment.

PART 2- PRODUCTS

2.1 Materials And Equipment

.1 Provide material and equipment.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from Electrical Inspections Department before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.2 Electric Motors, Equipment And Controls

.1 Provide all power and control wiring and connections including mechanical control wiring as specified on mechanical and electrical drawings.

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

.3 Control wiring and conduit: in accordance with Section 250501 - Controls: General Requirements except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

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 and labels as follows:

.1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.

.2 Sizes as follows:

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

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved with equipment tag.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

2.6 Wiring Identification

.1 Identify wiring with permanent indelible identifying markings, using Electrovert Type Z cable markers (or equal), on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

.5 Use number coded wires in control cables, matched throughout system. Identify conductors with permanent indelible identifying markings, numbered on both ends.

.6 Use number coded pairs in instrument cables, matched throughout system. Pairs shall be also colour coded black and white for polarity indication. Identify conductor pairs with permanent identifying markings at both ends.

2.7 Conduit and Cable Identification

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
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

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 Y1-1.

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

2.9 Electrical Single Line Diagrams

.1 Provide electrical single line diagrams under plexiglass as follows:

.1 Electrical distribution system: locate in main electrical room

.2 Drawings: 280 x 432 mm minimum size.

2.10 Scope of Work

.1 Demolition of existing electrical services and equipment. The existing two soft starts are to be turned over to the City of Winnipeg.

.2 Supply and installation of three (3) new 150HP Reduced Voltage Starters with across the line bypass contactor.

.3 Supply and installation of new electrical distribution panel, 15kVA transformer and lighting panel.

.4 Supply and installation of pump control panel complete with ultrasonic level transmitter.

.5 Supply and installation of three (3) termination enclosure, wireways and junction boxes for the 3 pumps.

.6 Supply and installation of new interior and exterior building lighting.

.7 Supply and installation of new electrical plugs.

.8 Supply and installation of all cable, conduit systems etc. for all electrical equipment.

.9 Supply and installation of electrical cabling for Unit heaters.

.10 Supply and installation of electrical cabling and controls for two exhaust fans.

.11 Supply and installation of new electrical equipment and indicated on the electrical drawings.

2.11 Electrical Service

.1 The City will arrange and pay for Manitoba Hydro to provide electrical service up to Manitoba Hydro's supplied pad mount transformer. All cabling from the secondary side terminals is the responsibility of the Contractor. The existing Manitoba Hydro pad mount transformer will remain in service. The Contractor shall arrange and co-ordinate the removal of the existing service cables as well as the installation of new service cables. A continuous wireway from the lockable metering enclosure to the CT's must be installed by the Contractor for Manitoba Hydro to install it's metering equipment. The Contractor is to coordinate with Manitoba Hydro for this work. The Contractor shall pay all Manitoba Hydro costs.

2.12 Telephone Service

.1 Telephone service is to be removed from the existing building to allow demolition and then reconnected to the new building. Contractor is responsible for coordinating telephone installation with MTS and paying all MTS costs.

PART 3- EXECUTION

3.1 Installation

.1 Do complete installation in accordance with the current edition of the Canadian Electrical Code, CSA C22.1, except where specified otherwise.

.2 Do overhead and underground systems in accordance with the current edition of CSA C22.3 No.1 except where specified otherwise.

.3 Perform all work in accordance with local codes and bylaws.

3.2 Nameplates and Labels

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

3.3 Conduit and Cable Installation

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: pvc, 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, and as shown on the drawings.

.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 and elevator machine rooms 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.Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 300 mm.

.5 Wall mounted telephone and interphone outlets: 1500 mm.

.6 Fire alarm stations: 1500 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: 1500 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 the following tests in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.1 Point to point wire continuity test for all conductors.

.2 Power generation and distribution system including phasing, voltage, grounding and load balancing.

.3 Circuits originating from branch distribution panels.

.4 Lighting and its control.

.5 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.6 Systems: fire alarm system and communications.

.7 Test resistance to ground of the completed grounding electrode.

.8 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.4 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.

.5 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.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Common Work Results – For Electrical

.1 Common Work Results – For Electrical shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1– GENERAL

1.1 Section Includes

.1 Materials and installation for wire and box connectors.

1.2 References

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2 No.65-93(R1999), Wire Connectors.

PART 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: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors for armoured cable and flexible conduit as required to: CAN/CSA-C22.2 No.18.

PART 3- EXECUTION

3.1 Installation

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Wire and Box Connectors 0 -1000 V

.1 Wire and Box Connectors 0 -1000 V shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 Related Sections

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

.2 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

.3 Section 26 05 44 – Installation of Cables in Trenches and in Ducts.

.4 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions

1.2 References

.1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131-M89(R1994), Type TECK 90 Cable.

1.3 Product Data

.1 Submit product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

PART 2PRODUCTS

2.1 Building Wires

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 1 kV TECK90 Power Cable

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

- .1 Grounding conductor: copper.
- .2 Circuit conductors: copper, size as indicated. (#12 AWG minimum where not indicated)

.3 Insulation:

- .1 Type: ethylene propylene rubber.
- .2 Chemically cross-linked thermosetting polyethylene rated type RW90, 1000 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight, explosion-proof approved for TECK cable.

2.3 600 V TECK90 Control Cable

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated. (#14 AWG minimum where not indicated)

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight, explosion-proof approved for TECK cable.

2.4 300 V Instrument Cable – Armoured

.1 Conductors: #16 AWG, 7 strand concentric lay, Class B tinned copper, twisted pairs/triads.

.2 Insulation: PVC TW75, 75 °C Wet, 105 °C Dry (-40 °C), 300 Volt.

.3 Twisted pairs/triads cabled with staggered lays.

.4 Shielding: Individual twisted pair(s)/triads Aluminum/mylar shield with ST drain wire, 100 % shield. Overall aluminum/mylar shield with ST drain wire. Individual drain wires one size smaller than conductor AWG. Overall drain wire the same AWG as conductors.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material (90 °C, -40 °C).

.7 Fastenings:

.1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 300 mm centers to prevent cable from drooping.

.8 Connectors:

.1 Watertight, explosion proof approved for armoured cable.

2.5 Type RW90 Conductor

.1 In accordance with CSA C22.2 No.38

.2 Circuit conductors shall be concentric stranded soft copper, size as indicated (#12 AWG minimum where not indicated).

.3 Insulation to be chemically cross-lined thermosetting polyethylene rated type RW90 XLP, 600V

.4 Suitable for installation in temperatures down to minus 40 °C.

.5 90 °C conductor operating temperature.

2.6 Type TEW Conductor

.1 Circuit conductors shall be stranded soft copper, as per ASTM B-3 and B-8.

.2 Insulation to be thermoplastic compound meeting the requirements of Canadian Standards Association Type TEW, per CSA 22.2 Part 1, No.127.

.3 Insulation rated to 600 Volts.

.4 Suitable for installation in temperatures down to minus 40 °C

.5 105 °C conductor operating temperature.

.6 Use #16 AWG for PLC cabinet internal wiring.

2.7 Wiring Identification

.1 Provide wiring identification in accordance with Section 26 05 01 – Common Work Results – For Electrical.

PART 3– EXECUTION

3.1 Installation of Building Wires

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 – 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.

.2 Install cable in trenches in accordance with Section 26 05 44 – Installation of Cables in Trenches and in Ducts.

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

3.3 Installation Of Armoured Cables

.1 Group cables wherever possible.

.2 Install cable in trenches in accordance with Section 26 05 44 – Installation of Cables in Trenches and in Ducts.

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

3.4 Installation of Control Cables

.1 Install control cables in conduit.

.2 Ground control cable shield.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Wires and Cables (0-1000 V)

.1 Wires and Cables (0-1000V) shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 Related Sections

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

1.2 References

.1 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

1.3 Description

.1 Supply and install a complete grounding system. Securely and adequately ground all components of the electrical system in accordance with the requirements of all related sections in the current edition of the Canadian Electrical Code, CSA C22.1, as adopted by the Province of Manitoba.

.2 The system to consist of cables, ground rods, supports, and all necessary materials and inter-connections to provide a complete system. Measured resistance to ground of the network shall not exceed 5 ohms.

PART 2 - PRODUCTS

2.1 Equipment

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as required.

.3 Rod electrodes: copper clad steel 19 mm dia by 3 m long.

.4 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.

.5 Insulated grounding conductors: stranded copper type RW90 complete with a green jacket.

.6 Ground bus: copper, size as required, complete with insulated supports, fastenings, connectors.

.7 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 Installation General

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Include a separate green ground wire in all power conduits including branch circuit wiring sized to Table 16 of the current edition of the Canadian Electrical Code.

.8 Expansion joints and telescoping sections of raceways shall be bonded using jumper cables as per the current edition of the Canadian Electrical Code.

.9 Use Burndy compression connectors or approved equal for all grounding splices and terminations unless otherwise shown on the Drawings. For bolted ground connections use Burndy Engineering Company's "Durium" hardware or approved equal in accordance with B6.

.10 Connect all transformer neutrals to the main building ground wire, using compression terminations.

.11 Install rigid conduit sleeves c/w bushings where ground wires pass through concrete slab.

.12 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.13 Install separate ground conductor to outdoor lighting standards.

.14 Connect building structural steel and metal siding to ground by welding copper to steel.

.15 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.16 Bond single conductor, metallic armoured cables to cabinet at supply end, and load end.

.17 Ground secondary service pedestals.

3.2 Electrodes

.1 Install rod electrodes and make grounding connections.

.2 Bond separate, multiple electrodes together.

.3 Use copper conductors for connections to electrodes, sized as required.

3.3 System And Circuit Grounding

.1 Install system and circuit grounding connections to neutral of secondary 120 V system.

3.4 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 All frames and metallic enclosures of all electrical equipment and electrically operated equipment shall be grounded through the conduit system and/or via a ground wire.

.3 All transformers, switchgear, motor control centres, panelboards and splitters fed from the main distribution center shall be grounded by grounding conductors sized in accordance with the current edition of the Canadian Electrical Code. The ground wire shall be terminated at each end with an appropriate grounding lug which shall be connected to the equipment ground bus.

.4 All sub panels such as lighting panels, local distribution panels, etc., shall be grounded with a green ground wire run back to the panel from which it is fed. The ground conductor shall be sized according to the current edition of the Canadian Electrical Code.

.5 All main distribution centres, switchgear, motor control centres, and all panels requiring equipment grounds shall contain a ground bus of adequate size, and tapped for lugs for the ground wire required.

.6 All motors shall be grounded by means of an adequately sized ground wire contained within the feeder conduit.

3.5 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.

3.6 Field Quality Control

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

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

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Grounding - Secondary

.1 Grounding – Secondary shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 References

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

PART 2 - PRODUCTS

2.1 Support Channels

.1 U shape, size 41 x 41 mm, 2.5 mm thick, solid configuration surface mounted or suspended.

PART 3 - EXECUTION

3.1 Installation

.1 Secure equipment to solid concrete or steel structures.

.2 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors and to toggle bolts.

.3 Secure equipment to poured concrete with expandable inserts.

.4 Secure equipment to wood trusses with ¼" lag screws.

.5 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.6 Support equipment, conduit or armoured cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.7 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.8 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.

.9 For surface mounting of two or more conduits use channels at spacing as per Rule 12-1010(1) of the current edition of the Canadian Electrical Code.

.10 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.11 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.12 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.13 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.

.14 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Hangers and Supports for Electrical Systems

.1 Hangers and Supports for Electrical Systems shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 Related Sections

.1 The City of Winnipeg Standard Construction Specification Section CW1110 – General Instructions

1.2 Shop Drawings And Product Data

.1 Submit shop drawings and product data for cabinets in accordance with The City of Winnipeg Standard Construction Specification Section CW1110 – General Instructions.

PART 2 - PRODUCTS

2.1 Splitters

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 Junction And Pull Boxes

.1 PVC construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 Cabinets

.1 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing sheet steel backboard for surface mounting.

PART 3 - EXECUTION

3.1 Splitter Installation

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 Junction, Pull Boxes and Cabinets Installation

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal block as indicated in Type T cabinets.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 Identification

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Splitters, Junction, Pull Boxes and Cabinets

.1 Splitters, Junction, Pull Boxes and Cabinets shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 References

.1 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

PART 2 - PRODUCTS

2.1 Outlet and Conduit Boxes General

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 Conduit Boxes

.1 Cast FS or FD copper free aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle for ridig conduit or Teck Cable.

.2 PVC boxes for PVC conduit.

2.3 Fittings - General

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - EXECUTION

3.1 Installation

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Outlet Boxes, Conduit Boxes and Fittings

.1 Outlet Boxes, Conduit Boxes and Fittings shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 References

.1 Canadian Standards Association (CSA)

.1 CSA C22.1-06, Canadian Electrical Code, Part 1 (20th Edition), Safety Standard for Electrical Installations.

.2 CAN/CSA C22.2 No. 18-98, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.

.3 CSA C22.2 No. 45-M1981(R1992), Rigid Metal Conduit.

.4 CSA C22.2 No. 211.2-M1984(R1999), Rigid PVC (Unplasticized) Conduit.

1.2 Preferences

.1 In general power and control wiring shall be by TECK or armoured cable. Where suitable, PVC conduit may be used in wet areas and RGS may be used in dry areas.

PART 2 - PRODUCTS

2.1 Conduits

.1 Rigid metal conduit: to CSA C22.2 No. 45, galvanized steel threaded.

.2 Rigid pvc conduit: to CSA C22.2 No. 211.2.

2.2 Conduit Fastenings

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at spacing as per Rule 12-1010 of the current edition of the Canadian Electrical Code for rigid metal conduit.

.4 Channel type supports for two or more conduits at spacing as per Rule 12-1114 of the current edition of the Canadian Electrical Code for pvc conduit.

.5 Threaded rods, 6 mm dia., to support suspended channels.

2.3 Conduit Fittings

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

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

2.4 Expansion Fittings for Rigid Conduit

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 Fish Cord

.1 Polypropylene.

PART 3 - EXECUTION

3.1 Installation

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Surface mount conduits.

.3 Install conduit sealing fittings in hazardous areas. Fill with compound.

.4 Minimum conduit size for lighting and power circuits: 19 mm.

.5 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.6 Mechanically bend steel conduit over 19 mm dia.

.7 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.8 Install fish cord in empty conduits.

.9 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.10 Dry conduits out before installing wire.

.11 Connect conduit to equipment securely to maintain continuity for the purpose of bonding to ground.

.12 Provide for expansion and contraction of the conduit system.

3.2 Surface Conduits

.1 Run parallel or perpendicular to building lines.

.2 Run conduits in flanged portion of structural steel.

.3 Group conduits wherever possible on suspended or surface channels.

.4 Do not pass conduits through structural members except as indicated.

3.3 Concealed Conduits

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.4 Conduits In Cast-In-Place Concrete

.1 Locate to suit reinforcing steel. 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. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 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.

3.5 Conduits Underground

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Conduits, Conduit Fastenings and Conduit Fittings

.1 Conduits, Conduit Fastenings and Conduit Fittings shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 Related Sections

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

1.2 References

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

PART 2 - PRODUCTS

2.1 Cable Protection

.1 38 x 140 mm planks pressure treated with coloured, or copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

PART 3 - EXECUTION

3.1 Direct Burial of Cables

.1 After sand bed, is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Underground cable splices not acceptable.

.4 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.5 Cable separation:

.1 Maintain 75 mm minimum separation between cables of different circuits.

.2 Maintain 300 mm horizontal separation between low and high voltage cables.

.3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.

.4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.

.5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.

.6 Install treated planks on lower cables 0.6 m in each direction at crossings.

.7 Installation configuration as per Canadian Electrical Code (CSA C22.1).

.6 After sand protective cover, is in place, install continuous row of overlapping 38 x 140 mm pressure treated planks as indicated to cover length of run.

3.2 Field Quality Control

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

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Provide Contract Administrator with list of test results showing location at which each test was made, circuit tested and result of each test.

.6 Remove and replace entire length of cable if cable fails to meet any of test criteria.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Installation of Cables in Trenches and in Ducts

.1 Installation of Cables in Trenches and in Ducts shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 Description

.1 The Contractor shall engage a firm to Provide an Arc Flash Hazard Analysis for the electrical distribution system shown on the single line diagram drawings. The intent of the Arc Flash Hazard Analysis is to determine hazards that exist at each major piece of electrical equipment shown on the one-line drawing. This includes switchgear, switchboards, panelboards, motor control centers, transformers, generators and other required electrical equipment. The analysis will include creation of Arc Flash Hazard Warning Labels, Figure 1. These labels serve as a guide to assist technicians and others in the selection of proper Personal Protective Equipment when working around exposed and energized conductors. The electrical contractor will install the labels.

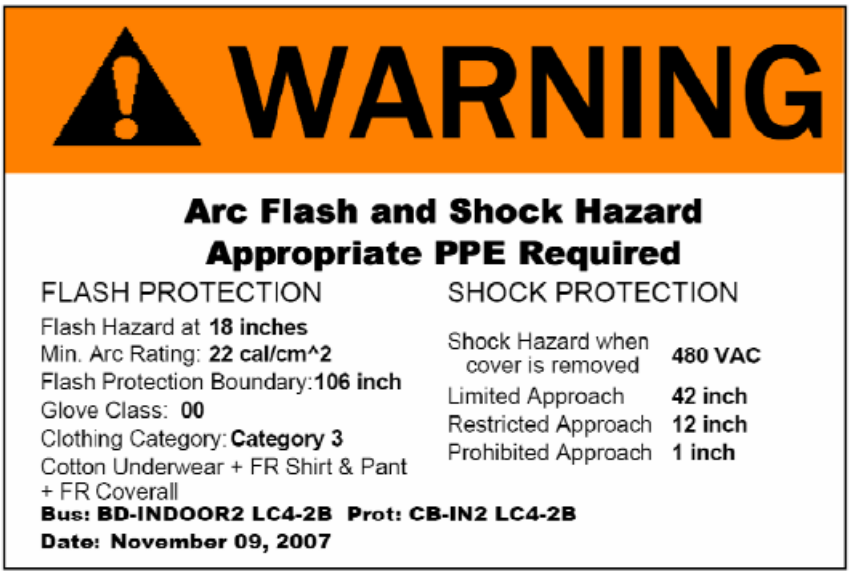

Figure 1 – Example of Arc Flash Warning Label

.2 The Arc Flash Hazard Analysis shall include the electrical distribution system equipment shown on the single line diagram drawings. If an existing up-to-date current short-circuit and protective device coordination studies are not available, perform short circuit and protective device coordination studies for the electrical distribution system before performing the Arc Flash Hazard Analysis. The Arc Flash Hazard Analysis shall consider operation during normal conditions, alternate operations, emergency power conditions, and any other operations, which could result in maximum arc flash hazard, and as required.

1.2 Related Sections

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 References

.1 Institute of Electrical and Electronics Engineers (IEEE)

.1 IEEE Std. 399 (Brown Book), Recommended Practice for Industrial and Commercial Power System Analysis.

.2 IEEE Std. 242 (Buff Book), Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

.3 IEEE Std. 1584, Guide for Performing Arc-Flash Hazard Calculations

.2 The National Fire Protection Association (NFPA)

.1 NFPA 70E, Standard for Electrical Safety in the Workplace

.3 Occupational Safety and Health Administration (OSHA)

.1 OSHA 29-CFR Subpart S, Underground Construction, Caissons, Cofferdams and Compressed Air.

1.4 Qualifications

.1 The Contractor shall have the analysis prepared by qualified professional engineer of an independent consultant. The consultant shall be a Registered Professional Electrical Engineer registered in the Province of Manitoba.

1.5 Submittals

.1 The Contractor shall submit the Arc Flash Hazard Analysis including Short Circuit Study and Coordination and arc flash hazard warning labels at least thirty (30) days prior to energizing the electrical equipment.

.2 Submit three (3) copies of the Arc Flash study and (1) set of warning labels in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

PART 2 - PRODUCTS

2.1 Written Report

.1 The results of the Arc Flash study shall be summarized in a final written report. The report shall include the following sections:

.1 Executive Summary

.1 A synopsis of our overall findings, including but not limited to equipment locations with highest incident energy levels, total number of over-current protective devices with inadequate short-circuit current interrupting ratings, and identification of equipment protective boundary conflicts.

.2 Introduction

.1 A brief paragraph to explain the necessity of performing an Arc-Flash Hazard Analysis and the criteria used during the project

.3 Methodology

.1 A brief paragraph to explain the basis for the analyses performed for this project.

.4 Assumptions

.1 A list of all valid engineering assumptions made and why they were made during the course of the project.

.5 Discussion

.1 A detailed discussion of each of the following power system analysis performed for this project:

.1 Short Circuit Analysis Results

.2 Protective Device Coordination Study Results.

.3 Arc-Flash Hazard Analysis Results

.6 Recommendations

.1 Our detailed recommendations to reduce existing incident energy levels and to improve overall future maintenance & operation of the plant.

.7 Bibliography - Industry references used to complete the arc-flash analysis for this plant.

2.2 Report Binder

.1 The Arc Flash Hazard Analysis report binder shall contain the written report above plus the additional following sections:

.1 Short-Circuit Analysis Results

.2 Equipment Evaluation Study Results

.3 Time Current Curves Plotted In Color on Log-Log Graph Paper

.4 Arc Flash Hazard Analysis Results in MS Excel Format

.5 Electrical One-Line Input Data used In Computer Software Model

.6 Electrical One-Line Diagram with Incident Energy, Flash Protection Boundary, and Pertinent Equipment and Component Ratings

PART 3 - EXECUTION

3.1 Short Circuit Study

.1 Provide a current, up-to-date short circuit current study. If one does not exist, then perform a short circuit study in accordance with IEEE Std 399 (Brown Book), “IEEE Recommended Practice For Industrial and Commercial Power System Analysis,” based upon the positive and zero sequence source impedance supplied by the local energy provider.

3.2 Protective Device Coordination Study

.1 Provide a current up-to-date protective device coordination study. If one does not exist, then perform a protective device coordination study in accordance with IEEE Std 242 (Buff Book), “IEEE Recommended Protection and Coordination of Industrial and Commercial Power Systems.”

3.3 Arc Flash Hazard Analysis

.1 Perform an Arc Flash Hazard Analysis after the short circuit and protective device coordination studies have been completed based upon IEEE Std 1584, “IEEE Guide For Performing Arc Flash Hazard Calculations.”

.2 The analysis shall be calculated by means of an appropriate software package. Pertinent data, rationale employed, and assumptions in developing the calculations shall be incorporated in the introductory remarks of the study.

.3 The analysis shall be in accordance with applicable NFPA 70E, OSHA 29-CFR, Part 1910 Subpart S and IEEE 1584 Standards.

.4 Determine the following:

.1 Flash Hazard Protection Boundary

.2 Limited Approach Boundary

.3 Restricted Boundary

.4 Prohibited Boundary

.5 Incident Energy Level
.6 Required Personal Protective Equipment Class
.7 Type of Fire Rated Clothing

.5 Produce an Arc Flash Warning label listing items 1 through 7 above. Also, include the bus name, system operating voltage, and date of issue. Labels shall be printed in color and be printed on adhesive backed labels. See example above.

.6 Produce Bus Detail Sheets that lists the items 1 through 7 from above and the following additional items.

.1 Bus Name
.2 Upstream Protective Devices Names, Type and Settings
.3 Bus Line-to-Line Voltage

.7 Produce Arc Flash Evaluation Summary Sheets listing the following additional items.

.1 Bus Name
.2 Upstream Protective Device Name, Type and Settings
.3 Bus Line-to-Line Voltage
.4 Bus Bolted Fault
.5 Protective Device Bolted Fault Current
.6 Arcing Fault Current
.7 Protective Device Trip / Delay Time
.8 Breaker Opening Time
.9 Solidly Grounded Column
.10 Equipment Type
.11 Gap
.12 Arc Flash Boundary
.13 Working Distance
.14 Incident Energy
.15 Required Protective Fire Rated Clothing Type and Class

3.4 Analysis

.1 Analyze the short circuit, protective device coordination, and arc flash calculations and highlight any equipment that is determined to be underrated or causes an abnormally high incident energy calculation.

.2 Propose approaches to reduce the energy levels. Proposed major corrective modifications will be taken under advisement by the Contract Administrator and the Contractor will be given further instructions.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Short Circuit/Co-ordination Study and Arc Flash Hazard Study
.1 Short Circuit/Co-ordination Study and Arc Flash Hazard Study shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 Section Includes

.1 Materials and components for dry type transformers up to 600 V primary, equipment identification and transformer installation.

1.2 Related Sections

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

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 References

.1 Canadian Standards Association (CSA International)

.1 CSA C9-M1981(R2001), Dry-Type Transformers.
.2 CSA C802.2-06, Minimum Efficiency Values for Dry-Type Transformers

.2 National Electrical Manufacturers Association (NEMA)

1.4 Product Data

.1 Submit product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Shop drawing submittal to include the following technical data:

.1 kVA rating.
.2 Primary and secondary voltages.
.3 Frequency.
.4 Number of phases.
.5 Polarity or angular displacement.
.6 Full load efficiency.
.7 Regulation at unity pf.
.8 BIL
.9 Insulation type.
.10 Sound rating.

PART 2 - PRODUCTS

2.1 Transformers

.1 Use transformers of one manufacturer throughout project and in accordance with CSA-C9.

.2 Transformers to meet or exceed minimum efficiency values as specified in CSA-C802.2.

.3 Design.

.1 Type: ANN.
.2 Ratings: As specified on drawings.
.3 Insulation: Class 220 °C, 150 °C temperature rise.
.4 Primary winding: 600 V, delta, BIL 10 kV.

.5 Secondary winding: Voltage and winding connection as specified on drawings.

.6 Sound rating: 50 dB maximum.

.7 Impedance: standard.

.4 Voltage Taps

.1 Three phase units:

.1 Units rated to 15 kVA, 1 ± 5 % FCAN and 1 ± 5 % FCBN.

.2 Units rated greater than 15 kVA, 2 ± 2.5 % FCAN and 2 ± 2.5 % FCBN.

.2 Single phase units:

.1 2 ± 2.5 % FCAN and 2 ± 2.5 % FCBN.

.5 Windings

.1 High grade, non-aging grain oriented silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum flux densities shall be substantially below the saturation point.

.2 Core volume shall allow for efficient transformer operation at 10% above the nominal voltage.

.3 Core lamination shall be tightly clamped and compressed.

.4 Coils shall be wound of electrical grade copper with continuous wound construction.

.5 The assembly shall be mounted on vibration absorbing pads.

.6 Enclosure

.1 Heavy duty ventilated NEMA type 1, Fabricated from sheet steel.

.2 Bolted removable panels for access to access separated primary and secondary terminals.

.3 Conductor entry: Knockouts.

.4 Designed for universal floor, wall mounting or trapeze hung.

.5 Indoor, ventilated, self cooled type. Temperature of exposed metal parts not to exceed 90 °C rise.

.6 Finish: in accordance with Section 26 05 01 - Common Work Results - Electrical.

2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Label size: 7.

PART 3 - EXECUTION

3.1 Installation

.1 Mount dry type transformers up to 75 kVA as indicated.

.2 Mount dry type transformers above 75 kVA on floor.

.3 Ensure adequate clearance around transformer for ventilation.

.4 Install transformers in level upright position.

.5 Remove shipping supports only after transformer is installed and just before putting into service.

.6 Loosen isolation pad bolts until no compression is visible.

.7 Set and secure transformers in place, rigid plumb and square.

.8 Make primary and secondary connections in accordance with wiring diagram.

.9 Energize transformers after installation and check secondary no-load voltage.

.10 Adjust primary taps as necessary to produce rated secondary voltage at no-load.

.11 Use torque wrench to adjust internal connections in accordance with manufacturers' recommended values.

.12 Check transformer for dryness before putting it into service and if it has not been energized for some considerable time.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Dry Type Transformers up to 600 V Primary

.1 Dry Type Transformers up to 600 V Primary shall be considered incidental to the Contract Lump Sum Price for "Electrical".

~End~

PART 1 - GENERAL

1.1 Section Includes

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

1.2 Related Sections

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

.2 Section 26 28 21 - Moulded Case Circuit Breakers.

.3 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 References

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.29-M1989(R2000), Panelboards and enclosed Panelboards.

1.4 Shop Drawings

.1 Submit shop drawings in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

PART 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 as indicated on drawings. 10 kA (symmetrical) interrupting capacity minimum.

.3 600 V panelboards: Bus and breakers rated as indicated on drawings. 22 kA (symmetrical) interrupting capacity minimum.

.4 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.

.5 Panelboards: tin plated copper mains, number of circuits, and number and size of branch circuit breakers as indicated.

.6 Two keys for each panelboard and key panelboards alike.

.7 Tin plated copper bus with neutral of same ampere rating as mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked grey enamel.

2.2 Breakers

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to City of Winnipeg.

2.3 Secondary Surge Arrester

.1 Able to withstand a maximum surge current of 40 kA per phase.

.2 SCCR Rating of 200 kA.

.3 Acceptable Product: Square D Part No. SDSA3650

2.4 Equipment Identification

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 - EXECUTION

3.1 Installation

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 01 - Common Work Results - Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Panelboards Breaker Type

.1 Panelboards Breaker Type shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 Section Includes

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

1.2 Related Sections

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

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions

1.3 References

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42-99(R2002), General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1-00, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55-M1986(July 2001), Special Use Switches.

.4 CSA-C22.2 No.111-00, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.4 Shop Drawings And Product Data

.1 Submit shop drawings and product data in accordance The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

PART 2 - PRODUCTS

2.1 Switches

.1 15 A, 120 V, single pole, double pole, three-way, four-way industrial grade switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111 as required.

.2 Manually-operated general purpose ac switches with following features:

.1 Terminal holes approved for No. 10 AWG wire.

.2 Silver cadmium oxide contacts.

.3 Fully enclosed with urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Brown toggle.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 Acceptable materials: Hubbell 1200 Series or equivalent.

2.2 Receptacles

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 [Ivory] [Brown] urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:

.1 Brown urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Acceptable materials: Hubbell 5252 or equivalent.

2.3 Cover Plates

.1 Stainless steel or pvc cover plates for wiring devices.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.5 Weatherproof double lift spring-loaded stainless steel or pvc cover plates, complete with gaskets for duplex receptacles as indicated on the drawings.

.6 Weatherproof spring-loaded stainless steel or pvc cover plates complete with gaskets for single receptacles or switches as indicated on the drawings.

PART 3 - EXECUTION

3.1 Installation

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.
.2 Install switches in gang type outlet box when more than one switch is required in one location.
.3 Mount toggle switches at height in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
.2 Mount receptacles at height in accordance with Section 26 05 01 - Common Work Results - Electrical.
.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Mount lighting fixture receptacles local to fixtures.

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Wiring Devices

.1 Wiring Devices shall be considered incidental to the Contract Lump Sum Price for "Electrical".

~End~

PART 1 - GENERAL

1.1 Section Includes

.1 Materials for moulded-case circuit breakers, circuit breakers, and ground-fault circuit-interrupters, fused circuit breakers, and accessory high-fault protectors.

1.2 Related Sections

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 References

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 Submittals

.1 Submit product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Include time-current characteristic curves for breakers with ampacity of 600 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

PART 2 - PRODUCTS

2.1 Breakers General

.1 Moulded-case circuit breakers, Circuit breakers, and Ground-fault circuit-interrupters, Fused circuit breakers, and Accessory high-fault protectors: to CSA C22.2 No. 5

.2 Bolt-on and Plug-in moulded case circuit breaker: quick-make, quick-break over center switching mechanism that is mechanically trip-free, for manual and automatic operation with temperature compensation for 40 degrees C ambient. Automatic tripping of the breaker shall be clearly indicated by the handler position. Contacts shall be non-welding silver alloy, and arc extinguishing shall be accomplished by means of DE-ION arc chutes.

.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 3-8 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum symmetrical rms interrupting capacity rating as indicated on the drawings.

.7 Circuit breakers identified as MCP will operate on the magnetic principle with a current sensing element in each pole.

.8 Circuit breakers 600 A through 2500 A frame shall be Cutler-Hammer type Westinghouse Series C with microprocessor-based RMS sensing trip units or approved equal.

.1 Each moulded case circuit breaker microprocessor-based tripping system shall consist of three current transformers, and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. True RMS sensing circuit protection shall be achieved by analysing the secondary current signals received from the circuit breaker current transformers and initiating trip signals to the circuit breaker trip actuators when predetermined trip levels and time delay settings are reached.

.2 Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed. Rating plugs shall be interlocked such that a breaker cannot be closed and latched with the rating plug removed.

.3 The microprocessor-based trip unit shall have thermal memory capabilities to prevent the breaker from being reset following an overload condition until after a preset time delay.

.4 When the adjustable instantaneous setting is omitted, the trip unit shall be provided with an instantaneous override. Internal ground fault protection adjustable pick-up ratings shall not exceed 1200 amperes.

.5 Breakers shall have built-in test points for testing the long time delay, instantaneous, and ground fault functions of the breaker by means of a 120 Volt operated test set. Provide one test set capable of testing all breakers 600 ampere frame and above.

.6 System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:

.1 Adjustable long time pick-up and delay.

.2 Adjustable short time pick-up and delay.

.3 Adjustable instantaneous pick-up.

.7 Circuit Breakers shall be Cutler-Hammer type Westinghouse Series C circuit breakers, microprocessor-based RMS sensing trip units type Digitrip RMS 310 LSI or LSIG trip units or approved equal.

.8 Accessories:

.1 Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

.9 Enclosure:

.1 All enclosed circuit breakers shall have EEMAC 1 general purpose enclosures.

.2 All enclosed circuit breakers shall have metal nameplates, front cover mounted, that contain a permanent record of catalog number and maximum rating. Provide handle mechanisms that are padlockable in the “OFF” position.

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 Acceptable Product: Cutler-Hammer type Westinghouse Series C or approved equal.

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.

PART 3 - EXECUTION

3.1 Factory Testing

.1 Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of CSA standard.

3.2 Installation

.1 Install circuit breakers as indicated on drawings per the manufacturer's recommendations.

3.3 Field Settings

.1 The contractor shall perform field adjustments of the circuit breakers as required to place the equipment in final operating condition. The settings shall be in accordance with the drawings.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Moulded Case Circuit Breakers

.1 Moulded Case Circuit Breakers shall be considered incidental to the Contract Lump Sum Price for "Electrical".

~End~

PART 1 - GENERAL

1.1 Section Includes

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

1.2 Related Sections

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

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions

1.3 References

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-M89 (R2000), Enclosed Switches.

.2 CSA C22.2 No.39-M89 (R2003), Fuseholder Assemblies.

1.4 Submittals

.1 Submit product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

PART 2 - PRODUCTS

2.1 Disconnect Switches

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure, to CAN/CSA C22.2 No.4 sized as per drawings.

.2 Provision for padlocking in off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated on drawings.

.5 Fuseholders: to CSA C22.2 No.39 relocatable and suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON-OFF switch position indication on switch enclosure cover.

2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Indicate name of load controlled on size 4 nameplate.

PART 3 - EXECUTION

3.1 Installation

.1 Install disconnect switches complete with fuses if applicable.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Disconnect Switches – Fused and Non-Fused

.1 Disconnect Switches – Fused and Non-Fused shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 Related Sections

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

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions

1.2 References

.1 National Electrical Manufacturer's Association (NEMA)

.1 NEMA Standards Publication ICS 2-2000: Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

1.3 Shop Drawings And Product Data

.1 Submit shop drawings in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.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 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

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

1.5 Extra Materials

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

.2 Provide listed spare parts for each different size and type of starter:

.1 3 contacts, stationary.
.2 3 contacts, movable.
.3 1 contacts, auxiliary.
.4 1 control transformer.
.5 1 operating coil.
.6 2 fuses.
.7 10% indicating lamp bulbs used.

PART 2 - PRODUCTS

2.1 Materials

.1 Starters: to NEMA ICS 2-2000.

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 One or Three overload heater(s) as required, manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle switch: heavy duty oil tight labelled as indicated.

.2 Indicating light: heavy duty oil tight type and colour as indicated.

.3 Locking tab to permit padlocking in "ON" or "OFF" position.

2.3 Full Voltage Magnetic Starters

.1 Magnetic and 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 fuse or circuit breaker with operating level on outside of enclosure to control circuit breaker, and provision for:

.1 Locking in "OFF" position with up to 3 padlocks.

.2 Independent locking of enclosure door.

.3 Provision for preventing switching to "ON" position while enclosure door open.

.3 Accessories:

.1 Selector switches: heavy duty oil tight labelled as indicated.

.2 Indicating lights: heavy duty oil tight 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 01 - Common Work Results - Electrical.

2.6 Equipment Identification

.1 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical.

.2 Manual starter designation label, white plate, black letters, size 1, engraved as indicated.

.3 Magnetic starter designation label, white plate, black letters, size 1 engraved as indicated.

PART 3 - EXECUTION

3.1 Installation

.1 Install starters, connect power and control as indicated.

.2 Ensure correct fuses and overload devices elements installed.

3.2 Field Quality Control

.1 Perform tests in accordance with Section 26 05 01 - Common Work Results - Electrical and manufacturer's instructions.

.2 Operate switches, contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Motor Starters to 600 V

.1 Motor Starters to 600 V shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 Scope

.1 This specification shall apply to the materials, design, fabrication, inspection, and testing of 600 V Reduced Voltage Starters (RVS).

.2 Detailed specifications on the RVS shall be indicated in this specification, drawings and attachments. In case of a conflict between the various specifications, the vendor shall contact the Purchaser for clarification. The RVS shall be manufactured by Benshaw.

.3 Ensure starter can handle the motor loads of the pumps actually purchased by the Contractor.

1.2 Related Sections

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

.2 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

1.3 References

.1 The RVS shall be designed, manufactured and tested in accordance with the latest applicable standards of CSA, NEMA, ANSI and UL, including but not limited to:

.1 CSA C22.2 No. 14-M91—Industrial Control Equipment

.2 NEMA ICS7—Industrial Control and Systems Adjustable Frequency Drives

.3 NEMA MG1—Motors and Generators

.4 NEMA ICS 7.1—Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Frequency Drives

.2 In all cases where more than one regulation, code, standard or specification applies to the same conditions, the most stringent one shall apply. Conflicts among any of the provisions of these listed codes, standards or specifications shall be referred to the Purchaser for resolution.

1.4 Shop Drawings And Product Data

.1 Submit shop drawings and product data in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Drawings shall be in SI units. If imperial units are used as well, they shall be shown in parenthesis after the SI units. In case of conflict between the two, SI units shall be considered to be correct.

.3 Equipment tag number, purchase order number and project name shall be shown on all Supplier supplied drawings. Data shall be located close to the title block.

.4 All drawings and data shall be submitted in a form that is easily reproduced. All data and drawings shall be submitted in both paper and electronic form. Final drawings are all required to be as-built.

.5 Review or approval of Supplier's drawings, design calculations and other documentation does not relieve Supplier of any responsibility for correctness of such drawings, calculations or other documentation.

.6 The following information shall be submitted to the Contract Administrator for approval:

.1 Master drawing index
.2 Dimensioned front view elevation
.3 Dimensioned floor plan
.4 Dimensioned top view
.5 Unit control schematics and wiring diagrams
.6 Nameplate schedule
.7 Cable entry/exit locations
.8 Assembly ratings, including short circuit, voltage, and continuous current ratings
.9 Major component ratings
.10 Minimum clearances to other equipment.
.11 Frequency spectrum for harmonic currents at line side of filter (where provided) at 50% and 100% of rated load.
.12 Manufacturers technical data sheets

1.5 Closeout Submittals

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

.2 Operation and maintenance manuals shall include as a minimum for each type and style of starter: Instruction books and/or leaflets, recommended renewal parts list and a complete set of as-built drawings.

.3 The following information shall be submitted to Contract Administrator for record purposes:

.1 Final as-built drawings and information
.2 Certified production test reports
.3 Installation information
.4 Seismic certification and equipment anchorage details (where applicable)

PART 2 - PRODUCTS

2.1 General

.1 All RVS will be fed from a CDP provided by others and protected by Breakers. Vendor shall indicate recommended breaker size.

.2 The RVS shall consist of a disconnect, logic board, keypad, SCRs, and bypass contactors for up to speed paralleling and across the line starting.

.3 The logic board shall be mounted for ease of testing, service and replacement. It shall have quick disconnect plug-in connectors for current transformer inputs, line and load voltage inputs, and SCR gate firing output circuits. The logic board shall be identical for all ampere ratings and voltage classes specified.

2.2 Enclosure

.1 NEMA 12 Gasketted. The RVS shall have complete front accessibility with easily removable assemblies.

.2 The RVS shall be suitable for mounting back to wall.

.3 A panel mounted non-resetable elapsed-time meter to measure operating hours with a minimum 6 digits display.

.4 Provide equipment identification in accordance with Section 26 05 01 - Common Work Results - Electrical. Nameplates shall be permanently attached with screws.

.5 The enclosure shall have appropriate warning labels indicating “CAUTION MULTIPLE CONTROL POWER SOURCES”

2.3 Ratings

.1 The RVS shall be designed for heavy-duty applications and in accordance with applicable datasheets.

.2 The RVS shall operate normally with incoming voltage and frequency of 600 V 60 Hz ± 10 % and have an overload capability of 125 % continuous and 500% for 30 seconds.

.3 The RVS shall consist of six SCR rated for a minimum of 1600 V peak inverse voltage and sized to withstand starting circuits of 500% for 30 seconds.

.4 Operating Conditions: Suitable for 0 °C to 40 °C and 5 % to 95 % relative humidity.

.5 The RVS shall be capable of starting when fed from temporary diesel generator (nominal size of 500 kVA).

.6 Drive rated for a minimum fault current of 22 kA Sym. I.C.

2.4 Protection

.1 Motor overload protection shall be two staged based upon an inverse time algorithm, one overload protection characteristic for starting and another for running. The overload characteristics shall be selectable by programming between Classes 5, 10, 20 and 30.

.2 Motor protection in the by-pass mode shall be provided by bimetallic overloads.

.3 Overload resets shall be mechanical pushbuttons from outside the enclosure and be capable of being electrically or automatically reset upon a fault condition.

.4 The SCR shall be complete with snubber networks to prevent false firing due to dV/dT effects.

.5 Over-temperature protection shall be provided on the heat sink and the control board.

.6 Phase Current Imbalance Protection: Trip level: 5 % to 30 % of motor FLA between any two phases and 1 to 20 second delay.

.7 Overcurrent Protection: Trip level: 50 % to 300 % of motor FLA and 1 to 20 second delay.

.8 Load Loss Trip Protection: Under current trip level: 10-90% of motor FLA and 1 to 60 second delay.

.9 Coast down Lockout Timer: 1 to 60 minutes.

.10 Starts-Per-Hour Lockout Timer: Range: 1 to 10 successful starts per hour. Time between starts: 1 to 60 minutes between start attempts.

.11 The RVS shall be capable of being setup and tested without a motor connected.

2.5 Adjustments and Configurations

.1 Acceleration adjustments shall be programmable and shall be capable of dual ramp settings with the following ranges:

.1 Programmable Ramp Types: Voltage Ramp (VR) or Current Ramp (CR).

.2 Starting Torque: 0 % to 100% of line voltage (VR) or 0 % to 600 % of motor FLA (CR).

.3 Ramp Time: 1 to 120 seconds.

.4 Current Limit: 200 % to 600 % (VR or CR).

.2 Deceleration adjustments shall be programmable with the following ranges:

.1 Begin Deceleration Level: 0 % to 100% of line voltage.

.2 Stop Deceleration Level: 0 % to 100 % less than Begin Deceleration Level

.3 Deceleration Time: 1 to 60 seconds

.3 The RVS shall be capable of being programmed that in the event of a fault, the motor either coasts to stop or decelerates according to the deceleration adjustment levels.

2.6 Interface

.1 The operator interface terminal shall have an alphanumeric, high resolution, high brightness LCD display, door mounted and complete with the following status indicators:

.1 Control “Power On”

.2 Full voltage “At Speed”

.3 Shorted SCR

.4 Phase loss

.5 Shunt trip

.6 Overload

.7 Over temperature

.8 Overcurrent

.2 The operator interface terminal shall allow complete control of the RVS and modification of adjustments and configuration parameters. All electrical values, parameters, application and activity function access, faults and local control shall be in plain English.

.3 The following monitoring values shall be available when in the operating mode:

.1 Phase currents

.2 Power factor

.3 Torque

.4 Remaining thermal capacity

.5 Elapse time

.6 Run cycle counter

.7 Lockout time values

.8 Fault codes

.9 Fault history complete with time and date stamps for the last three faults

.4 A reset key will allow a parameter to return the existing value if adjustment is not required and the value is displayed.

.5 The RVS shall have the following door mounted pilot light indicators (LED or neon type, colour as indicated), selector switches and push buttons:

.1 Running – Bypass Contactor Indicating Light (Green)

.2 Overload – Bypass Contactor Indicating Light (Yellow)

.3 Bypass Contactor – Overload Reset Pushbutton

.4 Soft Starter / Off / Bypass Contactor Selector Switch

.6 The RVS shall have Modbus RTU (2 wire, RS485, multidrop) interface for remote interrogation by a DCS or PLC controller. Vendor shall indicate all drive parameters that are accessible from this interface.

2.7 Control Systems – Analog and Discrete I/O

.1 RVS shall have a minimum of 3 programmable inputs used for the following control:

.1 2 wire start/stop control (Discrete Input)

.2 RVS shall have a minimum of 3 programmable dry relay outputs (form C) used to indicate:

.1 Fault Status (Discrete Output)

.2 Run Status (Discrete Output)

.3 Ready Status (Discrete Output)

.3 The contact rating for the 3 programmable dry relay outputs shall be a minimum of 2 A resistive at 120 Vac and 2 A resistive at 24 Vdc.

2.8 Factory Testing

.1 The manufacturer's standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of CSA and NEMA standards. Results from the test shall be provided with closeout submittals.

2.9 Acceptable Product

.1 Benshaw RB2-3 Series RVS.

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with Manufacturer's installation instructions and recommendations.

.2 Hire factory trained representative for setup and commissioning of RVS. Provide written report to Contract Administrator.

.3 Hire factory trained representative to provide one day of training for City of Winnipeg personnel.

.4 Confirm power lugs and RVS can accommodate the pump motor cables leads.

.5 Setup RVS so that pump ramps up to speed over 30 seconds and ramps down to 50 % voltage over 15 seconds at which point it stops the equipment.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Reduced Voltage Starter (Solid-State)

.1 Reduced Voltage Starter (Solid State) shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~

PART 1 - GENERAL

1.1 References

.1 American National Standards Institute (ANSI)

.1 ANSI C82.1-97, Electric Lamp Ballasts-Line Frequency Flourescent Lamp Ballast.

.2 ANSI C82.4-92, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41-1991, Surge Voltages in Low-Voltage AC Power Circuits.

.3 American Society for Testing and Materials (ASTM)

.1 ASTM F1137-88(1993), Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 United States of America, Federal Communications Commission (FCC)

.1 FCC (CFR47) EM and RF Interference Suppression.

1.2 Related Sections

.1 The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions

1.3 Shop Drawings And Product Data

.1 Submit shop drawings in accordance with The City of Winnipeg Standard Construction Specifications Section CW1110 – General Instructions.

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Contract Administrator.

.3 Photometric data to include: VCP Table and spacing criterion.

PART 2 - PRODUCTS

2.1 Lamps

.1 Lamps as per luminarie schedule on electrical drawings.

2.2 Ballasts

.1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic.

.1 Rating: 120 V, 60 Hz, for use with 2-32W, rapid start lamps.

.2 RFI/EMI suppression circuit to: FCC (CFR47) Part 18, sub-part C, Class A and Part 15, sub-part B, Class B.

.3 Totally encased and designed for 40 °C ambient temperature.

.4 Power factor: minimum 95 % with 95% of rated lamp lumens.

.5 Crest factor: 1.5 maximum current, 2.0 maximum voltage.

.6 Capacitor: thermally protected.

.7 Thermal protection: non-resettable on coil.

.8 Harmonics: 10 % maximum THD, including 49th for electronic discrete and hybrid ballasts, 25 % maximum THD including 49th for electromagnetic ballasts.

.9 Operating frequency of electronic ballast: 21 khz minimum.

.10 Total Circuit Power: 62 Watts.

.11 Ballast Factor: greater than 0.90.

.12 Sound rated: Class A.

.13 Mounting: integral with luminaire.

.14 Where available use premium

2.3 Luminaires

.1 Luminaries as per luminaire schedule on electrical drawings.

PART 3 - EXECUTION

3.1 Installation

.1 Locate and install luminaires as indicated.

3.2 Luminaire Supports

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

3.3 Luminaire Alignment

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Method of Measurement and Payment

.1 Lighting

.1 Lighting shall be considered incidental to the Contract Lump Sum Price for “Electrical”.

~End~