Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements that are common to NMS sections found in Division 26 - Electrical 27 - Communications 28 - Electronic Safety and Security.

.2 This section supplements requirements of Division 1.

.3 All drawings and all sections of the specifications shall apply to and form an integral part of this section.

.4 Carefully examine all plans and specifications pertaining to this Contract and become familiar with all details. Visit the site and determine all factors affecting this section of the work and include all costs for same in bid opportunity.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 The electrical installation shall comply with the requirements of the Electrical Supply Authority, the latest edition of the Canadian Electrical Code, with all Provincial and Municipal Laws, Rules and Ordinances, and to the satisfaction of those persons having jurisdiction over same.

.3 Notify the Contract Administrator of any discrepancies or conflictions with any regulation in accordance with the RFP requirements. Failing such notification, meet all such requirements without change to the contract price.

.4 In no instance shall the standard established by these specifications and drawings be reduced by any of the codes, rules or ordinances.

1.3 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.

.3 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.4 Language operating requirements: provide identification nameplates and labels for control items in English, unless otherwise indicated.

1.4 SUBMITTALS

.1 Submit shop drawings, produce detailed data and samples in accordance with previous sections, as specified herein, and to Contract Administrator's satisfaction.

.2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.3 Where applicable, include actual wiring, single line and schematic diagrams. Include all technical data and full details of each component.

.4 Include wiring drawings or diagrams showing interconnection with work of other sections.

.5 Shop drawings of all equipment must be submitted to the Contract Administrator for review in sufficient time to enable him to retain them for at least ten (10) working days.

.6 One print and one reproducible sepia of each shop drawing shall be submitted.

.7 Cross out or eradicate all non-related items.

.8 Bind each system separately eg. P.A., CCTV, Nurse Call, Intercom, Fire Alarm, etc. One common binder from one supplier will not be acceptable.

.9 Shop drawing submission shall include a photocopy of all applicable specification sections showing a complete compliance/ non-compliance listing. Refer to spec. detail sheet "Shop Drawing Compliance List Sample" for example.

.10 Division 26 shall check all shop drawings and make necessary changes, or cause the supplier to make necessary changes, prior to submission to the Contract Administrator. Shop drawings will be reviewed by the Contract Administrator and if re-submission is required, Division 26 shall ensure that the supplier's drawings have been changed to comply before returning them to the Contract Administrator for review again.

.11 Review of the shop drawings by the Contract Administrator shall not relieve the Contractor from responsibility for errors and omissions therein.

.12 Each drawing submission to bear the following signed stamp, and shall include name of project, equipment supplier, and clause number equipment is specified under.

CONTRACTORS CERTIFICATION
This drawing has been reviewed by
(firm name) .

All dimensions have been checked and found compatible with the contract drawings and all capacities, quantities, sizes, and other data contained in the contract documents have been listed by the supplier on this drawing and have been checked by the undersigned and found correct.

Date Per:

.13 Clearly show division of responsibility. No item, equipment or description of work shall be indicated to be supplied or work to be done "By Others" or "By Purchaser". Any item, equipment or description of work shown on shop drawings shall form part of contract, unless specifically noted to the contrary.

.14 Provide field dimensions required by electrical suppliers and sub-subcontractors. In cases where fabrication is required prior to field dimensions being available, check all related drawings and obtain clarification from Contract Administrator if necessary.

.15 Main distribution and utility metering shop drawings must be approved by local utility prior to submission to Contract Administrator.

.16 Incomplete submissions will be returned for updating and re-submittal without Contract Administrator's review.

.17 Product Data: submit WHMIS MSDS.

.18 Quality Control: in accordance with Section 01 45 00 - Quality Control.

.1 Provide CSA certified equipment and material.

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

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

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

.5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work.

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

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians or apprentices in accordance with authorities having jurisdiction and as per the conditions of Provincial or Territorial Act respecting manpower vocational training and qualification.

.3 Site Meetings:

.1 Site Meetings: as part of Manufacturer's Field Services described in Part 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.

.1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.

.2 During progress of Work.

.3 Upon completion of Work, after cleaning is carried out.

1.6 DELIVERY, STORAGE AND HANDLING

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

1.7 SYSTEM STARTUP

.1 Upon completion of the project, demonstrate the operation, care and maintenance of all system equipment and components in the presence of the City, or his representative, and the Contract Administrator. Obtain signed certification from the City that such equipment was shown to be fully operational and that all necessary operating instructions have been provided.

.2 Arrange and pay for services of manufacturer's factory service contract administrator 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.

1.8 DRAWINGS

.1 Carefully examine all drawings and specifications relating to all work, and all electrical work indicated thereon shall be considered as a part of the work by this section unless indicated otherwise. Prior to the date of the last addendum report at once to the Contract Administrator, any defect, discrepancy, omission or interference affecting the work of this section, or the guarantee of same.

.2 Install all equipment as shown or as specified and in accordance with manufacturer's approved shop drawings.

.3 The drawings accompanying these specifications are intended to show the general arrangement and extent of the work to be carried out, but the exact location and arrangement of all parts shall be determined as the work progresses. The location of equipment, outlets, etc., as given on the drawings are approximately correct, but it shall be understood that they are subject to such modifications as may be found necessary or desirable at the time of installation to meet any structural or architectural requirements. Such changes shall be implemented as directed by the Contract Administrator, without additional charge.

.4 Electrical drawings do not show all structural and other details. Architectural and structural conditions shall govern, and this Section shall make without charge, changes or additions to accommodate these conditions. Check all architectural plans, elevations and details for location of electrical devices, equipment and equipment to be connected.

.5 Where drawings indicate the general location and route to be followed by conduit, cable, etc., these locations must be governed by job conditions. Where the required conduit, cable, and boxes are not shown on drawings or only shown diagrammatically, they shall be installed to conserve maximum head room and interfere as little as possible with free use of space through which they pass. Maximum clearance above floor shall be

maintained under all suspended conduit and equipment, unless otherwise shown on the drawings, or approved by the Contract Administrator.

.6 Submit a complete set of drawings for the proposed installation to the Inspection Department having jurisdiction and receive written approval before installation or fabrication of any equipment. No extra compensation will be allowed for any changes or rearrangement of any electrical apparatus or materials necessary due to failure to receive this approval.

.7 Provide the Electric Utility with three copies of a drawing showing the main distribution and the proposed method of metering for approval prior to the manufacture of equipment.

1.9 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified.

.2 Include in operations and maintenance data:

.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension, and expansion of any portion or feature of the electrical installation.

.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature alone is not acceptable.

.3 Wiring and schematic diagrams and performance curves.

.4 Names and addresses of local suppliers.

.5 Copy of reviewed shop drawings.

.3 Provide four (4) complete, hard-backed, D-ring loose leaf Maintenance Manuals. These shall consist of typewritten or printed instructions for operating and maintaining all systems and equipment provided under this section of the specification. Manuals shall also contain shop drawings, wiring diagrams, test results and manufacturer's brochures on all equipment, together with typed index tab sheets.

.4 As work progresses, record on one (1) set of drawings, installed conduit layout as well as any approved changes and deviations from the original contract and/or working drawings, including outlets, equipment and panel locations. At completion of work, submit to the Contract Administrator, at the contractor's costs, reproducible mylar Record Drawings. The contract shall not be considered complete and no final payment shall be made until these drawings are accepted by the Contract Administrator. (Provide separate drawings for each system in order not to "crowd" drawings.)

.5 Reproducible sepias of Record Drawings are to be mylar (diazo coated plastic film).

1.10 TEMPORARY LIGHTING AND POWER

.1 All temporary and construction lighting and power work and costs for same are not included as part of the scope of the work of this section. Refer to such clauses in other sections of the specification.

1.11 EXAMINATION OF DOCUMENTS AND SITE

.1 Carefully examine all plans and specifications pertaining to this contract and become familiar with all details. Visit the site and determine all factors affecting this section of the work; include all costs for same in bid opportunity.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Div. 1.

.2 Equipment and material to be CSA certified or certified by an equivalent recognized certifying agency to meet Canadian Standards. Where there is no alternative to supplying equipment which is certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.

.3 Factory assemble control panels and component assemblies.

.4 Submit for Contract Administrator's approval, a duplicate list of makes and types of all equipment and materials for this project, prior to placing of orders for same. This shall be done within fourteen (14) days of the award of the project contract to the General Contractor in order to avoid delays in delivery and completion.

.5 Any material or equipment ordered or installed without the Contract Administrator's prior approval shall, if so directed by the Contract Administrator, be removed and replaced with approved material or equipment without a change in the contract price.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

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

.2 Supplier and installer responsibility is indicated in Motor Schedule on electrical drawings, or in this specification and related mechanical responsibility is indicated in Mechanical Equipment Schedule on mechanical drawings and specifications.

.3 Unless otherwise indicated, control wiring and conduit is specified in electrical sections except for conduit, wiring and connections below 50V which are related to temperature control systems specified in mechanical sections and/or shown on mechanical drawings and specifications.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction 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 type of conductors used.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows, and as indicated in other specification sections:

.1 Nameplates: lamicoid 3mm thick plastic engraving sheet, white face with black core (white with black letters) 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 6mm 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 "ASSET INVENTORY No. [___]" as directed by Contract Administrator .

.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.

.10 Room names and numbers used shall be actual room names and numbers that will be used on the project. Co-ordinate and confirm with trades involved.

.11 Co-ordinate names of equipment and systems with Mechanical section to ensure that identical names are used.

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

.13 Nameplates for disconnects, starters and contactors: Indicate equipment being controlled and voltage.

.14 Nameplates for terminal cabinets and pull boxes: Indicate system and voltage.

.15 Nameplates for transformers: Indicate capacity, primary and secondary voltages.

.16 Nameplates for control devices: indicate equipment controlled.

.17 Adjacent to each breaker in CDP type panelboards, provide and mount lamacoid nameplates identifying the respective load and location.

.18 To match existing where applicable.

.19 All convenience receptacles shall have a lamacoid size 1 plate on which the panel and circuit number from which it is fed, is indicated. The identification shall be mechanically secured to the coverplate on the appropriate outlet. Pressure indented adhesive strip nameplates are not acceptable and shall not be used.

.20 All receptacles fed from a UPS shall have a "UPS" lamacoid near top of cover plate.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings on both ends of phase conductors of feeders (coloured plastic tapes) and branch circuit wiring (numbered wire markers). Conductor marker identification shall correspond with panel or terminal board directory information.

.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. Colour coding used shall be documented by individual systems in Maintenance Manuals.

.5 Insulated grounding conductors shall have a green finish and shall be used only as a grounding conductor.

2.7 CONDUIT AND CABLE IDENTIFICATION

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

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

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

	Prime	Auxiliary
Up to 250V (normal power)	yellow	
Up to 600V (normal power)	yellow	green
Up to 250V (emergency power)	yellow & red	
Up to 600V (emergency power)	yellow & red	green
Telephone	green	
Other communication systems	green	blue
Fire alarm	red	
Emergency voice	red	blue

Other security systems	red	yellow
Control	blue	
Fibre optic	orange	

.4 Other conduit systems as directed on site; all conduit systems shall be identified.

.5 Color outlet box covers to color designated and show circuit numbers in black felt marker on inside of covers.

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 WORKMANSHIP AND MATERIALS

.1 The installation shall consist of material and equipment specified unless as provided herein. Electrical equipment provided under this contract shall be built in accordance with EEMAC standards and shall be C.S.A. certified (or certified by an equivalent recognized certifying agency to meet Canadian Standards) and/or locally approved. All equipment supplied under this contract shall be new and the best of its respective kind and of uniform pattern throughout.

.2 Any material or equipment ordered or installed without the Contract Administrator's prior approval shall, if so directed by the Contract Administrator, be removed and replaced with approved material or equipment without a change to the contract.

.3 Replace inferior work if so ordered by Contract Administrator without a change to the contract.

.4 Retain same foreman or superintendent on the job until completed, unless otherwise directed by the Contract Administrator.

2.10 REQUEST FOR EQUAL

.1 Applications for approval of equal, or alternate materials, or methods, as substitutions for those specified or shown, shall be submitted to the Contract Administrator. Refer to the ‘RFP’ for detailed instruction.

.2 If an "Equal" has been granted, the choice between the materials or methods specified and those approved as equal shall be optional with this Contractor.

.3 If an "Alternate" has been approved, the difference in cost between this alternate and the specified material or method shall be stated in the bid opportunity as an "add to" or "delete from" the bid opportunity price and the choice of materials or methods shall rest with the Contract Administrator.

.4 Costs for any required additional material, wiring and labour due to the granted equal or approved alternate shall be included in the bid opportunity price or alternate price. This shall include costs which are incurred by other Divisions of this specification.

.5 Any request for equal shall include the following:

.1 Catalogue information, all technical data, full detail and size of the proposed equipment and all components.

.2 Any information requested in the related specification section.

.3 Photometric Data for light fixtures.

.4 Provide block and riser diagram showing wiring and conduits required, power requirements, etc. with any requests. Maintain maximum allowable conduit sizes.

.5 Provide comply/non-comply list addressing each item of the specifications and drawings with each request for equal. This shall include a photocopy of all applicable specification sections showing a complete compliance / non-compliance listing. Refer to spec detail sheet "Shop Drawing Compliance List Sample", for example, (this detail sheet applies to Requests for Equal as well).

2.11 WIRING TERMINATIONS

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

2.12 SINGLE LINE ELECTRICAL DIAGRAMS

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

.1 Electrical distribution system: Locate in main electrical room or as designated by City' representative.

.2 Electrical power generation and distribution systems: Locate in main electrical room or as designated by City' representative.

.2 Provide fire alarm riser diagram, plan and zoning of building under plexiglass at fire alarm control panel.

.3 Drawings: 600 x 900mm minimum size.

2.13 SPARE PARTS

.1 The Contractor shall submit 15 days after bid opportunity a list of spare parts that the Contractor considers essential/important/useful to the operation of the systems described herein. This list shall be in addition to any spares/consumables called for in the Contract Documents and those which are required up to practical completion and hand over.

.2 Each spare part listed shall include the manufacturer's/ supplier's price including all mark-ups, delivery and packaging. The prices shall remain valid for 12 months following handover of the project.

.3 These spare parts may or may not be ordered during the Contract period. The Contractor shall only include these items in the Contract sum if specifically instructed to do so.

.4 Any spare parts listed shall be completely interchangeable with those specified in the Contract Documents and included in the works.

.5 Any spares ordered shall be delivered to the specified client's representative complete with all documents/instructions.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

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

3.3 CONDUIT AND CABLE INSTALLATION

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

.1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.4 Arrange for holes through exterior wall and roof to be flashed and made weatherproof.

3.4 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, 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.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1220mm.

.2 Wall receptacles:

.1 General: 400mm.
.2 Above top of continuous baseboard heater: 200mm.
.3 Above top of counters or counter splashback: 175mm.
.4 In mechanical rooms: 915mm.

.3 Panelboards, annunciators etc.: 2000mm to top.
.4 Voice/data and interphone outlets: 400mm.
.5 Wall mounted telephone and interphone outlets: 1500mm.
.6 Fire alarm stations: 1370mm.
.7 Fire alarm bells: 2290mm.
.8 End-of-line resistors: 1830mm.
.9 Television outlets: 400mm.
.10 Wall mounted speakers: 2100mm
.11 Clocks: 2100mm.
.12 Door bell pushbuttons: 1500mm.
.13 As per Architectural elevations.
.14 Heights as above or at bottom of nearest block or brick course.
.15 Heights to match existing where applicable.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Submit a complete Short Circuit and Time-Current Coordination Study for the breakers and fuses provided under this contract as well as for the existing upstream breakers and fuses affecting the distributions in this contract. Hydro protective devices to be included in the study.

.1 For the new distributions include all upstream overcurrent protection up to and including the (eg. main breaker in the normal main distributions and up to and including the main breaker in the emergency main distributions).
.2 Curves shall be plotted on a standard log-log scale as time versus current values on a common 600 Volt base. It shall be the responsibility of the Division 26 contractor to provide time-current curves of all breakers, fuses, etc.
.3 The study shall:
.1 Select settings and characteristics for the protective devices in order to achieve maximum selectivity between devices during fault conditions (ie. the device nearest the fault will operate first, thus minimizing the interruption) and to provide proper protection for all distribution equipment, transformers, cable, etc.
.2 Determine the fault currents at critical points in the power system under the worst case conditions in order to ensure the adequacy of the electrical equipment and protective devices. Motor contribution is to be taken into account.
.3 Include all breakers in CDP type panelboards. Breaker settings shall be listed in the study for all breakers with adjustable trips.
.4 In addition to the curves for the protective devices, each drawing shall show and include proper protection and coordination for:
.1 Transformer inrush points.

.2 Transformer full load currents.

.3 Transformer damage curves (single phase and three phase).

.4 Cable damage curves.

.5 The largest motor or motors likely to present coordination problems.

.5 All required breaker settings shall be listed in table form including breaker details such as breaker type, trip rating, etc. All breakers with adjustable trips shall be included in this list.

.6 Maximum available short circuit currents shall be listed for each bus. This listing shall also include the interrupting rating of the protective devices actually supplied in the contract.

.7 In all cases use actual values for transformer impedance, cable types, cable sizes, cable lengths, available utility fault current, etc.

.8 Identification names and numbers for breakers and distribution in the study shall match the identification shown on the contract documents.

.9 The short circuit and coordination study shall be done by a Professional Engineer licensed in the Province of Manitoba and the study shall be signed and sealed by the Professional Engineer.

.10 Ground fault curves shall be plotted on the same drawings as overcurrent curves to ensure proper coordination.

.11 Where there is a generator set, the study shall include the generator breakers.

.12 Where there is equipment such as power factor correction panels with incoming breakers include these breakers in the study.

.13 As a minimum, the study shall be bound in a 3-ring loose leaf binder and shall include:

.1 A title sheet listing the study name, project name, project number, date, Contract Administrating company that prepared the study (including address and phone number), the engineers seal and signature, etc.

.2 Table of Contents.

.3 Purpose of the study.

.4 The criteria for determining proper selective coordination, protection, adequacy, etc. (eg. describe when coordination is achieved, minimum/maximum tripping times and current values, separation between curves, safety margins, damage curves, etc.).

.5 Summary stating that proper selective coordination, proper protection, adequacy of the equipment for the maximum available short circuit currents, etc. was achieved and listing any areas of compromise, potential problems, marginal adequacies, etc.

.6 Drawings of the breaker curves showing proper selective coordination, protection, adequacies, etc. On each drawing, include a single line diagram of the distribution for the curves shown on the drawing, breaker settings, etc.

.7 Maximum available short circuit currents at each bus.

.14 The study shall be started immediately on award of contract and shall be submitted as a shop drawing for review in advance of distribution shop drawings. A minimum of 6 copies shall be submitted.

.15 In cases such as primary breaker protection for transformers provide breakers with fully adjustable solid state trips (fully adjustable LSIG setting) for transformers 30 kVa and larger in order to allow proper coordination. Costs for this shall be included in the bid opportunity price.

.16 All breakers shall be set per the curves in the coordination study.

.17 The Short Circuit and Time-Current Coordination Study (revised to as-built conditions) shall be included in the Operating and Maintenance Manuals.

.2 A certified testing agency normally engaged in field service equipment testing shall be engaged and shall test all the circuit breaker settings for coordination verification as follows (to include new and existing breakers that require adjustment of settings):

.1 Verification of coordination testing shall consist of:

.1 Testing of all circuit breaker solid state relays with the breaker manufacturer's test kit to verify at least 3 points on each time-current characteristic. One point shall be tested at the breakpoint of the characteristic at the high end and another point shall be tested at the breakpoint of the characteristic at the low end. The other points shall be tested along the straight line of the characteristic.

.2 Ductor (contact resistance) testing and meggar (insulation) testing of all breakers including moulded case breakers in CDP type panels, air circuit breakers, other breakers with solid state trips, high voltage breakers, etc.

.2 The report shall be bound in a 3-ring loose leaf binder, similar to the Short Circuit and Time-Coordination Study, with title sheet, table of contents, purpose, test criteria, test equipment used, summary and test data. The test data shall list all devices in table form with both the actual tested values and the required values listed. All test values shall fall within +/- 10% of the required values. Necessary corrective action shall be taken to correct any problems and then re-tested until the equipment passes all required tests. Compare test results to the time current coordination study and confirm that the curves as actually tested provide the required coordination. After all tests and analysis has been completed successfully, the summary in the final report shall clearly state that all equipment has successfully passed all tests and is in good operating condition. The test report shall be certified by the testing agency and shall be signed and sealed by a Professional Engineer responsible for the testing. A minimum of 6 copies shall be submitted.

.3 The breaker co-ordination test report shall be included in the Operating and Maintenance Manuals.

.3 Acceptable Supplier of Service:

.1 Manengco Engineering

.2 J.R. Stephenson Mfg. Ltd.

.3 Siemens

.4 Schneider

3.7 ARC FLASH HAZARD ANALYSIS

.1 Scope

.1 The scope of the studies shall include all new distribution equipment supplied by the equipment Manufacturer under this contract.

.2 References

.1 Institute of Electrical and Electronics Engineers, Inc. (IEEE)

.1 IEEE 141 - Recommended Practice for Electrical Power Distribution and Coordination of Industrial and Commercial Power Systems.

.2 IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

.3 IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis.

.4 IEEE 241 - Recommended Practice for Electric Power Systems in Commercial Buildings.

.5 IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

.6 IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations.

.2 The National Fire Protection Association (NFPA)

.1 NFPA 70 - National Electrical Code, latest edition.

.2 NFPA 70E - Standard for Electrical Safety in the Workplace.

.3 Submittals For Construction

.1 Arc flash labels shall be provided in hard copy only.

.4 Qualifications

.1 The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in the past year.

.5 Studies

.1 The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

.6 Arc Flash Hazard Analysis

.1 The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2004, Annex D.

.2 The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

.3 The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125kVA where work could be performed on energized parts.

.4 Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm^2.

.5 When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and

coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

.6 The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment locations. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculations will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

.7 The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculation on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follow:

.1 Fault contribution from induction motors should not be considered beyond 3-5 cycles.

.2 Fault contribution from synchronous motors and generators should e decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

.8 For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

.9 When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculations.

.10 Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to computer the incident energy for the corresponding location.

.11 Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arch flash event, a maximum clearing time based on the specific location shall be utilized.

.12 Incident energy and flash protection boundary calculations

.1 Arcing fault magnitude

.2 Protective device clearing time

.3 Duration of arc

.4 Arc flash boundary

.5 Working distance

.6 Incident energy

.7 Hazard Risk Category

.8 Recommendations for arc flash energy reduction

.7 Field Adjustment

.1 Arc Flash Warning Labels

.1 The contractor of the Arc Flash Hazard Analysis shall provide a 3.5in. x 3.5in. thermal transfer type label of high adhesion polyester for each work location analyzed.

.2 All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the City and after any system changes, upgrades or modifications have been incorporated in the system.

.3 The label shall include the following information, at a minimum:

.1 Location designation

.2 Nominal voltage

.3 Flash protection boundary

.4 Hazard risk category

.5 Incident energy

.6 Working distance

.7 Engineering report number, revision number and issue date

.4 Labels shall be machine printed, with no field markings.

.5 Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

.1 For each 600, 480 and applicable 208 volt panelboard, one arc flash label shall be provided.

.2 For each motor control centre, one arc flash label shall be provided.

.3 For each low voltage switchboard, one arc flash label shall be provided.

.4 For each switchgear, one flash label shall be provided.

.5 For medium voltage switches one arc flash label shall be provided.

.6 Labels shall be field installed by Electrical Contractor.

.8 Arc Flash Training

.1 The contractor of the Arc Flash Hazard Analysis shall train the City’s qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) or equivalent.

3.8 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads 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 following tests in accordance with Section 01 45 00 - Quality Control, etc.:

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

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

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

.5 Systems: fire alarm system, communications, security, etc.

.6 All other electrical systems.

.7 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 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.4 All circuits shall be tested to ensure that the circuit numbers are correct and that the proper neutral conductors have been provided and installed.

.5 Carry out tests in presence of Contract Administrator and City.

.6 Advise Contract Administrator of dates and times for all testing with sufficient advance notice to allow Contract Administrator to make arrangements to attend.

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

.8 Insert test results and supplier's certifications in Maintenance Manuals.

.9 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.

3.9 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.

3.10 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay all associated fees for inspection of the work by authorities having jurisdiction.

.3 Notify Contract Administrator of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish Certificates of Acceptance from authorities having jurisdiction on completion of work to Contract Administrator. Copies to be included in Maintenance Manuals.

3.11 RESPONSIBILITY

.1 Be responsible for any damage caused the City, or their Contractors due to improperly carrying out this work.

.2 Install all components of this work promptly and where applicable, in advance of concrete pouring, or similar construction. Provide and set in the proper sequence of construction, all sleeves, hangers, inserts, etc. and arrange for all necessary openings, where required to accommodate the electrical installation.

.3 Work shall be arranged in co-operation with other divisions of this specification in such a manner that it doesn't interfere with the progress of the project. In areas where ducts or pipes must be installed along with conduit or cable, co-operate with other divisions so that the finished job will represent the most efficient use of the space.

.4 In no case proceed with any work in uncertainty. Obtain, from the Contract Administrator, any clarification necessary and thoroughly understand all portions of the work to be performed.

3.12 CLEANLINESS AND CLEANING

.1 This division shall maintain a clean tidy job site. All boxes, crates, and construction debris due to this portion of the work shall be neatly piled outside the construction area

and shall be removed at least weekly during the construction period. All construction areas shall be kept clear of debris.

.2 Before the project will be accepted by the City, all lighting fixtures, lamps, lens, panelboards, switches, receptacles, cover plates, and other electrical equipment shall be clean and free of dust, plaster, paint, etc. Any equipment which is scratched or damaged shall be refinished or replaced if so designated by the Contract Administrator.

3.13 MODIFICATIONS

.1 Locations of all light fixtures, convenience receptacles, outlets, switches, telephone or similar outlets, fire alarm stations, bells, etc. are subject to modification by the Contract Administrator, who reserves the right to move these up to 3000 mm from the position shown, without change to the contract price, provided notice is given before the related work has commenced.

3.14 ENGINEERING OBSERVATIONS

.1 Contractor's work will be observed periodically by City, and/or Contract Administrator or their representatives, solely for purpose of determining general quality of work, and not for any other purpose. Guidance will be offered to Contractor in interpretation of plans and specifications to assist him to carry out work. Observation and directives given to Contractor does not relieve Contractor and his agents, servants and employees of their responsibility to erect and install work in all its parts in a safe and workmanlike manner, and in accordance with plans and specifications, nor impose upon City, and/or Contract Administrator or their representatives, any responsibility to supervise or oversee erection or installation of any work.

.2 Contractor shall notify Contract Administrator for a final distribution inspection prior to energizing distribution system. All distribution equipment shall be left with covers removed to allow a thorough inspection.

3.15 GUARANTEE

.1 Guarantee the satisfactory operation of all work and equipment supplied and installed as a part of this section of the specifications.

.2 Replace forthwith, at no additional material or labour cost, any part which may fail, or prove defective within a period of twelve (12) calendar months after the final acceptance of the complete installation, provided that such failure is not due to improper usage, or ordinary wear and tear.

.3 No certificate given, payment made, partial or entire use of the equipment by the City or his representative shall be construed as acceptance of defective workmanship or materials.

.4 This general guarantee shall not act as a waiver of any specified guarantee or special equipment guarantees covering a greater length of time.

3.16 CUTTING AND PATCHING

.1 Cutting, patching and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment and piping, and/or installation of new equipment and piping in existing building(s) to be included by - Electrical Contractor in bid opportunity price. - Electrical Contractor to employ and pay appropriate sub-trade whose work is involved, for carrying out work described above.

.2 Electrical Contractor shall mark all openings required for conduits, cables, ducts, and the like.

3.17 EXCAVATION AND BACKFILLING

.1 Excavate and backfill as required for underground electrical services as indicated. Provide protective materials around and over services and be present at all times during excavation and backfilling to supervise work. Backfilling shall restore the excavated area to the original condition and shall include sodding or asphalt repair where required.

.2 Work to be in accordance with the current CSA Bulletin.

.3 Include all costs for excavation and backfilling, for any underground electrical installation unless otherwise indicated.

3.18 FIREPROOFING

.1 Where cables or conduits pass through floors, block or concrete walls and fire rated walls, seal openings with 3 M Brand 7900 Series Fire Barrier System or equivalent, to maintain fire rating.

.2 Fireproofing of electrical cables, conduits, trays, etc. passing through fire barriers shall conform to local codes and inspection authorities.

3.19 ACCESS DOORS

.1 Provide and install access doors where electrical equipment requiring access is built-in. Access doors to be 2.5mm (12 ga.) steel, approximately 300mm x 300mm (12" x 12") minimum or as approved, finished prime coat only, with concealed hinges, anchor straps, plaster lock and without screws, all equal to Milcor manufacturer. All locks to be flush type, screwdriver operated. Where it is necessary for persons to enter through door, doors to be at least 600mm x 600mm.

.2 In applied tile or exposed glazed or unglazed structural tile, access doors shall take the tile and be sized and located to suit tile patterns. In masonry walls access doors to be sized and located to suit masonry unit sizes. In removable acoustic tile ceilings, no access doors are required.

.3 Access doors located in fire rated ceilings or walls shall be approved fire rated doors and frames.

.4 Co-ordinate access door types, locations, etc. with Contract Administrator.

3.20 SECURITY FASTENERS AND HARDWARE

.1 Refer to other sections of the specifications for Security Fasteners. Division 26 to install security fasteners required for Division 26 work.

.2 This shall also include security tamperproof screws that are exposed such as in light fixtures, coverplates, system devices, outlet covers, etc.

.3 Refer to other sections of the specifications for security hardware.

3.21 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts "LIVE 120 VOLTS", or with an appropriate voltage in English.

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

3.22 SCHEDULING OF WORK

.1 Existing buildings will remain in use during construction. Arrange work so that interruption of services is kept to a minimum. Obtain permission from City prior to cutting into electrical services. Where deemed necessary by Contract Administrator, temporary electrical shall be installed and/or work shall be carried out at night and on weekends.

.2 Contractor to maintain continuous and adequate all existing electrical systems and other services during entire time of this contract. Provide temporary conduit, wire, equipment, etc. where necessary to meet this requirement.

3.23 TESTING

.1 Test all circuits and wires for continuity, insulation resistance and high impedance grounds. Those circuits which test non-continuous, with an insulation resistance less than 2 Megohms or with high impedance grounds shall be replaced.

.2 All empty conduits shall be left with an insulated #14 AWG fish wire.

.3 Test all panels under full load and make necessary reconnection of single phase loads from one leg or phase to another to balance the load on legs or phases as nearly as possible. Test results, test values measured, date of each measurement, company name and signature of person making each measurement shall be neatly recorded. Record all changes on Record Drawings.

.4 Test all required ground rods for ground resistance, with standard test equipment.

.5 Keep a record of all final tests, bind, and turn over typewritten results to the Contract Administrator as a part of the maintenance manual. All final test values measured, date of each measurement, company name and signature of person making each measurement

shall be neatly recorded. After all tests have been successfully completed, each test report shall contain a summary which clearly states that all results were satisfactory.

.6 Upon completion of the work and adjustments of all equipment, all systems shall be tested in the presence of the Contract Administrator to demonstrate that all equipment furnished and installed or connected as a part of this section of the contract shall function electrically in the required manner as determined by the Contract Administrator.

.7 All circuits shall be tested to ensure that the circuit numbers are correct and that the proper neutral conductors have been provided and installed.

.8 Voltage tests shall be conducted and transformer taps adjusted or other corrective measures carried out as directed by the Contract Administrator.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

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

.2 CSA C22.2No.65, Wire Connectors.

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

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper sized to fit copper conductors as required.

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

.3 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install pressure type wire connectors and tighten according to manufacturers recommendations.

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

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

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

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

.2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

1.3 PRODUCT DATA

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

Part 2 Products

2.1 BUILDING WIRES

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

.2 Copper conductors: size as indicated, with minimum 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

2.2 TECK CABLE

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

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated. Minimum size 12 AWG and larger.

.3 Insulation:

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

.2 Colour code: Black, red, blue and white in 4C cable.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material meeting requirements of vertical tray test to CSA C22.2 No. 0.3 with maximum flame travel of 1.2M.

.7 Fastenings:

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

.2 Channel type supports for two or more cables.

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

.8 Connectors:

.1 To be approved for TECK cable.

2.3 MINERAL-INSULATED CABLES

.1 Conductors: solid bare soft-annealed copper, size as indicated.

.2 Insulation: compressed powdered magnesium oxide to form compact homogeneous mass throughout entire length of cable.

.3 Overall covering: annealed seamless copper sheath, Type M1 rated 600 V, 250EC.

.4 Outer jacket: PVC applied over sheath for direct-burial, wet locations, where corrosive agents exist when required by authorities having jurisdiction.

.5 Two hour fire rating.

.6 Connectors: to be approved for M1 cable.

.7 Termination kits: to be approved for M1 cable.

.8 Mineral insulated (MI) cables shall be as manufactured by (Pyrotenax) (BICC Cables).

2.4 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated. Minimum size 12 AWG.

.2 Type: AC90 to have a separate bare copper ground.

.3 Armour: interlocking type fabricated from galvanized steel strip.

.4 Type: ACWU90 - PVC flame retardant jacket over thermoplastic armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

.5 Connectors: as per manufacturer’s requirements.

2.5 ALUMINUM SHEATHED CABLE

.1 Conductors: copper, size as indicated.

.2 Insulation: type RA90 rated minimum 600 V.

.3 Sheath: aluminum applied to form continuous corrugated sheath.

.4 Outer jacket of PVC applied over sheath meeting requirements of vertical tray test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2M.

.5 Fastenings for aluminum sheathed cable:

.1 One hole straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables.

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

2.6 CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket, and armour of closely wound aluminum wire.

2.7 VARIABLE FREQUENCY DRIVE POWER CABLES

.1 For input power wiring to the VFD and for output wiring to the motor, from the VFD.

.2 Use cable specifically designed for Variable Frequency Drives.

.1 Teck Drive RX cable as manufactured by Alcatel.

.2 PVC jacket rated at FT4.

.3 Continuous corrugated impervious aluminum shield.

.4 CSA approved to standard C22.2 No. 123-96.

.5 Teck Drive RX cables are to be installed in connectors specifically made for use with the Drive RX cables.

.6 Terminate the Drive RX cable grounds as per the cable manufacturer's instructions, using ground bushings as directed. The ground connections are to be made at the ground points indicated by the VFD manufacturer. Coordinate with equipment supplier and shop drawings.

.7 Installed as per manufacturer's instructions.

2.8 Electronic Cables:

.1 Conductors:

.1 Minimum #18 AWG - STC Solid Copper

.2 Insulation: polyvinyl chloride (PVC)

.3 Configuration: twisted pairs (No. as indicated)

.4 Shielding: Copper braid

.5 Voltage Rating: 300V

.6 Certification: CSA

.7 Suitable for use with VFD and DDC controller.

.8 Ground the shield as per equipment manufacturer's instructions.

2.9 Fire Alarm Cable:

.1 Conductor: Solid Copper minimum #18 AWG

.2 Insulation: 105 deg. C Flame retardent PVC

.3 Configuration: Multi-conductor, (minimum 4 conductors per cable).

.4 Voltage Rating: 300V

.5 Conductor Identification: Colour coded

.6 Shielding: Aluminum mylar foil

.7 Outer Jacket: 105 deg. C red PVC jacket

.8 Certification: CSA Class #5851-01 File #LR41741

.9 Flame Rating: FT4

.10 Refer to Fire Alarm section for wiring to suit addressable fire alarm systems.

Part 3 Execution

3.1 GENERAL

.1 To Minimize Voltage Drop

.1 All branch circuits including lighting circuits shall be minimum #10 AWG for all circuits longer than 21 metres and shall be minimum #8 for all circuits longer than 35 metres.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems.

.2 In cabletroughs.

.3 In underground ducts.

.4 In trenches.

.5 In surface and lighting fixture raceways.

.6 In wireways and auxiliary gutters.

3.3 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Group cables wherever possible on channels.

.2 Single conductor cables shall be installed one cable diam. apart on suspended cable tray or channel supports and shall be clamped with aluminum cable clamps. Cables shall be terminated using non-magnetic connectors. Cable armor shall be grounded via an aluminum plate at the supply end and isolated via an insulating plate, at the load end of the cable. A #3/0 AWG bare (unless otherwise noted) copper ground wire shall be installed with each feeder. Cable bending radius shall be at least twelve times the overall cable diam. and bends shall not damage or distort the outer sheath.

.3 Do not install PVC jacketted cables in circulating air plenums.

.4 Single conductor cables installed underground shall be installed in the installation configuration outlined in Appendix B of the Canadian Electrical Code to provide the allowable ampacity required for the feeder.

3.4 INSTALLATION OF MINERAL-INSULATED CABLES

.1 Run cable exposed or concealed, securely supported by straps & hangers.

.2 Support 2 h fire rated cables at minimum 1m intervals.

.3 Make cable terminations by using factory-made kits.

.4 At cable terminations use thermoplastic sleeving over bare conductors.

.5 Where cables are buried in cast concrete or masonry, sleeve for entry, exit of cables.

.6 Do not splice cables.

.7 All mineral insulated (MI) cables shall be spaced and installed to manufacturers recommendations. Continuous lengths of M.I. cable without joints shall be used. Mineral insulated cable shall be clipped on minimum 1m centres. All cables shall be terminated with the self threading sealing end pot inside the brass gland body. In no case shall the copper sheath and sealing end pot extend beyond the brass gland body. Complete installation to meet all Code requirements and manufacturer's recommendations necessary for a two hour rating. All forming/bending of M.I. cable shall be done by manufacturer's recommended method.

.8 Lugs for M.I. cable shall be CSA approved for M.I. cable. Where CSA approved lugs are not available for M.I. cable, Pyrotenax "Quick Terminating Kits" shall be used.

.9 Type "P" cable clamps shall not be used to secure M.I. cable. Use approved two piece strut clamps.

.10 Testing of MI Cables

.1 Refer to drawings and specifications for MI power feeders. All testing is to be done after cables are bent and formed within panelboards but before the cables are terminated on breakers or lugs. All insulation resistance values to be 50 megohms or more. Any cables with values less than 50 megohms are to be re-terminated and re-tested. At completion of all testing and verification, submit a final report to the Contract Administrator. The report is to include test results for each cable, confirmation that all cables and terminations have been installed according to manufacturer's installation instructions and confirmation that there are no outstanding deficiencies in the installation.

.2 Electrical shall arrange for and shall pay all necessary charges for Pyrotenax to provide the testing services and to verify all terminations have been done correctly. Electrical shall provide sufficient advance notice to Pyrotenax to allow them to be present at the required time to provide training prior to start of cable installation and to perform testing.

.3 All Pyrotenax cable terminations shall be tested and verified. Each and every termination is to be tested immediately on completion of terminations and test results turned over to Contract Administrator immediately.

3.5 INSTALLATION OF ARMOURED CABLES

.1 Type AC90 armoured cable (BX) shall be used for connections from conduit systems to recessed luminaires in accessible ceilings. Cable to be of sufficient length to allow the lighting fixture to be relocated to any location within a 6' (1.8M) radius. Cable shall be clamped before entering the lighting fixture and shall be clipped before entering the conduit system junction box.

.2 Type AC90 armoured cable (BX) shall be used for connections from conduit systems to wiring devices in steel stud partitions and for interconnection of wiring devices within steel stud partitions, cable to be clipped before entering junction or outlet boxes. Cable to be clamped within partitioning with steel galvanized tie-wire.

3.6 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

.2 Single conductor cables shall be installed one cable diam. apart on suspended cable tray or channel supports and shall be clamped with aluminum cable clamps. Cables shall be terminated using non-magnetic connectors. Cable armor shall be grounded via an aluminum plate at the supply end and isolated via an insulating plate, at the load end of the cable. A #3/0 AWG bare (unless otherwise noted) copper ground wire shall be installed with each feeder. Cable bending radius shall be at least twelve times the overall cable diam. and bends shall not damage or distort the outer sheath.

.3 Do not install PVC jacketted cables in circulating air plenums.

.4 Single conductor cables installed underground shall be installed in the installation configuration outlined in Appendix B of the Canadian Electrical Code to provide the allowable ampacity required for the feeder.

3.7 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

3.8 INSTALLATION IN EQUIPMENT

.1 Group and lace-in neatly wire and cable installed in switchboards, panelboards, cabinets, wireways and other such enclosures.

3.9 TERMINATIONS

.1 Terminate wires and cables with appropriate connectors in an approved manner.

3.10 IDENTIFICATION

.1 Wire in conduit #2 AWG and smaller shall have solid coloured insulation, color coded as listed below.

.2 Wire in conduit 1/0 AWG and larger and single conductor cables for normal power feeders shall be identified at each outlet box and termination with a 150 mm band of coloured vinyl tape of the appropriate colour. Emergency power feeders shall be provided with an additional 75 mm band of red vinyl tape installed adjacent to the 150 mm band of the coloured phase identification tape, as listed below. Neutral and ground conductors shall be identified. Paint or other means of colouring the insulation shall not be used.

.3 Color code wire in conduit and single conductor cables as follows:

Phase A - red
Phase B - black
Phase C - blue
Neutral - white
Ground - green

.4 Maintain phase sequence and colour coding throughout project.

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

.6 Identify control conductors in motor control equipment, contactors, fire alarm panels, etc. with mylar/cloth wire markers.

.7 Refer to 26 05 00 for additional requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.41-M1987(R1999), Grounding and Bonding Equipment.

1.4 PRODUCT DATA

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

1.5 CERTIFICATES

.1 Obtain inspection certificate of compliance covering high voltage stress coning from manufacturer and include it with maintenance manuals.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper long barrel compression connectors to CSA C22.2 as required sized for conductors.

Part 3 Execution

3.1 INSTALLATION

.1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2No.41.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

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

.1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.

.2 Canadian Standards Association, (CSA International)

Part 2 Products

2.1 EQUIPMENT

.1 Grounding conductors system, circuit and equipment, grounding to be bare (or green insulated if indicated/required) stranded copper sized in accordance with the Canadian Electrical Code.

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

.3 Rod electrodes: galvanized steel 19 mm dia by 3 m long. Threaded to accept 3m extensions where required to achieve adequate grounding.

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

.5 Insulated grounding conductors: green, type RW90.

.6 Ground bus: copper, size minimum 50mm x 6mm x 300mm long, 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.

.7 Grounding or bonding clamps. All grounding and bonding clamps shall be brass where attached to copper pipes. Clamps for other applications shall be of a type and material that will minimize deterioration from galvanic action due to dissimilar metals.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including, electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of local authority having jurisdiction over installation.

.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 or Burndy "HyGround" compression connectors.

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

.6 Soldered joints not permitted.

.7 The main public metallic water service to a building shall be utilized as the main ground electrode where applicable. Artificial grounding electrode shall be provided as indicated, to suit the requirements of the local inspection authorities.

.8 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

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

.10 Install separate ground conductor to outdoor lighting standards.

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

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

.13 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

.14 Ground secondary service pedestals.

.15 All conduit runs containing feeders and branch circuits shall be complete with an insulated green ground wire bonded to all outlet boxes, junction boxes, pull boxes, equipment enclosures, etc. The conduit system shall be continuous but shall not be relied on to serve as the equipment grounding means. Ground conductors shall be sized according to the Canadian Electrical Code, but shall be minimum #12 AWG. All locknuts and couplings shall be securely tightened.

.16 All flexible conduit shall include an insulated ground wire and shall be properly grounded through an approved fitting.

.17 A separate ground conductor shall be installed in all fibre, PVC or plastic duct runs and shall be connected to maintain the grounding of the system.

3.2 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter.

.2 Install water meter shunt.

.3 Install electrodes and make grounding connections.

.4 Bond separate, multiple electrodes together.

.5 Use size 3/0 AWG copper conductors for connections to electrodes.

.6 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 SYSTEM AND CIRCUIT GROUNDING

.1 Install system and circuit grounding connections to neutral of 600 V and 208 V systems.

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, distribution panels and outdoor lighting.

3.5 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room.

3.6 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, data, sound, fire alarm, intercommunication systems, etc. as follows:

.1 Telephones: make telephone grounding system in accordance with telephone installers requirements.

.2 Sound, fire alarm, intercommunication systems, etc. as indicated and in accordance with manufacturer’s requirements.

3.7 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - 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. a report shall be submitted to the Contract Administrator from the testing agency.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

.5 Maximum ground resistance shall be 1ohm per ground rod.

.6 A ground electrode with an unsatisfactory resistance test result shall be altered as necessary until the required resistance reading is achieved.

END OF SECTION

Part 1 General

1.1 NOT USED

.1 Not Used.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size and thickness as required, surface mounted, suspended, or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with lead anchors or nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

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

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

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

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

- .1 One-hole 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.

.7 Suspended support systems.

- .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
- .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels.

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

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

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

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.

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

END OF SECTION

Part 1 General

1.1 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 01 33 00 - Submittal Procedures.

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 Welded steel construction with screw-on flat covers for surface mounting.

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

.3 Cast type with gasketted covers where exposed to weather or where specified.

.4 Explosion proof in hazardous areas to suit the hazardous classification.

2.3 CABINETS

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

2.4 CABINETS

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

.2 Provide other systems cabinets as specified and located on drawings.

2.5 CUSTOMER SERVICE TERMINATION ENCLOSURE (CSTE)

.1 Refer to Single Line Distribution Schematic for Amperage, Voltage & KAIC ratings.

.2 Enclosure shall be CSA 3R rated, padmount design, free standing.

.3 Single or double outer doors with 3 point latching and padlocking provision.

.4 Service entrance approved by Manitoba Hydro.

.5 Service entrance approved including main breaker and individual sub breakers. Refer to single line distribution schematic.

.6 Dead front construction c/w Integral barriers.

.7 Continuous 13 x 25mm ground bus.

.8 Stepped bus assembly of tin-plated aluminum.

.9 Constructed from 12 Ga. minimum steel, welded IAW CWB 47.1 Standards.

.10 Paint finish shall be 2 coats of outdoor UV and rust resistant Urethane over zinc based rust inhibitive primer. Color to be ASA #61 gray.

.11 Lug provisions for line and load conductors. Coordinate with the contractor & utility for all lug sizes. Minimum provisions are 2 - 2 hole NEMA studs for line conductors. Lug provisions for load conductors. (min. of 8 - 350MCM per phase & neutral)

.12 Complete provision to bolt in utility current and potential transformers. Bus shall be suitable to accept current transformer upgrade provisions.

.13 Stepped bus assembly c/w current transformer upgrade provisions.

.14 Provide remote metering cabinet on side of CSTE when indicated.

.15 Submit shop drawing to utility for approval prior to Contract Administrator review.

.16 Cantruss wire support channel for line/load conductors

.17 Quality assurance standard - ISO9001/94

.18 Acceptable manufacturer - J R Stephenson Mfg. Ltd

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 Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.5 Install junction and pull boxes clear of all mechanical ductwork and piping.

3.3 IDENTIFICATION

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

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

3.4 CUSTOMER SERVICE TERMINATION ENCLOSURE

.1 Mount on suitably sized concrete pad.

.2 Coordinate sleeving with Utility.

.3 Coordinate exact location and placement with Utility.

.4 Coordinate metering requirements with Utility.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

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

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

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

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

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

.7 Sectional boxes shall not be used without specific approval of the Contract Administrator.

.8 In finished areas switch, convenience receptacle, voice/data and blank cover plates shall be stainless steel. In finished area ceilings, junction and pull box covers shall be solid covers, painted to match the finish of the adjacent surface.

.9 In moist or dusty areas, gasketted watertight or dust tight boxes and covers shall be provided.

.10 Explosion proof in hazardous areas to suit requirements of authorities having jurisdiction.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 102 mm square outlet boxes with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.3 MASONRY BOXES

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

2.4 CONCRETE BOXES

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

2.5 FLOOR BOXES

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.

.2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 12 mm and 19 mm conduit. Minimum size: 73 mm deep.

2.6 CONDUIT BOXES

.1 Cast FS or FD feraloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle where exposed to moisture.

2.7 MOULDED VAPOUR BARRIER BOXES

.1 Moulded box vapour barrier: factory moulded polyethylene box c/w flange for use with recessed electric switch and outlet boxes.

2.8 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.

2.9 SERVICE FITTINGS

.1 Pedestal type 'high tension' receptacle fitting, 5" square low profile, 2 piece; steel frame with black plastic housing for two duplex receptacles. Bottom plate with knockout and BX connector for centered installation.

.2 Pedestal type 'low tension' fitting 5" square low profile, 2 piece steel frame with black plastic housing to accommodate two amphenol jack connectors. Bottom plate with slot for conduit entry.

.3 Pedestal type 'Combination Telephone/Receptacle Fitting 5" x 10", low profile, 2 piece; steel barriered frame with black plastic housing to accommodate two duplex receptacles

and two amphenol jack connectors. Bottom plate with BX connector in power section and slot for conduit entry in telephone section.

2.10 FLUSH FLOOR BOXES

.1 To be “Wiremould” #RC9 (120V Outlets) and #AMD (Voice/Data Outlets) colour and finish of faceplates as per Architect at time of shop drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

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

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

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

.5 Wires in outlet, junction and switch boxes, not having a connection within box shall not be spliced, but shall continue unbroken through the box.

.6 Maintain continuity of vapor barrier where boxes are installed in exterior walls and ceilings. Use air/vapor barrier boxes for outlets installed in walls or ceilings with a vapor barrier.

.7 Boxes to be mounted plumb and square with building lines.

.8 Where outlet boxes are shown on the drawings as being "back-to-back" shall have a minimum offset of 200 mm (8") between boxes to reduce sound transmission. In no case shall "thru-wall" boxes be used.

.9 Install pull boxes, or fittings, in conduit runs where more than four bends are necessary.

.10 Install pull boxes where run exceeds 23.0 (75 feet) in length.

.11 All junction, outlets and pull boxes shall be so installed that they are always readily accessible.

.12 No power driven pins (Ramset) shall be utilized to secure boxes without specific approval from Contract Administrator.

.13 Check opening provided for each recessed outlet box and if it is not completely covered by cover plate, report discrepancy to the division responsible and ensure that it is rectified.

.14 All concealed junction boxes, conduit fittings, etc. to be c/w galv. steel covers, secured with two bolts.

.15 Co-ordinate boxes in masonry with brick or block configuration, boxes to be saw cut in bottom of appropriate brick or block. They shall be of sufficient depth to allow conduit to pass through center of block.

.16 Co-ordinate locations with millwork.

.17 Apply acoustic sealant to and seal wires penetrating moulded vapour barrier boxes.

.18 Verify exact location of floor boxes with Contract Administrator. Adjust floor boxes level with finished floor.

.19 Verify exact location of service fittings with furniture drawings and/or Architect. Service fittings to be installed parallel and perpendicular to building lines.

.20 No more than two extension rings shall be used in sequence.

.21 For installations in hazardous areas, meet all requirements of authorities having jurisdiction.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
- .2 CSA C22.2 No. 45, Rigid Metal Conduit.
- .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
- .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
- .6 CAN/CSA C22.2 No. 227.3, Flexible Nonmetallic Tubing.

Part 2 Products

2.1 CONDUITS

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

.2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

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

.5 Flexible metal conduit: to CSA C22.2 No. 56, and liquid tight flexible metal conduit.

.6 FRE conduit.

.7 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3.

.8 Minimum size of conduit shall be 19mm.

2.2 CONDUIT FASTENINGS

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

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

.3 Channel type supports for two or more conduits.

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

2.3 CONDUIT FITTINGS

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

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

.3 Steel set screw connectors and couplings. Insulated throat liners on connectors.

.4 Raintight connectors and fittings c/w O-rings for use on weatherproof or sprinklerproof enclosures. Raintight couplings to be used for surface conduit installations exposed to moisture or sprinkler heads.

.5 Explosion proof in hazardous areas to meet requirements of authorities having jurisdiction.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 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 with 3M spare length at each conduit end.

Part 3 Execution

3.1 INSTALLATION

.1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

.2 Produce layout sketches of conduit runs through mechanical and electrical service areas in order to pre-avoid any conflict with other construction elements and to determine the most efficient route to run conduit.

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

.4 Conceal conduits except in mechanical and electrical service rooms.

.5 Use rigid galvanized steel threaded conduit except where specified.

.6 Use epoxy coated conduit in corrosive areas.

.7 Use electrical metallic tubing (EMT) except where specified otherwise.

.8 Use rigid pvc conduit underground unless otherwise specified.

.9 Use flexible metal conduit for connection to motors in dry areas, connection to recessed incandescent fixtures without a prewired outlet box, connection to surface or recessed fluorescent fixtures, transformers and equipment subject to vibration or movement. Provide a separate insulated grounding conductor within flexible conduit.

.10 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.11 Use explosion proof flexible connection for connection to explosion proof motors.

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

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

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

.15 Mechanically bend steel conduit over 19 mm dia.

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

.17 Install fish cord in empty conduits.

.18 Run 4-25 mm spare conduits up to ceiling space and 4-25 mm spare conduits down to ceiling space from each flush panel. Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

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

.20 Dry conduits out before installing wire.

.21 Conduit stubs from floor slabs where exposed to damage to be rigid galv. steel.

.22 The conduit sizes as shown or indicated are the minimum acceptable and shall not be reduced without the approval of the Contract Administrator.

.23 Conduit to be sized as per Canadian Electrical Code or as shown on drawings. Note that the sizes of branch circuit conductors scheduled and/or specified on the drawings are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with Canadian Electrical Code. Where conductor sizes are increased to suit voltage drop requirements, increase the conduit size to suit.

.24 Running threads will not be permitted; proper couplings shall be used.

.25 Not less than 900mm (3'-0") of flexible conduit (and of sufficient length to allow the lighting fixture to be relocated to any location within a 6 ft. (1.8m) radius) shall be used for the connection of recessed lighting fixtures. A separate drop to be used for each fixture unless fixtures are mounted in continuous rows.

.26 No circuits fed from emergency or essential power sources shall be run in the same conduit as other systems.

.27 Provide separate conduit system for emergency distribution.

.28 All conduit runs passing across expansion joints of the building shall be installed utilizing approved expansion fittings, and bonding devices.

.29 Refer to 16010 for identification requirements.

.30 All conduit systems in hazardous areas to be rigid galvanized steel to meet the requirements of the authorities having jurisdiction.

.31 No power driven pins (Ramset) shall be utilized to secure any portion of the conduit.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels.

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

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

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

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Conduits shall not be Cast-In-Place.

.2 Install sleeves where conduits pass through slab or wall.

.3 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.4 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.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CAN/CSA-C22.2 No. 62, Surface Raceway Systems.

1.2 PRODUCT DATA

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

.2 Indicate types of raceways with terminology similar to that used in this Section.

Part 2 Products

2.1 SURFACE RACEWAY SYSTEM (WIRING PULLED IN)

.1 Steel: to CSA C22.2 No. 62, one piece, free of sharp edges.

.2 Corners, pull boxes, elbows, tees, two piece assembly to facilitate site wiring.

.3 Finish: buff enamel.

.4 Necessary switch, receptacle, extension boxes, adapters and utility fittings required for complete installation.

2.2 SURFACE RACEWAY SYSTEM (WIRING LAID IN)

.1 Steel: to CSA C22.2 No. 62, two piece.

.1 Finish: buff enamel.

.2 Necessary switch, receptacle, extension boxes, adapters and utility fittings required for complete installation.

2.3 SURFACE FLOOR RACEWAY SYSTEM

.1 Steel: to CSA C22.2 No. 62, two piece, manufactured as lay-in type raceway.

.2 Finish: buff enamel.

.3 Necessary switch, receptacle, extension boxes, adapters and utility fittings required for complete installation.

2.4 CHANNEL RACEWAY

.1 Channel type raceway: to CSA C22.2 No. 62, steel, perforated.

2.5 FITTINGS

.1 Elbows, tees, couplings and hanger fittings: to CSA C22.2 No. 62, manufactured as accessories to raceway supplied.

Part 3 Execution

3.1 INSTALLATION

.1 Install raceways before installation of wiring. Install covers for raceways and fittings after installation or wiring.

.2 Install supports, elbows, tees, connectors, fittings, bushings, adaptors as required.

.3 Keep number of elbows, offsets, connections to minimum.

.4 Use wiring with mechanical protection in channel raceways.

.5 Install barriers in raceways where different voltage systems are indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2No.126, Cable Tray Systems.

.2 National Electrical Manufacturers Association (NEMA) standards

.1 NEMA VE 1, Metal Cable Tray Systems.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with section 01 33 00 - Submittal Procedures.

.2 Identify types of cabletroughs used.

.3 Show actual cabletrough installation details and suspension system.

Part 2 Products

2.1 CABLETROUGH

.1 Cabletroughs and fittings: to NEMA VE 1.

.2 Cabletroughs and fittings: to EEMAC F5-1.

.3 Ventilated type, Class C1 to CSA C22.2No.126 for voice/data communications, systems, etc.

.4 Trays: galvanized steel with depth of 100mm and width as indicated on drawings.

.5 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cabletrough supplied.

.1 Radii on fittings: 600 mm minimum.

.6 Solid covers for complete cabletrough system including fittings.

.7 Barriers where different voltage systems are in same cabletrough.

2.2 SUPPORTS

.1 Provide supports as required.

2.3 ACCEPTABLE MANUFACTURERS

.1 Acceptable Manufacturers: Burndy, Canstrut, Pilgrim, Pursley, Unistrut.

Part 3 Execution

3.1 INSTALLATION

.1 Install complete cabletrough system as indicated. Co-ordinate the installation with all trades.

.2 Support cabletrough on both sides at a height as indicated. Support system to be capable of supporting the rated weight capacity of the cabletrough system.

.3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

.4 Provide additional offsets, bends, etc. as required to adjust cable tray routing and height to avoid conflict with ducts, pipes, beams, etc.

.5 Install cabletrough system to meet code clearance (vertical and horizontal clearances).

.6 Install expansion joints with ground jumpers at building expansion joints and where recommended by the manufacturer in long runs.

3.2 CABLES IN CABLETROUGH

.1 Install cables individually.

.2 Lay cables into cabletrough. Use rollers when necessary to pull cables.

.3 Secure cables in cabletrough at 6 m centres, with nylon ties.

.4 Identify cables every 30 m with size 2 nameplates.

3.3 FIRE BARRIERS

.1 Arrange for opening in fire rated walls, and floors for width and depth of cabletray to pass through.

.2 Provide fire rating of floors or walls after cables have been installed in accordance with Section 26 05 00.

3.4 GROUNDING

.1 Ground cable tray in accordance with the Inspection Authorities requirements.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSAC22.2No.26, Construction and Test of Wireways, Auxiliary Gutters and Associated Fittings.

1.3 PRODUCT DATA

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

Part 2 Products

2.1 WIREWAYS

.1 Wireways and fittings: to CSA C22No.26.

.2 Sheet steel with hinged cover to give uninterrupted access.

.3 Finish: baked grey enamel.

.4 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

.5 Acceptable Manufacturers: Pursley, Square D, and Pilgrim.

Part 3 Execution

3.1 INSTALLATION

.1 Install wireways and auxiliary gutters.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers in the full length of wireways where required.

.5 Install gutter to full length of equipment.

.6 Provide wire markers on individual wires in systems wireway section indicating system type. Markers to be installed every 1000 mm.

.7 Provide wire markers on individual wires in power wireway section indicating circuit number. Markers to be installed every 1000 mm.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Division 31.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.2 REFERENCES

.1 Canadian Standards Association, (CSA International)

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

Part 2 Products

2.1 CABLE PROTECTION

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

2.2 MARKERS

.1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

Part 3 Execution

3.1 DIRECT BURIAL OF CABLES

.1 After sand bed specified in Division 31, 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 150 mm minimum separation between cables of different circuits.

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

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

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

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

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

.6 After sand protective cover specified in Division 31, is in place, install continuous row of overlapping 38 x 140 mm pressure treated planks as indicated to cover length of run.

3.2 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.1 Do not pull spliced cables inside ducts.

.2 Install multiple cables in duct simultaneously.

.3 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.4 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.5 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.6 After installation of cables, seal duct ends with duct sealing compound.

3.3 MARKERS

.1 Mark cable every 150 m along runs and changes in direction.

.2 Where markers are removed to permit installation of additional cables, reinstall existing markers.

.3 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.4 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 Pre-acceptance tests.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.7 Provide Contract Administrator with list of test results showing location at which each test was made, circuit tested and result of each test. Include copies in Maintenance Manuals.

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

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

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

.2 Common Work Results-For Mechanical — Section 21 05 01

1.2 PRODUCT DATA

.1 Submit product data in accordance.

Part 2 PRODUCTS

2.1 ELECTRIC HEATING CABLE - EXTERNAL TYPE

.1 Supply all electric heating cable as shown on plan or as specified.

.2 Cables for heat tracing of pipe to be self limiting type SRCT by Pyrotenax or approved equal.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Externally Installed Heat Trace Cable

.1 Install all electric heating cable where shown on plans or as specified. Distribute length evenly over a 10 foot section of pipe. Provide straps as required.

.2 Installations to be as recommended by the cable manufacturer. Provide a letter from the cable manufacturer confirming that all cables are installed as recommended.

.2 Installations to be as recommended by the cable manufacturer. Provide a letter from the cable manufacturer confirming that all cables are installed as recommended.

End Of Section

Part 1 General

1.1 SECTION INCLUDES

.1 Materials, components, cabinets, instruments and installation for metering and switchboard Instruments.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

.3 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

1.3 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C39.1, Requirements, Electrical Analog Indicating Instruments.

.2 Canadian Standards Association, (CSA International)

.1 CAN3-C17, Alternating - Current Electricity Metering.

1.4 PRODUCT DATA

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

.2 Indicate meter, instrument, outline dimensions, panel drilling dimensions and include cutout template.

Part 2 Products

2.1 METER

.1 Single-phase or Polyphase, kilowatt-hour energy meter: to CAN3-C17.

.2 Single-phase or Polyphase, kilovar demand meter: to CAN3-C17.

.3 Combination energy and demand meter: to CAN3-C17.

.4 Accuracy: 1%.

.5 Ratings: as indicated.

2.2 METER SOCKET

.1 Weatherproof meter sockets to suit meters with automatic current transformer shorting devices when meter removed.

2.3 METER CABINET

.1 Sheet steel CSA enclosure with meter backplate, to accommodate meters, test terminal block and associated equipment, factory installed and wired.

2.4 METERING INSTRUMENT TRANSFORMER CABINET

.1 Sheet steel CSA enclosure to accommodate potential and current transformers.

2.5 TEST TERMINAL BLOCKS

.1 Test terminal blocks: as required.

2.6 INDICATING INSTRUMENTS

.1 Indicating instruments: to ANSI C39.1, 1% accuracy, switchboard mounting,

.1 Ammeter: true RMS range as required.
.2 Voltmeter: true RMS range as required.
.3 Wattmeter: range as required.
.4 Varmeter: range as required.
.5 Frequency meter: range as required.
.6 Power factor meter: range as required.
.7 Synchroscope: range as required.

2.7 INSTRUMENT SELECTOR SWITCHES

.1 Voltmeter and Ammeter selector switches: rotary, multi-position, maintained contacts, panel mounting, round notched handle, rated to suit instruments, nameplate marked as indicated to coincide with each rotary position. Ammeter selector switches designed to preclude opening of current circuits.

.2 Four position ammeter selector switches identified "off-A-B-C".

.3 Four position voltmeter selector switches identified "A-B, B-C, C-A, off".

.4 Seven position voltmeter selector switches identified "A-B, B-C, C-A, off, A-N, B-N, C-N".

2.8 SHOP INSTALLATION

.1 Install meters and instrument transformers in separate compartment of switchboard.

.2 Install instruments on panel or switchboard.

.3 Ensure adequate spacing between current transformers installed on each phase.

.4 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources, electrical supplies.

Part 3 Execution

3.1 METERING INSTALLATION

.1 Install meters and instruments in location free from vibration and shock.

.2 Make connections in accordance with diagrams.

.3 If applicable, ensure power factor corrective equipment connected on load side of meter.

.4 Connect meter and instrument transformer cabinets to ground.

.5 Locate meters within 9 m of instrument transformers. Use 1-1/4" (32 mm) conduit for interconnections. Use separate conduit for each set of current transformer connections, exclusive for metering.

3.2 FIELD QUALITY CONTROL

.1 Conduct tests in accordance with Section 26 05 00 - Common Work Results - Electrical and in accordance with manufacturer's recommendations.

.2 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.

.3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.

.4 Perform tests to obtain correct calibration.

.5 Do not dismantle meters and instruments.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Section Includes:

.1 Materials and installation for low voltage control system designed to provide remote switching of lighting loads by use of:

.1 Low voltage momentary contact switches.

.2 Manual switch control.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.1 Submit two (2) copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC content.

.2 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.3 Closeout Submittals:

.1 Submit maintenance data in accordance with Section 01 78 10 - Closeout Submittals.

.4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Test reports:

.1 Submit certified test reports indicating compliance with specifications for specified performance characteristics and physical properties.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions.

.3 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

Part 2 Products

2.1 RELAY CABINETS

.1 Cabinets to be close coupled to breaker panel as indicated. Cabinets to be 17” (43mm) wide with height and depth to match panelboard. Cabinets to be complete with lockable door keyed alike with breaker panels.

.2 Relay cabinet to accommodate 32 plug-in relays, one ON/OFF 32 point output scanner and one transformer.

.3 Cabinet finish shall match that of adjacent power panel.

.4 Provide steel barrier between high voltage terminals and low voltage terminals.

2.2 REMOTE CONTROL SWITCHES

.1 Single pole, momentary contact, heavy duty, rated 20 A, 25 V, double push-button or centre pivot rocker action with LED indicator lights, on/off.

.2 Coverplates to be stainless steel.

2.3 LOW VOLTAGE RELAYS

.1 Electrically operated by momentary impulse, mechanically latched until activated.

.2 Two coil solenoid type with one coil to close relay contacts and one coil to open relay contacts.

.3 Operating voltage: 24 V, AC.

.4 Load contacts: 20 A, 120, 347 V, AC as indicated on drawings.

.5 Coloured pre-stripped leads.

2.4 CONTROL TRANSFORMER

.1 Low voltage power Class 2, input 120 or 347 V, AC, 60 Hz, output 50 VA at 24 V.

2.5 RECTIFIER

.1 Selenium type: 24 V, AC, 60 Hz input, 0.36 A continuous duty output.

.2 Silicon type: 24 V, AC, 60 Hz input, [20 A intermittent duty] output.

2.6 MANUAL CONTROL

.1 Remote control switches as indicated.

2.7 MANUFACTURERS

.1 Acceptable manufacturers: ‘PDM’ Manufacturing, Douglas Power Equipment Ltd.

.2 Acceptable manufacturers: Leviton.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

3.3 FIELD QUALITY CONTROL

.1 Site Tests:

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

.2 Actuate control units in presence of Contract Administrator to demonstrate lighting circuits are controlled as designated.

.3 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. 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.

.2 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

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

Part 2 Products

2.1 PHOTOELECTRIC LIGHTING CONTROL

2.1 PHOTOELECTRIC LIGHTING CONTROL

2.1 PHOTOELECTRIC LIGHTING CONTROL

.1 Cabinet or wall or luminaire mounting.

.2 Capable of switching 1800 W of lighting at 120 or 347 V.

.3 Voltage variation: plus or minus 10%.

.4 Temperature range: minus 40 EC to plus 40 EC.

.5 Switching on lights at 20 lx.

.6 Switching off lights at 400 lx.

.7 Rated for 5000 operations.

.8 Options:

- .1 Lightning arrester.
- .2 Fail-safe circuit completed when relay de-energized.
- .3 Terminal strip.
- .4 Sensitivity adjustment.

.9 Switching time delay of 30 s.

.10 Wall mounting bracket where required.

.11 Colour coded leads: size 10 AWG, 460 mm long.

2.2 CONTACTOR/RELAYS

.1 Cabinet mounting.

.2 Capable of switching multiple lamp circuits.

.3 Astronomic time clock, switch inputs, 20 Amp relays, 10,000 on/off cycles, 120/347 - 60 Hz.

.4 Manual override.

.5 Acceptable Manufacturer: Leviton - Zmax

Part 3 Execution

3.1 INSTALLATION

.1 Install photoelectric controls in accordance with manufacturer's instructions.

.1 Install photoelectric controls in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

.3 Section 26 50 00 - Lighting.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No.184.1-96, Solid-State Dimming Controls (Bi-national standard with UL 1472).

1.3 PRODUCT DATA

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

.2 Submit product data sheets for fluorescent lighting control equipment. Include product characteristics, performance criteria, physical size, limitations and finish.

.3 Manufacturer’s Instructions: Provide to indicate special handling criteria, installation

.3 Manufacturer’s Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate shielded wiring requirements.

Part 2 Products

2.1 EQUIPMENT - GENERAL

2.1 EQUIPMENT - GENERAL

2.1 EQUIPMENT - GENERAL

.1 Dimming system: to CSA C22.2 No.184.1, packaged in accordance with the Canadian Code for Preferred Packaging guidelines, components to be from one manufacturer, and to comprise an integrated system.

.2 System to start, and operate continuously, within intensity setting of 10% to 100%.

.2 System to start, and operate continuously, within intensity setting of 10% to 100%.

.3 System to include approved radio, VCR and TV interference suppressors.

.4 System voltage as indicated.

2.2 INTENSITY SELECTOR

.1 Intensity selector unit, containing solid state firing circuit, master potentiometer, manually operated, providing for continuous adjustment from maximum intensity, to lower level of maximum intensity, suitable for installation in a single gang wall box and complete with knob and faceplate.

2.3 ON-OFF SWITCH

.1 On-off switch integral to dimmer unit.

2.4 DIMMING AUXILIARIES

.1 Dimming auxiliaries, to control multiple dimming ballasts, suitable for mounting in lighting fixture.

Part 3 Execution

3.1 INSTALLATION

.1 Install components comprising dimming system in accordance with manufacturer's instructions, and as indicated.

.2 Install wiring, shielding, grounding in accordance with manufacturer's instructions.

.3 Ensure shielded leads [between intensity selector potentiometer and intensity controls] have outer insulating jackets and are connected to ground at one point only.

.4 Keep radio, VCR, TV and intercom wiring a minimum of 1.8 m away from dimming circuitry. Where crossing of wiring is essential, ensure that grounded shields surround such intercom wiring, and that crossings take place at 90°.

.5 Locate intensity controls and "on-off" switches as indicated.

.6 Ensure positive, low resistance lamp to pin contact within lampholder.

.7 Season lamps by operating at full intensity for 100 h prior to final inspection. Operate ballasts in ambient temperature above 18°C.

.8 Ensure connections are correctly made and to same phase before energizing.

3.2 FIELD QUALITY CONTROL

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

.2 Demonstrate that dimming systems are installed as indicated.

.3 Demonstrate that dimming systems operate as intended and that there are no problems in starting lamps, nor in keeping them lit, and free of perceptible flicker at any setting of dimming intensity control.

.4 Demonstrate that no radio, VCR or TV interference is carried by system and that there is no interference between dimming system and locally used infrared-based remote/integral controls.

END OF SECTION

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 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.47, Air-Cooled Transformers (Dry Type).

.2 CSA C9, Dry-Type Transformers.

.2 National Electrical Manufacturers Association (NEMA)

1.4 PRODUCT DATA

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

Part 2 Products

2.1 TRANSFORMERS - VENTILATED

.1 Dry-type transformers: to CSA C22.2 No. 47, CSA C9, CAN/CSA C802.

.2 Use transformers of one manufacturer throughout project.

.3 Type: ANN. K rating to be minimum K-13 or as indicated on drawings. Parking lot transformers need not be K-13 rated.

.4 3 phase, 600V Delta primary, 120/208V wye, secondary, 60 Hz, copper windings.

.5 Voltage taps: 4 @ 2 1/2 %; two FCAN; two FCBN.

.6 Insulation: Class H; 150C temperature rise above 40C ambient.

.7 Basic Impulse Level (BIL): standard

.8 Hipot: standard

.9 Average sound level: 50 db for up to 150 kVA & 55 db above 150 kVA.

.10 Impedance at 75 deg. C: to be 3% to 5% for transformers up to 225kVA (minimum 3.75% for 225 kVA transformers and 5% for transformers 300 kVA and larger).

.11 Enclosure: EEMAC 1, removable metal front panel, sprinklerproof in sprinklered buildings.

.12 Mounting: floor or wall.

.13 Finish: in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.2 TRANSFORMERS - NON-VENTILATED

.1 Dry-type transformers: to CSA C22.2 No. 47, CSA C9, CAN/CSA C802.

.2 Epoxy potted. K rating to be minimum K-13 or as indicated on drawings. Parking lot transformers need not be K-13 rated.

.3 3 phase, 600V Delta primary, 120/208V wye, secondary, 60 Hz.

.4 Voltage taps: 4 @ 2 1/2%; two FCAN; two FCBN.

.5 115 deg. temp. rise insulation system.

.6 Basic Impulse Level (BIL): standard.

.7 Hipot: standard

.8 Average sound level: standard

.9 Impedance at 75 deg.C: standard

.10 Enclosure: sealed

.11 Mounting: floor or wall as indicated.

.12 Finish: in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.3 ELECTRO-STATICALLY SHIELDED TRANSFORMERS

.1 Dry-type transformers: to CSA C22.2 No. 47, CSA C9, CAN/CSA C802.

.2 Use transformers of one manufacturer throughout project.

.3 Type: ANN. K rating to be minimum K-13 or as indicated on drawings. Parking lot transformers need not be K-13 rated.

.4 3 phase, 600V Delta primary, 120/208V wye, secondary, 60 Hz, copper windings, or aluminum windings.

.5 Voltage taps: 4 at 2-1/2%; two FCAN; two FCBN.

.6 Insulation: Class H; 150C temperature rise above 40C ambient.

.7 Basic Impulse Level (BIL): standard.

.8 Hipot: standard.

.9 Average sound level: 50 db for up to 150 kVa and 55 db above 150 kVa.

.10 Common noise attenuation of 60 db.

.11 Impedance at 75 deg. to be 3% to 5% for transformers up to 225kVA (minimum 3.75% for 225 kVA transformers and 5% for transformers 300 kVA and larger).

.12 Enclosure: EEMAC 1, removable metal front panel; sprinkler proof in sprinklered buildings.

.13 Mounting: floor or wall.

.14 Neoprene vibration insulation pads.

.15 Finish: in accordance with Section 26 05 00 - Common Work Results - Electrical.

2.4 APPROVED MANUFACTURERS

.1 Schneider, Hammond, Rex Manufacturing, Polygon, Siemens.

.2 All transformers shall be of same manufacturer.

2.5 EQUIPMENT IDENTIFICATION

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

.2 Label size: 7.

Part 3 Execution

3.1 MOUNTING

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

.2 Mount dry type transformers above 75 kVA on (100mm) high concrete housekeeping pad, unless otherwise indicated.

.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 Mount transformers with vibration isolation.

3.2 CONNECTIONS

.1 Make primary and secondary connections indicated on wiring diagram.

.2 Energize transformers immediately after installation is completed, where practicable.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for potential and current transformers.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN3-C13, Instrument Transformers.

1.4 PRODUCT DATA

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

.2 Indicate dimensions and connection details.

Part 2 Products

2.1 POTENTIAL TRANSFORMERS

.1 Potential transformers: to CAN3-C13, dry type for indoor use, with following characteristics:
- .1 Nominal voltage class: as indicated.
- .2 Rated frequency: 60 Hz.
- .3 Basic impulse level: as required.
- .4 Voltage ratio: as indicated.
- .5 Metering accuracy rating: 1%.

.2 Potential transformers fused with separate fuse block. Fuses: as required.

2.2 CURRENT TRANSFORMERS

.1 Current transformers: to CAN3-C13, dry type for indoor use with following characteristics:
- .1 Nominal voltage class: as indicated.
- .2 Rated frequency: 60 Hz.
- .3 Basic impulse level: as required.
- .4 Metering accuracy rating: +/- 1%.
- .5 Rated primary and secondary current: as indicated/5 Amps secondary.
- .6 Continuous-current rating factor: as indicated.

.2 Positive action automatic short-circuiting device in secondary terminals.

2.3 MOUNTING BRACKETS

.1 Potential transformers with mounting brackets to suit distribution manufacturer.

.2 Fabricate brackets and channels from electrogalvanized code gauge painted steel.

Part 3 Execution

3.1 INSTALLATION

.1 Install instrument transformers and ensure accessibility.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for low voltage switchgear.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 26 05 00 - Common Work Results - Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2 No.31, Switchgear Assemblies.

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

.1 EEMAC G8-3.3, Metal-Enclosed Interrupter Switchgear Assemblies.

1.4 DESCRIPTION OF EQUIPMENT

.1 Main distribution board incorporates service entrance cable connection section, main breaker c/w built-in ground fault, utility metering transformer compartment, sub-feeder distribution section and customer metering section, factory assembled in one enclosure.

1.5 SHOP DRAWINGS PRODUCT DATA

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

.2 Indicate on shop drawings.

.1 Floor anchoring method and foundation template.
.2 Dimensioned cable entry and exit locations.
.3 Dimensioned position and size of bus.
.4 Overall length, height and depth.
.5 Dimensioned layout of internal and front panel mounted components.
.6 Shipping sections and weights.
.7 Circuit breaker details.

.3 Include time-current characteristic curves for breakers and fuses as required for the coordination study.

1.6 QUALITY ASSURANCE

.1 Submit 4 copies of certified factory test results.

1.7 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for secondary switchgear for incorporation into manual in accordance with Section 01 78 00 - Closeout Submittals.

.2 4 maintenance data for complete switchgear assembly including components.

1.8 STORAGE AND PROTECTION

.1 Store switchgear on site in protected, dry location. Cover with plastic to keep off dust.

.2 Provide energized strip heater in each cell to maintain dry condition during storage.

1.9 COORDINATION AND SHORT CIRCUIT & ARC FAULT STUDY

.1 Switchboard manufacturer to provide a coordination and short circuit & arc fault study as per section 26 05 00 and submit to Contract Administrator with switchboard shop drawings.

Part 2 Products

2.1 MATERIALS

.1 Switchgear assembly: to CAN/CSA-C22.2No.31

2.2 RATING

.1 Service entrance switchboard rated 347/600V, 3 phase, 4 wire. grounded neutral, 60 Hz, as indicated on drawings. Short circuit current rated at RMS symmetrical as indicated on the drawings.

.2 Refer to drawings for ampere rating.

2.3 ENCLOSURE

.1 Wall mounted or free standing, totally enclosed dead front sheet steel enclosure, indoor CSA enclosure 1 or 2 sprinkler proof.

.2 Sheet steel barriers to separate adjoining sections.

.3 Provision for installation of supply authority metering transformers.

.4 Customer metering instruments, transformers and selector switches as indicated on drawings.

.5 Distribution section.

.6 Hinged access panels with captive knurled thumb screws. Utility metering section to have provision for utility seals.

.7 High conductivity aluminum bus.

.8 Bus from load terminals of main breaker via metering sections to main lugs of distribution section.

.9 Identify phases with colour coding.

.10 Sprinkler proof construction to suit local authority having jurisdiction, which includes hinged door on distribution section.

.11 Access from front.

2.4 BUSBARS

.1 Three phase and full capacity neutral bare busbars, continuous current rating as indicated on drawings, self-cooled, extending full width and height of cubicle suitably supported on insulators.

.2 Main connections between bus and major switching components to have continuous current rating to match major switching components.

.3 Busbars and main connections: 99.30% conductivity aluminum.

.4 Tin plated joints, secured with non-corrosive bolts and Belleville washers.

.5 Identify phases of busbars by suitable marking.

.6 Busbar connectors, when switchboard shipped in more than one section.

.7 Provision for extension of unit without need for further drilling or preparation in the field.

2.5 MAIN BREAKER

.1 The main circuit breaker shall be bolt-on fixed mounted, quick-make, quick-break type, full rated moulded case circuit breaker for manual and automatic operation. Breaker shall be equipped with microprocessor based trip unit to provide the following time/current curve shaping adjustments: (1) Long Time Pickup Setting (2) Long Time Delay (3) Short Time Pickup (4) Short Time Delay (5) Ground Fault Pickup (6) Ground Fault Time Delay (7) Instantaneous Pickup.

.2 The relay shall be provided with four light emitting diodes (L.E.D.'s) to indicate tripping occurred from: (1) long delay over-load, (2) short delay over-load, (3) instantaneous or (4) ground fault current. The relay shall be equipped with contacts for remote indication. The breaker shall be equipped with in-built current sensors on each phase and neutral. Current sensors ampere tap setting shall be rated to match the frame size of the main breaker. Shunt trip shall be direct acting solenoid type powered by the sensor/relay energy.

2.6 GROUNDING

.1 Copper ground bus not smaller than 50 x 6mm extending full width of switchboard and located at bottom.

.2 Lugs at each end sized for grounding cables.

2.7 CUSTOMER METERING SECTION

.1 Microprocessor based, self-contained, door mounted device designed to both monitor and display the following electrical parameters:

.1 AC line current (each phase) +/- 1% accuracy.
.2 AC line to line voltage (all 3) +/- 1% accuracy.
.3 AC line to neutral voltage (all 3) +/- 1% accuracy.
.4 Watts +/- 2% accuracy.
.5 Vars +/- 2% accuracy.
.6 Power factor +/- 4% accuracy.
.7 Peak Demand +/- 2% accuracy.
.8 Frequency +/- 5% accuracy.
.9 Watt hours +/- 2% accuracy.

.2 Voltage may be directly monitored on 3 phase AC lines within a range of 120 to 600 VAC without external potential transformers.

.3 Current monitoring is through external current transformers. Current transformers to be dry type for indoor use with following characteristics:

.1 Nominal voltage class as indicated.
.2 Rated frequency: 60 Hz.
.3 Primary current rated to match ampere rating of main bus. Secondary rated @ 5 Amps.

.4 Capability to detect user-chosen electrical parameters.

.1 Phase loss
.2 Phase unbalance
.3 Phase reversal
.4 Undervoltage
.5 Overvoltage

2.8 POWER SUPPLY AUTHORITY METERING

.1 Provided in CSTE

2.9 DISTRIBUTION SECTION

.1 The distribution section to consist of a CDP type panelboard with moulded case circuit breakers and hinged door. Each breaker shall be manually operated, fixed type with trip ratings as shown on the drawings. Minimum interrupting rating to be RMS symmetrical as indicated on the drawings. Breakers feeding transformers 30 kVA and larger to be c/w fully adjustable LSIG settings. The CDP type panelboard is to meet the requirements of 26 23 10 Secondary Switchgear.

2.10 FINISHES

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

.1 Cubicle exteriors gray.
.2 Cubicle interiors white.
.3 Supply 2 spray cans touch-up enamel.
.4 Treated to inhibit rusting.

2.11 EQUIPMENT IDENTIFICATION

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

.2 Nameplates:

.1 White plate, black letters, size 7.
.2 Complete switchgear labelled: for voltage rating.
.3 Main cubicle labelled: "Main Breaker".
.4 Distribution units labelled: to indicate distribution or equipment feed.

2.12 MANUFACTURERS

.1 Schneider, Square D, Seimens.

Part 3 Execution

3.1 INSTALLATION

.1 Locate service entrance switchboard as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Connect service entrance cables to line terminals of switchboard.

.3 Connect load terminals of distribution breakers to outgoing feeders as indicated.

.4 Check factory made connections for mechanical security and electrical continuity.

.5 Run minimum 4/0, bare copper, grounding conductor in 25 mm conduit from ground bus to main building ground.

.6 Check trip unit settings against coordination study to ensure proper working and protection of components.

.7 Where floor mounted, arrange for main distribution switchboard to be mounted on 100mm housekeeping pad.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1 Electrical General Requirements Section 26 23 10

.2 Moulded Case Circuit Breakers Section 26 28 21

1.2 SHOP DRAWINGS PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 00.

.2 Indicate on shop drawings:
- .1 Floor or wall anchoring method and foundation template.
- .2 Dimensioned cable entry and exit locations.
- .3 Dimensioned position and size of bus.
- .4 Overall length, height and depth of complete switchgear.
- .5 Dimensioned layout of internal and front panel mounted components.

.3 Include time-current characteristic curves for breakers as required for the coordination study.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for secondary switchgear for submission to Contract Administrator and incorporation into manual specified in Section 26 05 00.

1.4 STORAGE

.1 Store switchgear on site in protected, dry location. Cover with plastic to keep off dust.

1.5 COORDINATION AND SHORT CIRCUIT STUDY

.1 Switchboard manufacturer to provide a coordination and short circuit study as per section 26 05 00, and submit to Contract Administrator with switchboard shop drawings.

Part 2 Products

2.1 RATING

.1 Secondary switchgear: indoor 347/600V, 3 phase, 4 wire, 60 Hz or 120/208 V, 3 phase, 4 wire, 60 Hz as indicated on drawings. Minimum interrupting capacity (rms symmetrical) as indicated on drawings but in any case no less than 14,000 Amps RMS symmetrical at 600 Volts and 10,000 Amps RMS symmetrical at 208 Volts. Amperage rating as indicated on drawings.

2.2 ENCLOSURE

.1 Distribution sections to contain:
- .1 Molded case circuit breakers sized as indicated.
- .2 High conductivity aluminum bus.
- .3 Panel covers.
- .4 Hinged doors with lock. All locks to be keyed alike.

.2 Blanked off spaces for future units.

.3 Metal enclosed wall or floor mounted, dead front, indoor CSA Enclosure 1 or 2. Sprinklerproof construction to suit local authority having jurisdiction, which includes panel cover on distribution section.

.4 Switchboard to be CDP type.

.5 Access from front.

2.3 BUSBARS

.1 Three phase and full capacity neutral bare busbars, continuous current rating as indicated on drawings, self-cooled, extending full height of cubicle suitably supported on insulators.

.2 Main connections between bus and major switching components to have continuous current rating to match major switching components.

.3 Busbars and main connections: 99.30% conductivity aluminum.

.4 Tin plated joints, secured with non-corrosive bolts and Belleville washers.

.5 Identify phases of busbars by suitable marking.

2.4 GROUNDING

.1 Copper ground bus not smaller than 50 x 6 mm extending full width of switchboard and situated at bottom.

.2 Lugs at each end sized for grounding cables.

2.5 MOLDED CASE CIRCUIT BREAKERS

.1 The Moulded Case Circuit Breakers shall be manually operable fixed mounted c/w frame size and trip settings as indicated. Breakers feeding transformers 45 kVa and larger to be c/w fully and independently adjustable LSIG settings.

2.6 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 - Electrical General Requirements.
- .1 Cubicle exteriors gray.
- .2 Supply 2 spray cans touch-up paint.
- .3 Treated to inhibit rusting.

2.7 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Electrical General Requirements.

.2 Nameplates:
- .1 Provide a size 7 nameplate to indicate voltage, amp rating and designation.
- .2 Sub-breakers: Nameplates to indicate panel or equipment fed.

2.8 MANUFACTURERS

.1 Schneider, Square D, Siemens.

Part 3 Execution

3.1 INSTALLATION

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

.2 Connect load side of breakers in distribution cubicles to distribution feeders.

.3 Check factory made connections for mechanical security and electrical continuity.

.4 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

.5 Where floor mounted, arrange for switchboard to be mounted on 100mm housekeeping pad.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 06 10 00 - Rough Carpentry.

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

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

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2No.29, Panelboards and enclosed Panelboards.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

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

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2No.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.

2.2 CUSTOM BUILT PANELBOARD ASSEMBLIES

.1 450 mm relay section on one or two sides of panels as indicated for installation of low voltage remote control switching components.

.2 Double stack panels as indicated.

.3 Contactors in mains as indicated.

.4 Feed through lugs as indicated.

.5 Isolated ground bus as indicated.

2.3 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.

.5 Lock-on devices for receptacles, fire alarm, emergency, door supervisory, intercom, stairway, exit, night light circuits and similar circuits.

2.4 EQUIPMENT IDENTIFICATION

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

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

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

2.5 MANUFACTURERS

.1 .1 Acceptable Manufacturers: Schneider, Square D and Siemens.

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 in accordance with Section 06 10 00 - Rough Carpentry. 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 branch circuit neutral conductors to common neutral bus. Common neutrals shall be shared by vertically adjacent breakers except for GFI protected branch circuits and dimmer circuits which shall not share neutrals with other circuits. Neutral conductors shall be identified with mylar/cloth wire markers showing the circuit numbers of the circuits sharing the neutral.

.6 Trims of recessed panelboards to be flush with wall. Coordinate installation with wall installer to ensure that walls with recessed equipment will be deep enough to accept the equipment.

.7 Finish parking lot panel enclosures to match site lighting poles.

.8 Locate all panelboards as shown on the drawings, an arrow indicating the front.

.9 Wiring in panelboards shall be neat and set in as if laced. All neutral conductors shall be identified in the panel with their associated circuit numbers by means of Brady Markers.

.10 All panelboards throughout the building shall be phased together such that the left-hand, centre and right-hand panelboard busses represent phases A, B and C respectively. All indicating meters shall be identified to this sequence.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This section describes the requirements for automatic harmonic current reduction which shall be done by means of installing electronic harmonic filtering equipment capable of monitoring and actively reducing harmonic currents, as they are or may become present, within the electrical system. One filter shall be provided to filter the input to CDP-EE.

.2 The harmonic current measured at the Point(s) of Common Coupling (PCC) shall be less than or equal to the magnitudes outlined in IEEE Std. 519-1992, Table 10.3 " Current Distortion Limits for General Distribution Systems (120 V Through 69,000 V)".

Part 2 Products

2.1 ACCEPTABLE MANUFACTURES

.1 Aim Energy Incorporated

2.2 GENERAL REQUIREMENTS

.1	Input Voltage:	600V, 3 Phase, 3 Wire, + ground +6%, -14% steady state +11%, -19% for 20 minutes
.2	Input Frequency:	60Hz. ±5%
.3	Environmental:	0° to 40° C Operating Temperature -30° to 50° C Storage Temperature To 95% Humidity, non-condensing To 1500 meters altitude

2.3 ELECTRICAL RATINGS

.1	Nominal Voltage:	600V AC, 60Hz.
.2	Harmonic Current Cancellation:	90 RMS @ 600V Amps.
.3	Corrective Reactive Current (A RMS):	75 @ 600V
.4	Total Current Injected (A RMS):	117 @ 600V
.5	Corrective kVar (85% electronic):	78 @ 600V
.6	Losses @ Rated Output (kW):	2.2 @ 600V
.7	Transient Protection:	Transient IEEE 587, Class B

.8 Interrupting Capacity: 100 kA RMS symmetrical

.9 Peak Harmonic Current: 3X nominal rms maximum rating

.10 Start-up time: 6 seconds

.11 Harmonic Current Attenuation Factor: I_H (source) / I_H (load)

Harmonic Number	Harmonic Factor(typical)
2	0.3
4	0.1
5-7	0.05
8-11	0.08
12-15	0.1
16-21	0.15
22-27	0.2
28-33	0.3
34-41	0.4
42-51	0.5

2.4 ACCEPTABLE UNIT TYPE

.1 Aim Energy Inc., Series 3A AIM Conditioners 90 Amp

2.5 MECHANICAL DESIGN

.1 Enclosure

.1 The Unit shall be housed in a free standing, NEMA type 1 enclosure.

.2 Cabinet doors/covers shall require a manufacturer supplied key or tool to gain access. Front access only shall be required for servicing, adjustment and installation.

.3 The cabinet shall be structurally adequate and have provisions for hoisting, jacking and forklift handling. Color and finish to manufacturer's standard. Cabinet to be complete with fused disconnect with compression lugs for customer top entry connection. Terminal blocks for manufacturer supplied (contractor installed) Current Transformers shall be provided. The cabinet will have fan forced ventilation sufficient to maintain an internal temperature of less than 50°C. with an external ambient temperature of up to 40°C. Cabinet shall include fused disconnect switch.

.2 Alarms

.1 The harmonic filter shall provide an audible and visual alarm on the front of the unit for any fault condition within the unit related to malfunction, over temperature, and overload.

.2 The filter shall have a form “C” Summary Alarm Contact for remote alarm indication of any alarm condition.

.3 Controls

.1 The front panel will have an on-off/reset switch to allow for a controlled startup of the filter and a clearing of latched alarms.

.2 LED indicators will display the system's status; Power Applied, Operating, and At Maximum Capacity.

.3 The filter shall have a form “C” contact for remote indication of the operating status.

2.6 OPERATION

.1 The harmonic filter shall consist of a three-phase transconductance power amplifier which is connected in parallel to the AC line. The amplifier rectifies line current and stores energy in a DC capacitor bank. Using current transformers the system measure the load current and feeds an analogue signal to the amplifier's control circuit. This signal is proportional to the harmonic current generated by the load. The amplifier uses the harmonic current signal and energy from the DC capacitor bank to inject the inverse of the load's harmonic current into the AC line.

.2 The amplifier shall use Pulse Width Modulation (PWM) to generate the current waveform. The filter shall respond instantly to changes in the system and the power components shall be switched at sufficient speed to allow for cancellation from the 2^{nd} to 52^{nd} harmonic.

.3 The filter shall current limit its output at its rated harmonic injection current but continue to operate, while displaying " At Max Capacity" on the front panel.

.4 The harmonic filter shall be capable of being paralleled with additional harmonic filters for additional capacity and redundancy.

.5 The filter shall be designed to work in conjunction with variable frequency drives static UPS systems, rectifiers for main frame computers, x-ray equipment power supplies, electronic ballasts, and other non-linear loads. The system shall work with either the utility or diesel generators as the source of power.

Part 3 Execution

3.1 EQUIPMENT INSTALLATION

.1 Install wiring to conform to the requirements of the National Electrical Code and applicable State and Local Codes and manufacturer’s requirements.

3.2 START-UP

.1 Manufacturer shall provide a factory trained service representative to start-up, and commission the equipment, and perform a harmonic survey to verify compliance to this specification.

3.3 TRAINING

.1 Provide a training course for the City's staff covering sequence of operation and general maintenance requirements.

End Of Section

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

Part 2 Products

2.1 MATERIALS

.1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish, Munsell Notation 7.5GY3.5/1.5, size as indicated.

.2 Entire enclosure capable of withstanding maximum impact force of 86 MN/m^2 area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Enclosure equipped with hot dipped galvanized mounting rails 1.3 m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.

.1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.

.2 Holes in side panel flanges in 60 mm increments for vertical adjustment.

.5 Cover: tamperproof, bolt-on, domed to shed water.

.6 Door: minimum 1 m wide, hinged, 3 point latching, with padlocking means.

.7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, vermin.

.8 Enclosure construction such as to allow any configuration of single or ganged enclosures.

.9 Enclosure capable of being shipped in knocked-down condition.

Part 3 Execution

3.1 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and mount on concrete pad.

.2 Mount equipment in enclosure.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

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 with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 SWITCHES

2.1 SWITCHES

2.1 SWITCHES

.1 15 and 20 A, 120 V, single pole, double pole, three-way, four-way switches to:

.1 15 and 20 A, 120 V, single pole, double pole, three-way, four-way switches to: CSA-C22.2 No.55 and CSA-C22.2 No.111.

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

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

.2 Silver alloy contacts.

.3 Urea or melamine moulding for parts subject to carbon tracking.

.4 Suitable for back and side wiring.

.5 Ivory toggle.

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

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

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

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

.2 Other receptacles with ampacity and voltage as indicated.

.3 Receptacles of one manufacturer throughout project.

2.3 SPECIAL WIRING DEVICES

.1 Special wiring devices:

.1 Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic jewel lense flush type.

2.4 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.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 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

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 00 - Common Work Results - Electrical as indicated.

.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 00 - Common Work Results - Electrical as indicated.
- .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.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.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

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

.2 Section 26 05 32 Outlet Boxes, Conduit Boxes and Fittings

1.2 REFERENCE STANDARDS

.1 All materials and installation procedures shall conform to applicable provisions of the current edition of the National Building code of Canada, the Canadian Electrical Code, and materials standards referenced herein.

1.3 SYSTEM DESCRIPTION

.1 Intelligent parking lot controller:

Individual microprocessor-based programmable duplex receptacle controller, each unit capable of managing power consumption and demand for two parking stalls in commercial, industrial and institutional parking lot applications.

.1 Red and green message indicator lights.

.2 Communication interfaces for two-way data communication; capable of setting and changing operational modes and limits in the field, and collect data to local computer.

1.4 FUNCTIONAL REQUIREMENTS

.1 The controller shall:

.1 Allow programmable predetermined power parameters.

.2 Measure ambient temperature and windchill.

.3 Detect power load as it is asserted or removed.

.4 Indicate power ready.

.5 Detect and indicate faulty vehicle equipment.

.6 Detect and indicate power overload.

.7 Detect and indicate power failure.

.8 Allow collection and download of operational data.

1.5 SHOP DRAWINGS

.1 Provide preliminary instruction data to be used for design purposes, with sufficiently accurate data to allow roughing-in at site, finalization of schematics and preparation of program.

.2 Preliminary instruction data shall contain the following as a minimum requirement:

.1 Storage, installation and operating instruction.

.2 Outline drawings and showing general arrangement, dimensions, weights and shipping instructions.

.3 Drawing showing field wiring termination locations and details.

.4 Full programming documentation.

1.6 WARRANTY

.1 The equipment shall be guaranteed free of defects in operation and workmanship. The supplier shall replace, free of charge, any parts showing defects which are not due to misuse or neglect and which develop within one year from the date of purchase.

Part 2 Products

2.1 CODES AND STANDARDS

.1 All units shall be CSA approved and bear a CSA label.

.2 System shall be eligible for Manitoba Hydro rebate under the Commercial Construction Program.

2.2 INTELLIGENT PARKING LOT CONTROLLER

.1 Acceptable IPLC manufacturer: IPLC Corp., P.O. Box 334, Elie, Manitoba. Telephone (204) 353-2785, Fax (204) 353-2119.

2.3 MATERIALS

.1 Aluminum elastomer filled weatherproof housing assembly with all weather gaskets.

.2 Factory wired outlet receptacle, dual circuit rated for 15 Amps per circuit.

.3 Green light emitting diodes, encapsulated in elastomer.

.4 Red light emitting diodes, encapsulated in elastomer.

2.4 GENERAL ELECTRICAL SPECIFICATIONS

.1 Dual 125 VAC, AC supply

.1 15 Amps rms, 60 Hz circuit operation, Resistive loads only.

.2 240 VAC single phase split circuit with neutral.

.3 208 VAC single phase split circuit with neutral.

2.5 PROGRAMMING

.1 Unit preprogrammed to user requirements or to standard specifications:

.1 Programmable time elapsed after plug-in for delivery of power up to 19 hours.

.2 Programmable outside temperature to begin delivery of power and the magnitude of power.

2.6 BI-DIRECTIONAL COMMUNICATION

.1 Access connector on each unit to provide for two-way electronic communication.

.2 Set and change operational modes and limits in the field.

.3 Collect and download operational data to local computer.

2.7 HAND HELD PROGRAMMER

.1 Controller Housing

.1 Four part injection molded assembly.
.2 Electronic controls and user interface contained within housing.
.3 Integrated battery compartment.
.4 Battery compartment accessible via a finger snap plate.
.5 LEDs and buttons shall be readily visible and weather sealed with a translucent custom printed lexan sheet.

.2 Operation

.1 Controller operational features shall be implemented within the microcontroller programs and provided non-volatile memories.
.2 Operational features and functions shall be updateable or changed via data communication port one.
.3 Each controller shall implement and maintain several internal databases and a virtual machine kernel.
.4 Each controller shall implement user feedback and diagnostic functions.

.3 Components

.1 Two IPLC handheld model #300
.2 Personal computer serial cable.
.3 IPLC talk cable.
.4 AC power adapter.
.5 Alkaline 9V battery.
.6 Installation diskettes (3.5").

Part 3 Execution

3.1 INSTALLATION

.1 Install aluminum IPLC module in all weather outlet box at target installation site, in accordance with the manufacturer's instructions.

.2 Wiring and commissioning procedures shall be done in accordance with the manufacturer's instructions.

.3 Coordinate user requirements with City and program each receptacle to suit requirements.

.4 Provide at no extra cost, additional program changes as requested by City, for one full year after substantial completion.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 23 00 - Low Voltage Switchgear.

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 Section 01 33 00 - Submittal Procedures.

Part 2 Products

BREAKERS GENERAL

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

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.3 Common-trip breakers: with single handle for multi-pole applications.

.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.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

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

2.3 MAGNETIC BREAKERS DESIGN B

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

2.4 SOLID STATE TRIP BREAKERS DESIGN D

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

2.5 OPTIONAL FEATURES

.1 Include:

.1 Shunt trip.
.2 Auxiliary switch.
.3 Under-voltage release.
.4 On-off locking device.
.5 Handle mechanism.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1	Common Work Results-Electrical	Section 26 05 00
.2	Panelboards Breaker Type	Section 26 24 17

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 Submittal Procedures.

Part 2 Products

2.1 MATERIALS

.1 Components comprising ground fault protective system to be of same manufacturer.

2.2 BREAKER TYPE GROUND FAULT INTERRUPTER

.1 Single or Two pole ground fault circuit interrupter for 15 to 40A, 120/240V, 1 phase circuit c/w test and reset facilities.

2.3 GROUND FAULT PROTECTOR UNIT

.1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:
- .1 Solid state ground sensing device.
- .2 Facility for testing and reset.
- .3 Flush mounted with stainless steel face plate.

Part 3 Execution

3.1 INSTALLATION

.1 Do not ground neutral on load side of ground fault relay.

.2 Pass phase conductors including neutral through zero sequence transformers.

.3 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

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

.2 Arrange and pay for field testing of ground fault equipment by independent testing laboratory before commissioning service.

.3 Submit report of tests to Contract Administrator and a certificate that system as installed meets criteria specified herein. Include copies of report in maintenance manuals.

.4 Demonstrate simulated ground fault tests.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 00 - Common Work Results - Electrical.

.3 Section 26 23 00 - Low Voltage Switchgear.

.4 Section 26 28 14 - Fuses - Low Voltage.

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 Section 01 33 00 - Submittal Procedures.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 -

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 -

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

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

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers Steel Metal, Plastic waste in accordance with Waste Management Plan.

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

Part 2 Products

DISCONNECT SWITCHES

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure one, to

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure one, to CAN/CSA C22.2 No.4 size as indicated.

.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, in accordance with Section 26 28 14 - Fuses - Low Voltage.

.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 00 - 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.

.2 Disconnect switches which are provided on motors fed from a ‘VFD’ shall be c/w auxillary contact, which is to be wired to the VFD. The contact shall disable the VFD automatically if the disconnect is opened.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for contactors for system voltages up to 600 V

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

.3 Section 26 29 03 - Control Devices.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.14-95 (R2001), Industrial Control Equipment.

1.4 PRODUCT DATA

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

Part 2 Products

2.1 CONTACTORS

.1 Contactors: to CSA C22.2 No.14.

.2 Mechanically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.

.3 Breaker combination contactor as indicated.

.4 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.5 Mount in CSA Enclosure 1 unless otherwise indicated.

.6 Include following options in cover:

.1 Red indicating lamp.
.2 Stop-Start pushbutton.
.3 Hand-Off-Auto selector switch.

.7 Control transformer: in accordance with Section 26 29 03 - Control Devices, in contactor enclosure.

2.2 EQUIPMENT IDENTIFICATION

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

.2 Size 4 nameplate indicating name of load controlled.

Part 3 Execution

3.1 INSTALLATION

.1 Install contactors and connect auxiliary control devices.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1	Common Work Results-Electrical	Section 26 05 00
.2	Conduits, Conduit Fastenings and Conduit Fittings	Section 26 05 34
.3	Wires and Cables (0-1000 V)	Section 26 05 21
.4	Outlet Boxes, Conduit Boxes and Fittings	Section 26 05 32
.5	Wiring Devices	Section 26 27 26
.6	Disconnect Switches - Fused and Non-Fused	Section 26 28 23

1.2 SYSTEM DESCRIPTION

.1 Make all required electrical connections to devices, equipment, appliances, etc. furnished by other trades, as indicated or implied on the drawings or in the specifications.

.2 Provide and install miscellaneous electrical components where required.

1.3 COORDINATION

.1 Verify electrical supply characteristics of all equipment prior to rough-in. Report any discrepancies immediately. Revise wire sizing, device type, connection type, breaker size, etc., as required, to accommodate the electrical supply characteristics of the equipment supplied by other trades.

Part 2 Products

2.1 GENERAL

.1 Provide all required electrical devices, components, conduits, fittings, wiring, disconnects, and miscellaneous equipment to make all connections to equipment.

.2 Be familiar with the apparatus being supplied and carefully coordinate and cooperate with the supplier/installer to ensure a proper and complete installation.

2.2 RECEPTACLES

.1 Where equipment has line cord and plug, ensure cap is compatible with receptacle. Provide cordsets to equipment where required.

2.3 PUSHBUTTON/BUZZERS

.1 Provide weatherproof pushbuttons adjacent to loading dock overhead door.

.2 Provide flush mounted buzzers with s.s. coverplate in area designated.

.3 Provide 120/24V AC transformer.

2.4 MOTORIZED DOORS

.1 Wire and connect operator motors, up/down or open/close control stations and safety controls for the motorized doors as per the equipment supplier requirements.

.2 Provide and install disconnect switch at motor operators.

2.5 ILLUMINATED SIGNS

.1 Wire and connect all illuminated signs. Provide disconnect at each sign.

.2 Utilize water-tight wiring methods for exterior signs as required.

.3 Obtain shop drawings and coordinate electrical outlet location.

Part 3 EXECUTION

3.1 EQUIPMENT SUPPLIED BY OTHER TRADES

.1 Wire and connect all equipment requiring an electrical connection. Install disconnect switches where required.

.2 Provide a direct connection or receptacle and cord set to suit hook-up requirements of each piece of equipment. Confirm connection method with City or General Contractor.

End Of Section

Part 1 General

1.1 RELATED SECTIONS

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate:

- .1 Mounting method and dimensions.
- .2 Starter size and type.
- .3 Layout of identified internal and front panel components.
- .4 Enclosure types.
- .5 Wiring diagram for each type of starter.
- .6 Interconnection diagrams.

1.3 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.

1.4 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 transformers.
- .5 1 operating coil.
- .6 2 fuses.
- .7 10% indicating lamp bulbs used.

Part 2 Products

2.1 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/Three overload heater(s), manual reset, trip indicating handle.

.2 Accessories:

.1 Toggle Key switch pushbutton: heavy duty labelled as indicated.

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

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

2.2 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 motor circuit interrupter circuit breaker with operating lever on outside of enclosure to control disconnect motor circuit interrupter 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 Pushbuttons Selector switches: heavy duty labelled as indicated.

.2 Indicating lights: heavy duty type and color as indicated.

.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.3 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.

2.4 FINISHES

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

2.5 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - 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 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 00 - 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.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1	Common Work Results-Electrical	Section 26 05 00
.2	Conduit	Section 26 05 34
.3	Wire and Cables (0-1000V)	Section 26 05 21
.4	Automatic Load Transfer	Section 26 32 33

1.2 DESCRIPTION OF SYSTEM

.1 Generating system consists of:

- .1 Diesel engine.
- .2 Alternator.
- .3 Control panel.
- .4 Automatic transfer equipment with manual bypass switch.
- .5 Battery charger and battery.
- .6 Automatic engine room ventilation system.
- .7 Fuel supply system, fuel tank base.
- .8 Exhaust system.
- .9 Structural steel mounting base.
- .10 Weatherproof/outdoor housing.

.2 System designed to operate in as emergency standby power source unattended.

.3 Diesel generator set shall be designed to start and accept full load in 10 seconds (with a one second start delay) and within the voltage and frequency tolerances specified in C282.

.4 The engine, generator, and all major items of auxiliary equipment shall be products of manufacturers regularly engaged in the production of such equipment. The assembly shall be made up of coordinated components by an organization regularly engaged in assembling such equipment. The assembler or his authorized distributor shall maintain a parts and service facility satisfactory to the Contract Administrator.

.5 The manufacturers shall ensure that the requirements of the specifications are met and that the equipment to be supplied can be accommodated.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00.

.2 Include:

- .1 Engine: make and model, with performance curves.

.2 Alternator: make and model.

.3 Voltage regulator: make, model and type.

.4 Automatic transfer switch with manual bypass switch: make, model and type.

.5 Battery: make, type and capacity.

.6 Battery charger: make, type and model.

.7 Control panel: make and type of meters and controls.

.8 Governor type and model.

.9 Cooling air requirements in m^3/s.

.10 British standard or DIN rating of engine.

.11 Flow diagrams for:

- .1 Diesel fuel.
- .2 Lubricating oil.
- .3 Cooling air.

.12 Dimensioned drawing showing complete generating set mounted on steel base, including vibration isolators, exhaust system, drip trays, and total weight.

.13 Continuous full load output of set at 0.8 PF lagging.

.14 Description of set operation including:

- .1 Automatic starting and transfer to load and back to normal power, including time in seconds from start of cranking until unit reaches rated voltage and frequency.
- .2 Manual starting.
- .3 Automatic shut down and alarm on:
  - .1 Overcranking.
  - .2 Overspeed.
  - .3 High engine temp.
  - .4 Low lube oil pressure.
  - .5 Short circuit.
  - .6 Alternator overvoltage.
  - .7 Lube oil high temperature.
  - .8 Thermistor overtemperature on alternator.
  - .9 Low battery voltage/battery charge.
  - .10 Other shutdowns and alarms as required by CSA C282.

.15 Submit engine generator set performance tests together with shop drawings before manufacture of equipment. Tests shall have been carried out on a prototype of the generating set series in accordance with procedures certified by an independent testing laboratory. Tests shall include the following:

- .1 Max. power level.
- .2 Max. motor starting capability.
- .3 Single step load pick-up.
- .4 Torsigraph analysis.
- .5 Steady-state and transient voltage response.
- .6 Steady-state and transient frequency response.
- .7 Harmonic analysis and voltage waveform deviation.

.8 Three phase circuit strength (mechanical and electrical).

1.4 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for diesel generator for incorporation into manual specified in Section 26 05 00.

.2 Include in Operation and Maintenance Manual instructions for particular unit supplied and not general description of units manufactured by supplier and:

.1 Operation and maintenance instructions for engine, alternator, control panel, automatic transfer switch, manual bypass switch, battery charger, battery, fuel system, engine ventilation system, exhaust system, accessories, etc. to permit effective operation, maintenance and repair.

.2 Technical data:

.1 Illustrated parts lists with parts catalogue numbers.

.2 Schematic diagram of electrical controls.

.3 Flow diagrams for:

.1 Fuel system.

.2 Lubricating oil.

.3 Cooling system.

.4 Certified copy of factory test results.

.5 Certified copy of Site test results.

.6 Maintenance and overhaul instructions and schedules. Complete set of service manuals are to be the same as those issued to factory trained technicians.

.7 Precise details for adjustment and setting of time delay relays or sensing controls which are required on Site adjustment.

.8 Spare parts list.

1.5 MAINTENANCE MATERIALS

.1 Include:

.1 2 fuel filter replacement elements.

.2 2 lube oil filter replacement elements.

.3 2 air cleaner filter elements.

.4 2 sets of fuses for control panel.

.5 Special tools for unit servicing.

.6 3 pairs of ear protectors.

.7 1 set of belts.

1.6 SOURCE QUALITY CONTROL

.1 Factory test generator set including engine, alternator, control panels, transfer switch, accessories, etc. to ensure compliance with specifications and send certified test results to the Contract Administratorprior to shipping.

1.7 SITE TEST

.1 Provide on Site testing of complete generator set installation including engine alternator, control panels, transfer switch and accessories, environmental system, fuel system, etc. Testing shall be performed by factory-trained representative of the diesel generator set supplier.

.2 Ensure room environment control is operational and that all controls required for generator set operation are fed from emergency circuits.

.3 Notify Contract Administrator 7 days in advance of on-site test.

.4 Tests:

.1 Test procedure:

.1 Prepare blank forms and check sheet with spaces to record data. At top of first sheet record:

.1 Date.

.2 Generator set serial no.

.3 Engine, make, model, serial no.

.4 Alternator, make, model, serial no.

.5 Voltage regulator, make and model.

.6 Rating of generator set, kW, kVA, V, A, r/min, Hz.

.2 Mark check sheet and record data on forms in duplicate as test proceeds.

.2 Tests:

.1 With 100% rated load, operate set for 6 hours, taking readings at 30 minute intervals, and record following:

.1 Time of reading.

.2 Running time.

.3 Ambient temp in deg. C.

.4 Lube oil pressure in kPa.

.5 Lube oil temp in deg. C.

.6 Engine coolant temp in deg. C.

.7 Exhaust stack temp in deg. C.

.8 Alternator voltage: phase 1, 2, 3.

.9 Alternator current: phase 1, 2, 3.

.10 Power in kW.

.11 Frequency in Hz.

.12 Power Factor.

.13 Alternator stator temp in deg. C.

.2 After completion of run, demonstrate operation of all shut down devices and alarms including:

.1 Overcranking.

.2 Overspeed.

.3 High engine temp.

.4 Low lube oil pressure.

.5 Short circuit.

.6 Alternator overvoltage.

.7 Low battery voltage, or no battery charge.

.8 Manual remote emergency stop.

.9 High alternator temperature.

.3 Next install continuous strip chart recorders to record frequency and voltage variations during load switching procedures with chart speed of 1.3 mm/s. Each load change delayed until steady state conditions exist. Switching increments to include:

.1 No load to full load to no load.

.2 No load to 70% load to no load.

.3 No load to 20% load to no load.

.4 20% load to 40% load to no load.

.5 40% load to 60% load to no load.

.6 60% load to 80% load to no load.

.3 Demonstrate:

.1 Automatic starting of set, automatic transfer of load on failure of normal power and retransfer to normal power on automatic control.

.2 Automatic shut down of engine on resumption of normal power.

.3 Operation of manual bypass switch.

.4 That battery charger reverts to high rate charge after cranking.

.5 Unit start and shut down on "Manual" control.

.6 Unit start and transfer on "Test" control.

.7 Unit start on "Engine start" control.

.8 Satisfactory performance of dampers in ventilating system to provide adequate engine cooling.

.4 Demonstrate low oil pressure, high engine temperature and other shutdown and alarm device operation without subjecting engine to these excesses.

.5 Provide additional testing as required by Manitoba Building Code, Canadian Electrical Code and CSA Standards.

1.8 TRAINING

.1 Provide a minimum of 6 hours of "hands-on" training of personnel in operation and maintenance procedures of all aspects of the standby generating system.

.2 Training shall include system operation descriptions, review of manual and automatic operation, review of controls, regular maintenance procedures, etc.

.3 Provide a videotape of the training session for future use by the City of Winnipeg.

Part 2 Products

2.1 DIESEL ENGINE

.1 Diesel engine: to ISO 3046/1 - 1981.

.1 Engine: standard product of current manufacture, from company regularly engaged in production of such equipment.

.2 Two or Four cycle, turbo charged and after cooled as required, synchronous speed 1800 r/min.

.3 Capacity:

.1 Rated continuous power in kW at 1800 r/min, after adjustment for power losses in auxiliary equipment necessary for engine operation; to be calculated as follows:

$$\text{Rated continuous output} = \frac{\text{Generator kW}}{\text{Generator Eff @ FL}}$$

.1 Under following Site conditions:

.1 Altitude: 500 m.

.2 Ambient temperature: 30 deg. C.

.3 Relative humidity: 90%.

.4 Cooling System:

.1 Liquid cooled: heavy duty industrial radiator mounted on generating set base with engine driven pusher type fan to direct air through radiator from engine side. Thermostatically controlled, with ethylene glycol anti-freeze non-sludging above minus 46 deg. Ensure radiation fan has sufficient capacity to exhaust air through the plenum (and area wells where specified) to provide proper cooling.

.2 To maintain manufacturer's recommended engine temperature range at 10% continuous overload in ambient temperature of 40 deg. C.

.3 Block heater: thermostatically controlled liquid coolant heater to allow engine to start in room ambient 0 deg. C.

.4 Provide flexible hose connections.

.5 Engine to have coolant temperature gauge.

.5 Fuel:

.1 Type A fuel oil: to CGSB 3-GP-6c.

.6 Fuel system: solid injection, mechanical fuel transfer pump with hand primer, fuel filters and air cleaner, fuel rack solenoid energized when engine running, flexible fuel line connections, fuel oil pressure gauge, etc.

.7 Governor:

.1 Electronic type:

.1 Steady state speed band of plus or minus 0.5%.

.2 Isochronous speed regulation no load to full load.

.3 Adjustable isochronous to 5% droop.

.4 Transient frequency variation shall not exceed 15% of rated frequency when full load at rated power factor is applied. Recovery to stable operation shall occur within five seconds.

.8 Lubrication system:

.1 Pressure lubricated by engine driven pump.

.2 Lube oil filter: replaceable, full flow type, removable without disconnecting piping.

.3 Lube oil cooler.

.4 Engine sump drain valve.

.5 Oil level dip-stick.

.6 Lube oil temperature gauge.

.7 Lube oil pressure gauge.

.9 Starting system:

.1 Positive shift, gear engaging starter 24 Vdc.

.2 Cranking limiter to provide 3 cranking periods of 10 s duration, each separated by 5 second rest.

.3 Lead acid, 12 V storage batteries with sufficient capacity to crank engine for 3 min at 0 deg. C without using more than 25% of ampere hour capacity. To be complete with battery cables, interconnectors and steel rack.

.4 Battery charger: constant voltage, solid state, two stage from trickle charge at standby to boost charge after use. Regulation: plus or minus 1% output for plus or minus 10% input variation. Automatic boost for 6 h every 30 days. Equipped with dc voltmeter, dc ammeter and on-off switch. Charger to be capable of recharging completely discharged batteries to 80% capacity within 12 hours.

.10 Vibration isolated engine instrument panel with:

.1 Lube oil pressure gauge.

.2 Lube oil temperature gauge.

.3 Coolant temperature gauge.

.4 Running time meter: non-tamper type.

.5 Fuel oil pressure gauge.

.11 Guards to protect personnel from hot and moving parts. Locate guards so that normal daily maintenance inspections can be undertaken without their removal.

.12 Drip tray.

.13 Connect the following alarms to a common supervisory trouble zone in main fire alarm panel.

.1 Overcranking

.2 Overspeed

.3 High engine temperature

.4 Low lube oil pressure

.5 Short circuit

.6 Alternator overvoltage

.7 Low battery voltage or no battery charge

.8 Manual remote emergency stop

.9 High alternator temperature

.10 Low fuel

.11 Generator fail

.12 Generator running

.14 All piping and connections to the engine and generator shall include a flexible section supplied with the engine.

2.2 ALTERNATOR

.1 Alternator: to NEMA MG1.

.2 Rating: 3 phase, 347/600V, 3 wire, 4 wire 60 Hz, continuous duty, 125°C temperature rise.

.3 Output at 40 deg. C ambient:

.1 100% full load continuously.

.2 125% full load for 1 min.

.4 Revolving field, brushless, single bearing.

.5 Drip proof.

.6 Amortisseur windings.

.7 Synchronous type.

.8 Dynamically balanced rotor permanently aligned to engine by flexible disc coupling.

.9 Exciter: rotating brushless or permanent magnet. The exciter shall have capacity to provide 150% of required excitation at rated load and voltage. Excitation shall provide for current output of 300% for 10 seconds.

.10 EEMAC class H insulation on windings.

.11 Thermistors embedded in stator winding and connected to alternator control circuitry.

.12 Voltage regulator: solid state thyristor controlled rectifiers with phase controlled sensing circuit:

.1 Stability: 0.1% maximum voltage variation at any constant load from no load to full load.

.2 Regulation: 0.5% maximum voltage deviation between no-load steady state and full-load steady state.

.3 Transient: 10% maximum voltage dip on one-step application of 0.8 PF full load.

.4 Transient: 15% maximum voltage rise on one-step removal of 0.8 PF full load.

.5 Transient: 2s maximum voltage recovery time with application or removal of 0.8 PF full load.

.6 Transient: 10% maximum voltage dip in most severe motor starting condition.

.7 Transient voltage variation shall not exceed 20% of rated voltage when full load at rated power factor is applied or removed. Recovery to stable operation shall occur within two seconds.

.13 Alternator: capable of sustaining 300% rated current for period not less than 10 s permitting selective tripping of down line protective devices when short circuit occurs.

2.3 CONTROL PANEL

.1 Totally enclosed, weather proof, mounted on generator with vibration dampers.

.2 Panel door with formed edges and lockable handle with 2 keys.

.3 Flexible conductors between door and fixed panel.

.4 Instruments:

.1 Analogue or digital indicating type 2% accuracy, rectangular scale, flush panel mounting:

.1 Voltmeter: ac, scale 0 to 750 V.

.2 Ammeter: ac, scale 0 to 125% of rated amperage.

.3 Wattmeter: scale 0 to 125% of rated kW.

.4 Frequency meter: scale 55 to 65 Hz.

.5 Power Factor meter.

.6 Running time meter.

.2 Voltmeter selector switch, rotary, panel mounting, four position, labelled "Off-Phase A-Phase B-Phase C".

.3 Ammeter selector switch, rotary, maintained contacts, panel mounting, designed to prevent opening of current circuits, four position labelled "OFF- Phase A-Phase B-Phase C".

.4 Fuses for indicating instruments: miniature, glass, fast acting, fitted at rear of instrument.

.5 Instrument Transformers

.1 Potential-dry type for indoor use:

.1 Ratio: 600 to 120.

.2 Rating: 600 V, 60 Hz, BIL 3 kV.

.2 Current-dry type for indoor use:

.1 Ratio: as required.

.2 Rating: 600 V, 60 Hz, BIL 3 kV.

.3 Positive action automatic short-circuiting device in secondary terminals.

.5 Controls:

.1 Engine start button.

.2 Selector switch: Off-Auto-Manual.

.3 Engine emergency stop button and provision for remote emergency stop button.

.4 Alternator output breaker:

.1 Circuit breaker: bolt-on, moulded case, temperature compensated for 40 deg. C ambient, dual thermal-magnetic trip.

.5 Voltage control rheostat: mounted on the inside of the control panel and to be screwdriver adjust type with locking nut.

.6 Operating lights, panel mounted:

.1 "Normal power" pilot light.

.2 "Emergency power" pilot light.

.3 Green pilot lights for breaker on and red pilot lights for breaker off.

.7 Solid state indicator lights for alarm with 1 set manually reset NO/NC form "C" contacts wired to terminal block for remote annunciation on:

.1 Low fuel level.

.2 Low battery voltage or high battery voltage.

.3 Ventilation failure.

.4 Engine high temperature (above 110%).

.5 Engine low lube oil pressure (at 80%).

.6 Low coolant.

.8 Solid state controller for automatic shutdown and alarms with 1 set manually reset NO/NC form "C" contacts wired to terminal block for remote annunciation on:

.1 Engine overcrank.

.2 Engine overspeed.

.3 Engine high temperature (shutdown at 115%).

.4 Engine low lube oil pressure (shutdown at 40%).

.5 Short circuit.

.6 Alternator over voltage.

.9 Push to test lamp buttons.

.10 Provision for remote monitoring.

.11 All devices to be wired to a terminal block.

2.4 STRUCTURAL STEEL MOUNTING BASE

.1 Complete generating set mounted on structural steel base of sufficient strength and rigidity to protect assembly from stress or strain during transportation, installation and under operating conditions on suitable level surface.

.2 Assembly fitted with vibration isolators and control console resiliently mounted.

.3 Spring type isolators with adjustable side snubbers and adjustable for levelling.

.4 Sound insulation pads for installation between isolators and concrete base.

2.5 EXHAUST SYSTEM

.1 Super critical grade exhaust silencer with condensate drain, plug and flanged couplings.

.2 Fittings and accessories as required.

.3 Provide sound criteria as part of the shop drawing submission.

2.6 FUEL SYSTEM/FUEL TANK/BASE TANK

.1 A UL listed, dual wall sub base 750 gallon auxiliary fuel tank shall be provided which complies with local codes and ordinances. The tank shall incorporate threaded pipe connections, fuel gauge, low fuel level alarm contact, and leak leakage contact wired to indicating light on Genset control panel, and a vent with locking cap.

.2 Division 26 to fill fuel tank. After completion of testing,

2.7 ENCLOSURE - GENSET

.1 A steel, weather protective sound attentuated enclosure with a minimum ambient capacity of 43°C (110°F) shall be provided. The enclosure shall be painted dark bronze utilizing an electrostatically applied, power baked polyester paint. All sheet metal shall be painted prior to assembly to ensure all surfaces, including edges, are fully painted to prevent rust. All hardware shall be zinc plated or stainless steel. Doors shall be lockable and utilize stainless steel hinges and locks. Coolant and oil drains shall be piped to the edge of the Genset baseframe where they shall be terminated with a locking capped NPT pipe fitting accessible from the exterior of the enclosure. The circuit breaker and control panel shall be mounted on the right hand side of the enclosure and shall be located to allow easy access to control and power wiring. A super critical grade silencer shall be mounted on the inside of the enclosure. The enclosure shall be fully winterized and insulated with 2" Aeroflex with perforated steel liner. Sound attentuation shall be 75 dbA at 7 meters. The enclosure shall include motorized intake and discharge louvers with 15 degree snow hoods. The interior of the enclosure shall include a suitably rated, 600V-120/208V, 3 phase, dry type transformer feeding a 120/208 Volt, 3 phase, 4 wire breaker panel and breakers, 5kW heater, two incandescent light fixtures complete with 100 watt lamps, one light switch, and one convenience GFI duplex receptacle, all pre-wired to the breaker panel with minimum #12 AWG copper conductors in EMT conduit or liquid-tight flexible conduit. The block heater and battery charger shall be connected by supplier.

2.8 REMOTE ALARM PANEL

.1 Remote 16 point, LED annunciator c/w points as noted on plans.

.2 LED's to be red colour for "faults"; amber for pre-alarms.

.3 Reverse polarity protected.

.4 Lamp test pushbutton.

.5 Short circuit protection.

.6 Environmentally sealed.

2.9 EQUIPMENT IDENTIFICATION

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

.2 Control panel:

.1 Size 5 nameplates for controls such as alternator breakers and program selector switch.

.2 Size 2 nameplates for meters, alarms, indicating lights and minor controls.

2.10 FABRICATION

.1 Shop assemble generating unit including:

.1 Base.

.2 Engine and radiator.

.3 Alternator.

.4 Control panel.

.5 Battery and charger.

.6 Automatic transfer equipment.

.7 Base fuel tank.

Part 3 Execution

3.1 INSTALLATION

.1 Locate generating unit and install as indicated.

.2 Complete wiring and interconnections as indicated.

.3 The initial start-up shall be performed by factory-trained representative of the diesel generator set supplier.

.4 Start generating set and test to ensure correct performance of components.

.5 Provide wiring between generator control panel and transfer switch in conduit. Wiring as required.

.6 Wire from generator alarm panel to F.A.C.P. Provide “Generator Running” and “Generator Trouble” signals.

3.2 TESTING

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

.2 Notify Contract Administrator 7 working days in advance of test date.

.3 Provide and install necessary load banks for testing.

.4 Provide fuel for testing and leave full tanks on acceptance.

.5 Run unit on load for minimum period of 6 h to show load carrying ability, stability of voltage and frequency, and satisfactory performance of dampers in ventilating system to provide adequate engine cooling.

.6 At end of test run, check battery voltage to demonstrate battery charger has returned battery to fully charged state.

End Of Section

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1	Common Work Results-Electrical	Section 26 05 00
.2	Low Voltage Switchgear	Section 26 23 00
.3	Secondary Switchgear (120/208V & 347/600V)	Section 26 23 10
.4	Power Generation Diesel	Section 26 32 03

1.2 DESIGN CRITERIA

.1 Automatic load transfer equipment to:

- .1 Monitor voltage of normal power supply.
- .2 Initiate cranking of standby generator unit on normal power failure or abnormal voltage.
- .3 Transfer load from normal supply to standby unit when standby unit reaches rated speed and voltage.
- .4 Transfer load from standby unit to normal power supply when normal power restored.
- .5 Shut down standby unit.
- .6 The transfer switch shall have an integral bypass to allow manual transfer of load to either normal source or emergency source.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00.

.2 Include:

- .1 Make, model and type.
- .2 Single line diagram and wiring schematics showing controls, relays, etc.
- .3 Description of equipment operation including:
  - .1 Automatic starting and transfer to standby unit and back to normal power.
  - .2 Test control.
  - .3 Manual control.
  - .4 Automatic shutdown.

1.4 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for automatic load transfer equipment for incorporation into manual specified in Section 26 05 00.

.2 Detailed instructions to permit effective operation, maintenance and repair.

.3 Technical data:

.1 Schematic diagram of components, controls and relays.

.2 Illustrated parts lists with parts catalogue numbers.

.3 Certified copy of factory test results.

1.5 SOURCE QUALITY CONTROL

.1 Complete equipment, including transfer mechanism, controls, relays and accessories factory assembled and tested.

.2 Tests:

.1 Operate equipment both mechanically and electrically to ensure proper performance.

.2 Check selector switch, in 4 positions (Test, Auto, Manual, Engine Start) and record results.

.3 Check voltage sensing and time delay relay settings.

.4 Check:

.1 Automatic starting and transfer of load on failure of normal power.

.2 Retransfer of load when normal power supply resumed.

.3 Automatic shutdown.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Meters: to CAN3-C17.

.2 Instrument transformers: to CAN3-C13.

.3 Contactors: to NEMA ICS.

2.2 AUTOMATIC TRANSFER SWITCH

.1 Three phase contactors mounted on common frame, in double throw arrangement, mechanically and electrically interlocked, solenoid operated, with CSA sprinkler proof enclosure. To have integral bypass.

.2 Rated: 347/600V, 60 Hz. Refer to drawings for amperage rating.

.3 Main contacts: silver surfaced, protected by arc disruption means including separate arcing contacts, arc splitters and blow out coils for load current.

.4 Copper buswork.

.5 Switch and relay contacts, coils, spring and control elements accessible for inspection and maintenance from front of panel without removal of switch panel or disconnection of drive linkages and power conductors.

.6 Auxiliary contact: to initiate emergency generator start-up on failure of normal power.

.7 The transfer switch shall have an in-phase monitor or time-delay neutral position to limit the over-voltages caused by the “out of phase” transfer of motor loads.

.8 Short circuit withstand rating: 42 kA RMS symmetrical at rated voltage.

.9 Inrush current rating minimum 20 times rated current.

.10 Sprinklerproof.

2.3 CONTROLS

.1 Selector switch - four position "Test" "Auto" "Manual" "Engine start".

.1 Test position - Normal power failure simulated. Engine starts and transfer takes place. Return switch to "Auto" to stop engine.

.2 Auto position - Normal operation of transfer switch on failure of normal power; retransfers on return of normal voltage and shuts down engine.

.3 Manual position - Transfer switch may be operated by manual handle but transfer switch will not operate automatically and engine will not start.

.4 Engine start position - Engine starts but unit will not transfer unless normal power supply fails. Switch must be returned to "Auto" to stop engine.

.2 Control transformers: dry type with 120 V secondary to isolate control circuits from:

.1 Normal power supply.

.2 Emergency power supply

.3 Relays: continuous duty, industrial control type, with wiping action contacts rated 10 A minimum:

.1 Time Delay adjustment from 0.5 to 6 seconds to prevent activation of 'engine start' on momentary normal voltage fluctuation. Factory set at 1 second.

.2 Time Delay adjustment from 0 to 60 seconds on transfer to emergency position after emergency source is available. Factory set at 0 seconds.

.3 Time Delay adjustment from 0 to 5 minutes on retransfer to normal. Factory set at 3 minutes. Should the emergency source fail during this timing period, there shall be an immediate retransfer to the normal source.

.4 Time delay adjustment from 0 - 4 minutes to delay resetting of 'engine start' signal after retransfer to the normal source Engine cool down provision. Factory set at 4 minutes.

.5 Adjustable, close differential, voltage sensing on all phases of the normal source. Pickup voltage adjustable from 85% 510V to 100% 600V of nominal. Dropout voltage is adjustable from 75% to 98% of pickup. Factory set at: Pickup 90% 540V Dropout 85%510V.

.6 Adjustable, close differential, voltage sensing on two phases of the emergency source. Pickup voltage adjustable from 85% 510V to 100% 600V of nominal. Factory set at: Pickup 95% 570V.

.7 Adjustable frequency sensing of emergency source. Pickup adjustable from 90% 54 Hz to 100% 60 Hz. Factory set at: Pickup 95% 57 Hz.

.8 Three spare normally open auxiliary contacts and three spare normally closed auxiliary contacts shall be provided.

2.4 ACCESSORIES

.1 Pilot lights to indicate switch position, green for normal, red for standby, mounted in panel. Lamps to be LED type.

.2 Solid neutral bar.

.3 Auxiliary relay to provide 8 N.O. and 8 N.C. contacts for remote alarms.

.4 Solid state electronic monitors:

.1 Voltage sensing, three phase with time delay and circuit opening closing arrangement.

.2 Under Over frequency sensing, with adjustable differential for nominal frequency of 60 Hz with 2 N.O. and 2 N.C. contacts, repetitive accuracy plus or minus 0.2 Hz.

.3 In-phase monitor or time - delay neutral position.

.5 Provide a contact output to UPS to close when the generator is supplying power to the building. Contact is used to disable UPS battery charging.

2.5 BYPASS

.1 The transfer switch shall either come with an integral bypass or shall be cabled to an external bypass mechanism.

.1 The bypass mechanism shall be constructed so as to provide no interruption to the load during operation.

.2 The bypass mechanism shall be mechanically interlocked to prevent any chance of connecting the utility and emergency sources.

.3 The bypass mechanism shall give visual indication of each position.

.4 External bypass switches shall meet the following:

.1 Provide in separate sprinklerproof enclosures by-pass switches located as shown on drawings.

.2 By-pass switches shall be totally enclosed, sprinklerproof, dead front, fabricated from formed and welded #12 gauge steel and front accessible only. Enclosure shall be painted uniformly with two coats of ASA61 grey. Prior to painting enclosure shall be cleaned and throroughly phosphatized. Enclosure to have a door with lock. Locks shall be keyed the same as the panelboards.

.3 By-pass switches shall be moulded case non-auto type as indicated on drawings. Breakers shall contain auxiliary contacts for breaker position. These contacts shall be wired to by-pass position indicating lights. Interrupting capacity of breakers to match rating of upstream breakers feeding the by-pass switch.

.4 Enclosure shall have a 120 Volt section at the top for by-pass indicating lights. The 120 Volt section shall be barriered from the circuit breaker section. This section shall contain transformer (if required), fusing, terminal strips for all wire terminations, heavy duty watertight, neon indicating lights, etc. as required. All wiring shall be identified. Refer to drawings.

.5 Bus bars shall be tin plated copper braced to withstand a short circuit current of 50,000 Amperes symmetrical at 600 Volts. Neutral bus, where required, shall be full size. Ground bus shall be copper.

.6 Supply and install slide-bolt type interlocking as shown on drawing. Sliding bar safety interlock shall not interfere with by-pass switch cover/trim removal/ replacement. Sliding bar shall have spring loaded ball and socket momentary stops at each position. It shall also be padlockable in the three operating positions.

.7 Supply and install lamacoids identifying each by-pass breaker and complete sequence of by-pass operation as directed by Contract Administrator. Supply and install schematic engraved on a lamacoid. Prior to fabrication, submit shop drawing to Contract Administrator for review and approval.

2.6 EQUIPMENT IDENTIFICATION

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

2.7 FABRICATION

.1 Shop assemble transfer equipment including:

.1 Mounting base and enclosure.

.2 Transfer switch and operating mechanism.

.3 Control transformers and relays.

.4 Accessories.

Part 3 Execution

3.1 INSTALLATION

.1 Locate, install and connect transfer equipment.

.2 Check solid state monitors and adjust as required.

.3 Install and connect battery and remote alarms.

.4 Wire and connect to elevator controllers, gen set, fire alarm panel, etc. as required.

3.2 FIELD QUALITY CONTROL

.1 Factory trained and authorized technician of the transfer switch manufacturer shall set up, test and commission the automatic transfer switch and controls.

.2 Perform tests in accordance with Section 26 05 00 - Common Work Results-Electrical.

.3 Energize transfer equipment from normal power supply.

.4 Set selector switch in "Test" position to ensure proper standby start, running, transfer, retransfer. Return selector switch to "Auto" position to ensure standby shuts down.

.5 Set selector switch in "Manual" position and check to ensure proper performance.

.6 Set selector switch in "Engine start" position and check to ensure proper performance. Return switch to "Auto" to stop engine.

.7 Set selector switch in "Auto" position and open normal power supply disconnect. Standby should start, come up to rated voltage and frequency, and then load should transfer to standby. Allow to operate for 10 min, then close main power supply disconnect. Load should transfer back to normal power supply and standby should shutdown.

.8 Repeat, at 30 minute intervals, 7 times, complete test with selector switch in each position, for each test.

.9 Test bypass switch for correct operation.

End Of Section

Part 1 General

1.1 SUMMARY

.1 This specification describes a three-phase continuous duty, on-line, double conversion, solid-state uninterruptible power system, hereafter referred to as the UPS. The UPS shall operate in conjunction with the existing building electrical system to provide power conditioning, back-up and distribution for critical electrical loads. The UPS shall consist of the UPS module, battery backup, maintenance bypass/distribution cabinet, and other features as described in this specification.

.2 The UPS shall be supplied by "Powerware" #9390-80.

1.2 UPS SYSTEM DESCRIPTION

.1 UPS System Components: The UPS system shall consist of the following main components:

.1 UPS module containing a Rectifier, Inverter, Battery Charger, Static Bypass, and associated Control and Monitor Panel.

.2 Battery string(s) in Line-and-Match Battery Cabinets.

.3 Integrated maintenance bypass and distribution in a Line-and-Match cabinet.

.2 UPS Module Modes of Operation: The UPS Module shall operate as an on-line, fully automatic system in the following modes:

.1 Normal: Utilizing commercial AC power, the critical load shall be continuously supplied by the Inverter. The Inverter shall power the load while regulating both voltage and frequency. The Rectifier shall derive power from the commercial AC source and shall supply DC power to the Inverter. Simultaneously, the Battery Charger shall charge the battery.

.2 Battery: Upon failure of the commercial AC power, the critical load shall continue to be supplied by the Inverter, which shall obtain power from the batteries without any operator intervention. There shall be no interruption to the critical load upon failure or restoration of the commercial AC source.

.3 Recharge: Upon restoration of the AC source, the Charger shall recharge the batteries and simultaneously the Rectifier shall provide power to the Inverter. This shall be an automatic function and shall cause no interruption to the critical load.

.4 Bypass: If the UPS module must be taken out of the Normal mode for overload, load fault, or internal failures, the static bypass switch shall automatically transfer the critical load to the commercial AC power. Return from Bypass mode to Normal mode of operation shall be automatic. No-break transfer to and from Bypass mode shall be capable of being initiated manually from the front panel.

1.3 REFERENCES

.1 UL 1778 (Underwriters Laboratories) – Standard for Uninterruptible Power Supply Equipment. Product safety requirements for the United States.

.2 CSA C22.2 No 107.1(Canadian Standards Association) – Commercial and Industrial Power Supplies. Product safety requirements for Canada.

.3 NEMA PE-1 – (National Electrical Manufacturers Association) – Uninterruptible Power Systems standard.

.4 IEC 62040-1-1 (International Electrotechnical Commission) – Uninterruptible power systems (UPS) – Part 1-1: General and safety requirements for UPS used in operator access areas.

.5 IEC 62040-1-2 (International Electrotechnical Commission) – Uninterruptible power systems (UPS) – Part 1-2: General and safety requirements for UPS used in restricted access locations.

.6 IEC 62040-3 (International Electrotechnical Commission) – Uninterruptible power systems (UPS) – Part 3: Method of specifying the performance and test requirements.

.7 IEEE 587 (ANSI C62.41) Category A & B (International Electrical and Electronics Engineers) – Recommended practices on surge voltages in low voltage power circuits.

.8 FCC Rules and Regulations 47, Part 15, Class A (Federal Communications Commission) – Radio Frequency Devices.

.9 MIL-HDBK-217E (Military Handbook) – Reliability prediction of electronics equipment

1.4 SUBMITTALS

.1 The UPS shall be supplied with sufficient documentation, including the following manuals:

.1 Installation and Operation Manual: One copy of the installation and operation manual shall be furnished. It shall possess sufficient detail and clarity to enable the City's technicians or representatives to install and operate the UPS equipment. The manual shall include the following major items:

.1 UPS description
.2 UPS site planning and unpacking
.3 UPS installation
.4 Optional accessory installation
.5 UPS theory of operation
.6 Operating procedures
.7 System events
.8 UPS maintenance
.9 Performance and technical specifications
.10 Wiring requirements and recommendations
.11 Physical features and requirements
.12 Cabinet dimensions

1.5 QUALIFICATIONS

.1 The UPS manufacturer shall have a minimum of forty years experience in the design, manufacture and testing of solid-state UPS systems. A list of installed UPS systems of the same type as the manufacturer proposes to furnish for this application shall be supplied upon request.

.2 The UPS manufacturer shall have ISO 9001 certification for engineering/R&D, manufacturing facilities and service organization.

.3 The UPS manufacturer shall maintain a staffed 7x24x365 call center for technical and emergency support.

.4 Field Contract Administrator Support: The UPS manufacturer shall directly employ a nationwide field service department staffed by factory-trained field service Contract Administrators dedicated to startup, maintenance, and repair of UPS equipment. The organization shall consist of local offices managed from a central location. Field Contact Administrators shall be deployed in key population areas to provide on-site emergency response within 24 hours. A map of the United States showing the location of all field service offices must be submitted with the proposal. Third-party maintenance will not be accepted.

.5 Spare Parts Support: Parts supplies shall be located in the field to provide 80% of all emergency needs. The factory shall serve as the central stocking facility where a dedicated supply of all parts shall be available within 24 hours.

.6 Product Enhancement Program: The UPS manufacturer shall make available feature upgrade service offerings to all users as they are developed. These upgrades shall be available as optional field-installable kits.

.7 Maintenance Contracts: A complete range of preventative and corrective maintenance contracts shall be provided and offered with the proposal. Under these contracts, the manufacturer shall maintain the user's equipment to the latest factory revisions.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 The UPS shall withstand any combination of the following external environmental conditions without operational degradation.

.1 Operating Temperature: 0 degrees C to + 40 degrees C (32 degrees F to 104 degrees F) without de-rating (excluding batteries).

.2 Storage Temperature: - 25 degrees C to + 60 degrees C (-13 degrees F to 140 degrees F). Prolonged storage above + 40 degrees C (104 degrees F) will cause rapid battery self-discharge.

.3 Relative Humidity (operating and storage): 95% maximum non-condensing.

.4 Elevation:

.1 Operational: 6600 ft (2000 m) maximum without de-rating.

.2 Transportation: Capable of air transport.

1.7 SAFETY

.1 The UPS shall be certified by Underwriters Laboratories in accordance with UL 1778.

.2 The UPS shall be certified by the Canadian Standards Association in accordance with CSA C22.2 NO.107.1-M91.

Part 2 Products

2.1 MANUFACTURERS

.1 Approved Manufacturers: Eaton's Powerware Division

.1 Or approved equal.

2.2 UPS MODULE STANDARD FEATURES

The UPS module shall consist of the following standard components:

.1 Rectifier/Charger: The rectifier/charger shall convert incoming AC power to regulated DC output for supplying the inverter and for charging the battery. The rectifier/charger shall be a high-frequency PWM design, using Insulated Gate Bi-polar Transistors (IGBTs). The modular design of the UPS shall permit safe and fast removal and replacement of the rectifier/charger module. Mean time to repair (MTTR) for the module shall be no more than 30 minutes in order to return UPS to normal mode. The rectifier/charger module shall also provide the following:

.1 The rectifier shall be capable of drawing power from the utility with a power factor of 0.99 under nominal conditions.

.2 The rectifier shall feature protection circuitry that prevents the IGBTs from sourcing current in excess of their published ratings.

.2 Inverter: The inverter shall feature an IGBT pulse-width-modulation (PWM) design with high speed switching. The inverter shall also have the following features:

.1 The inverter shall be capable of providing the specified quality output power while operating from any DC source voltage (rectifier or battery) within the specified DC operating range.

.2 The modular design of the UPS shall permit safe and fast removal and replacement of the inverter module. Mean time to repair (MTTR) for the module shall be no more than 30 minutes in order to return UPS to normal mode.

.3 The inverter shall feature protection circuitry that prevents the IGBTs from sourcing current in excess of their published ratings.

.3 Static Bypass: The bypass shall serve as an alternative source of power for the critical load when an abnormal condition prevents operation in normal mode. The bypass shall consist of a fully rated, naturally-commutated static switch for high-speed transfers. The bypass shall feature the following transfer and operational characteristics.

.1 Transfers to bypass shall be automatically initiated for the following conditions:

.1 Output overload period expired.

.2 Critical bus voltage out of limits.

.3 Over temperature period expired.

.4 Total battery discharge.

.5 UPS failure.

.2 Uninterrupted automatic re-transfer shall take place whenever the inverter is capable of assuming the critical load.

.3 Uninterrupted automatic re-transfers shall be inhibited for the following conditions:

.1 When transfer to bypass is activated manually or remotely.

.2 In the event of multiple transfers/re-transfer operations the control circuitry shall limit "cycling" to three (3) operations in any ten minute period. The fourth transfer shall lock the critical load on the bypass source.

.3 UPS failure.

.4 Uninterrupted manual transfers shall be initiated from the control panel. Uninterrupted manual transfers to bypass and from bypass shall be possible with the inverter logic. During manual transfers to bypass mode, the inverter must verify proper bypass operations before transferring the critical load to the bypass.

.5 All transfers to bypass shall be inhibited for the following conditions:

.1 Bypass voltage out of limits (+/- 10% of nominal)

.2 Bypass frequency out of limits (+/- 3 Hz, adjustable, factory set)

.3 Bypass out of synchronization

.4 Bypass phase rotation / installation error

.6 Static transfer time: No break, complete in less than 4ms.

.7 The bypass shall be manually energized using the control panel or remotely through a building alarm input.

.4 Monitoring and control components: The following components shall provide monitor and control capability:

.1 Control panel with status indicators.

.2 Alarm and metering display.

.3 Building alarm monitoring.

.4 Inverter and bypass contactor monitoring.

.5 Communication ports.

.5 Battery management system: The UPS shall contain a battery management system which has the following features:

.1 The battery management system shall provide battery time remaining while operating in normal mode and battery mode. Battery time available information shall be displayed real-time, even under changing load conditions. Upon commissioning, battery runtime information shall be available.

.2 The battery management system shall automatically test the battery string(s) to ensure that the battery is capable of providing greater that 80% of it's rated capacity. Testing the batteries shall not jeopardize the operation of the critical load. Upon detection of the battery string(s) not capable of providing 80%, the UPS system will alarm that the battery needs attention/replacement. The battery test shall be able to detect the following:

Open battery string
Shorted battery string
Battery capacity (runtime) less than 80% of "new" battery capacity

.3 The UPS shall communicate battery test and monitoring data to the UPS manufacturer's remote monitoring site. Battery life remaining, capacity, and number of on-battery events shall be provided in a monthly report.

.4 An optional temperature sensor shall be available to monitor the ambient temperature internal to the battery cabinet. If the ambient temperature increases, the UPS system charger shall automatically reduce the charging voltage to a level recommended by the battery manufacturer. If the ambient temperature is decreased the UPS shall automatically increase the battery charge voltage to that recommended by the battery manufacturer.

.6 Wiring Terminals: For 4-wire output configurations, the neutral output compression terminal shall be sized for 200% of UPS module rated current to accommodate higher neutral currents associated with non-linear loads. The UPS module shall contain mechanical compression terminals (adequately sized to accommodate 90°C wiring) for securing user wiring to the following locations:

.1 Rectifier/charger input connections (3-wire plus ground)

.2 Bypass input connections (3-wire plus ground for 3-wire plus ground output configuration, or 4-wire plus ground for 4-wire plus ground output configuration)

.3 DC link connections for battery cabinets (positive and negative).

.4 AC output connections (3 or 4 wires plus ground).

2.3 UPS MODULE OPTIONS AND ACCESSORIES

The UPS module shall consist of the following options and accessories:

.1 Integrated Maintenance Bypass and Distribution: An integrated maintenance bypass and output distribution cabinet shall be provided that includes:

.1 All hardware and interconnecting cable for connection to UPS module.

.2 Rotary maintenance bypass switch to isolate UPS module from commercial AC input and critical load. Switch shall provide complete isolation of UPS for servicing and, if necessary, complete removal and replacement of UPS while still providing bypass power to critical load. Switch shall be 2-position, make-before-break, interlocked between UPS and bypass to prohibit improper operation.

.3 K-20 output isolation transformer.

.2 SNMP Network Adapter and UPS Power Monitoring Software: SNMP adapters shall provide a communications interface between the UPS module and SNMP-compatible network management systems. This capability shall allow the unit to be monitored remotely over an Ethernet network using a standard web browser.

.1 UPS Power Monitoring Software: This system shall continuously monitor critical power elements associated with the UPS, using the communications port on each module and a customer furnished PC. The system shall automatically alarm if any problems arise and notify local or remote personnel of the alarm condition via email, page, or text message.

.3 Battery Cabinet: The battery cabinet shall feature valve regulated, high-rate discharge, lead-acid batteries which provide energy to the support the critical load during a momentary loss of input power to the rectifier. The batteries shall be flame retardant in accordance with UL 94V2 requirements. The battery cabinet shall have the following features:

.1 The battery cabinet shall be the same depth and height as the UPS module.

.2 The battery cabinet shall feature a mechanical enclosure of like appearance to the UPS module and shall feature casters. Each battery cabinet shall require front access only for installation, service and maintenance. The battery cabinet shall provide top and bottom cable entry.

.3 Power wiring internal to each battery cabinet shall be factory provided. Each battery cabinet shall feature 10 battery trays which can be individually disconnected from the battery cabinet power wiring with quick disconnect devices. Each battery tray shall be firmly secured to the battery cabinet frame with fasteners. Each battery tray shall be removable from the front of the battery cabinet.

.4 Each battery cabinet shall feature a DC rated circuit breaker. The circuit breaker within the battery cabinet shall only provide protection to the battery string within that battery cabinet. For battery configurations involving multiple battery cabinets, a battery string in one battery cabinet may be isolated from the DC link via its circuit breaker without removing other battery strings from the DC link and the UPS module.

.5 The circuit breaker in each battery cabinet shall feature an A/B auxiliary switch. The UPS module shall be capable of monitoring and alarming an open battery cabinet circuit breaker condition.

.6 The circuit breaker in each battery cabinet shall feature an undervoltage release device. The UV device shall operate to trip the battery breaker(s) for an emergency power off command or battery disable command.

.7 Power and Control wiring between the battery cabinet and the UPS shall be factory provided with compression type connectors between cabinets.

.8 The batteries shall be configured with a ¼" spade type connector for attaching sense leads to each jar to facilitate the future addition of a battery monitoring system.

.9 Expected battery life: 200 complete full load discharge cycles when operated and maintained within specifications.

.10 Battery Voltage Characteristics. The UPS battery system shall have the following characteristics:

.1 UPS module will automatically adjust battery shutdown based upon loading and battery capacity.

.1 The UPS module shall automatically adjust the final discharge voltage between 1.67 and 1.75 Volts per cell based on the existing load and the rate and length of discharge.

.2 The absolute minimum operational voltage is 1.67 V per cell (adjustable).

.2 Nominal Float Voltage: 2.25 V per cell.

.3 Equalizing Voltage: 2.38 V maximum per cell (adjustable).

.4 Module Tie Cabinet. (OPTION) An external cabinet shall be available which shall allow connection of up to four (4) UPS modules to be connected for parallel operation. Module Tie Cabinet rating shall be in accordance with UPS module output ratings. This cabinet shall be utilized where individual UPS module output disconnect and isolation is desired, or when future expansion of a parallel system is planned. Cabinet shall also have the ability to house a(n) (optional) main output breaker and a(n) (optional) bypass breaker.

Cabinet shall be designed for remote installation using customer-supplied wiring and conduit, and shall be capable of free-standing or wall-mounted installation.

2.4 UNINTERRUPTIBLE POWER SUPPLY RATINGS AND OPERATING CHARACTERISTICS

.1 UPS Continuous Ratings. The UPS shall be rated at:

80kVA/72kW or
(maximum for a load power factor range of 0.9 lagging to 0.9 leading).

.2 Rectifier/charger input:

.1 Nominal three phase input voltage: 600 VAC:
3-wire plus ground for 3-wire plus ground output configuration

.2 Operating input voltage range: + 10%, - 15% of average nominal input voltage without battery discharge.

.3 For 60Hz systems, operating input frequency range shall be 55 to 65Hz.

.4 Input power factor 0.99 lagging.

.5 Normal input current limit: The UPS shall have the following programmable input current limit settings while operating in normal mode:

.1 Rectifier/charger input current limit shall be adjustable from 100 to 115% of full-load input current.

.2 Battery input current limit shall be adjustable from 10% to 15% of the UPS full load input current regardless of the actual load on the UPS.

.6 On generator input current limit: The UPS shall have the following programmable input current limit settings while operating in normal mode on generator:

.1 Rectifier/charger input current limit shall be adjustable from 100% to 115% of full-load input current.

.2 Battery recharge input current limit shall be adjustable from 10% to 15% of the UPS full load input current regardless of the actual load on the UPS.

.7 Input current total harmonic distortion (THD) shall be less than 4.5%.

.8 Power walk-in: Ramp-up to full utility load adjustable from 3 seconds to 60 seconds.

.3 Bypass input:

.1 Synchronizing bypass voltage range shall be +/- 10% of average nominal input voltage.

.2 Synchronizing bypass frequency range is centered on the nominal frequency.

.3 Input surge withstand capability: The UPS shall be in compliance with IEEE 587 (ANSI C62.41), category A & B (6kV).

.4 Rectifier/charger output:

.1 Nominal DC voltage shall be variable between 384VDC to 480VDC for 208V input, and between 432VDC to 480VDC for 480V input.

.2 Steady state voltage regulation shall be +/- 0.5%.

.3 Voltage ripple shall be less that 0.5% (peak-to-peak).

.4 Capacity: The rectifier/charger shall support a fully loaded inverter and recharge the battery to 90% of its full capacity within 10 times the discharge when input current limit is set at maximum.

.5 Low line operation: The rectifier/charger shall be capable of sharing the DC load with the battery when the input voltage falls below the specified operation input voltage range, the on battery indicator shall enunciate operation in this mode.

.6 Battery equalize: Automatic and manual means must be provided for battery equalization.

.7 DC sensing: Redundant DC voltage sensing methods shall be incorporated for providing battery over-voltage protection.

.5 UPS output in normal mode

.1 Nominal output voltage 600 VAC, 3-phase, - 4 wire plus ground at the output of the Integrated Distribution and Bypass cabinet. Output wiring configuration is based upon input wiring configuration for systems without internal transformers.

.2 Steady-state voltage regulation (in inverter) shall be within +/- 1% average from nominal output voltage.

.3 Transient voltage response shall be < +/- 5% from nominal voltage for 100% load step, full load re-transfers and full load drop on battery.

.4 Transient voltage recovery shall be 25ms to within +/- 1% of steady state.

.5 Linear load harmonic distortion capability: Output voltage THD of less than 2% for 100% linear load.

.6 Non-linear load harmonic distortion capability: Output voltage THD of less than 5% for 100% non-linear load when tested using the non-linear load described in IEC 62040-3 connected line to neutral.

.7 Manual output voltage adjustment shall be +/- 3% from nominal.

.8 Line synchronization range shall be +/- 3Hz, adjustable to +/- 5Hz.

.9 Frequency regulation shall be +/- 0.01Hz free running.

.10 Frequency slew rate shall be 1 Hz/second maximum (adjustable).

.11 Phase angle control:

.1 Balanced linear load shall be +/- 1 degree from nominal 120 degrees

.2 Unbalanced linear loads shall less than +/- 5 degrees from average phase voltage for 100% load unbalance.

.12 Phase voltage control:

.1 Balanced linear loads shall be +/- 1% from average phase voltage

.2 Unbalanced linear loads shall be less than +/- 5% for 100% load unbalanced

.13 Overload current capability (with nominal line and fully charged battery): The unit shall maintain voltage regulation for up to 110% of resistive/inductive load for 10 minutes, up to 125% for 30 seconds, and up to 150% for 10 seconds.

.14 Fault clearing current capability: 150% phase-to-phase for 10 cycles; 300% phase-to-neutral for up to 10 cycles

.15 Static transfer time: No break, completed in less than 4ms.

.16 Common mode noise attenuation:

.1 -65dB up to 20kHz, -40db up to 100kHz

.2 > 100dB with isolation transformer

.17 Acoustical noise: Noise generated by the UPS under normal operation shall not exceed 65dbA at one meter from any operator surface, measured at 25 degrees C (77 degrees F) and full load.

.18 EMI Suppression: The UPS shall meet FCC rules and regulation 47, part 15, for Class A devices.

.19 Electrostatic discharge (ESD): The UPS shall meet IEC 801-2 specifications. The UPS shall withstand a 25 kV pulse without damage and with no disturbance or adverse effect to the critical load.

.20 Efficiency: The UPS efficiency shall be up to 94%.

2.5 MECHANICAL DESIGN

.1 Enclosures: The UPS shall be housed in free-standing double front enclosures (safety shields behind doors) equipped with casters and leveling feet. The enclosures shall be designed for computer room applications

.2 Ventilation: The UPS shall be designed for forced-air cooling. Air inlets shall be on the front of the unit. Air outlets shall be on the top. Eighteen inches of clearance over the UPS outlets shall be required for proper air circulation. Air filters shall be commonly available sizes.

.3 No back or side clearance or access shall be required for the system. The back and side enclosure covers shall be capable of being located directly adjacent to a wall.

.4 Cable entry: Standard cable entry for the UPS cabinet shall be through either the enclosure bottom or top. A dedicated wireway shall be provided within the UPS cabinet for routing user input and output wiring.

.5 Front access: All serviceable subassemblies shall be modular and capable of being replaced from the front of the UPS (front access only required). Side or rear access for installation, service, repair or maintenance of the UPS system shall not be required.

.6 Service area requirements: The system shall require no more than thirty-six inches of front service access room and shall not require side or rear access for service or installation.

2.6 CONTROLS AND INDICATORS

.1 Microprocessor controlled circuitry: The UPS controls shall have the following design and operating characteristics:

.1 Fully automatic operation of the UPS shall be provided through the use of microprocessor controlled Digital Signal Processing. DSP shall eliminate variances from component tolerance or drift, and provide consistent operational responses.

.2 All operating and protection parameters shall be firmware controlled, thus eliminating a need for manual adjustments. The logic shall include system test capability to facilitate maintenance and troubleshooting. Printed circuit board replacement shall be possible without requiring calibration.

.3 Start-up and transfers shall be automatic functions.

.2 Digital Front Panel Display: The UPS control panel shall be a digital front panel display that features an 8x40 (8 lines, each with 40 characters) backlit LCD display. The LCD shall display UPS status, metering, battery status, alarm/event queue, active alarms and UPS configurations. The front panel display shall show a system mimic diagram with an outlined power path, current operating mode and event logs.

.3 Control Panel Indicators: The UPS control panel shall provide the following monitoring functions with indicator LED's:

.1 NORMAL: This shall indicate that the commercial AC utility or generator source is supplying power to the rectifier and the inverter is supporting the critical load. A text message shall indicate if the bypass line is not within tolerance.

.2 BYPASS: This shall indicate that the UPS has transferred the load to the bypass circuit.

.3 BATTERY: This shall indicate that the commercial AC utility or generator source has failed and the battery is supplying power to the inverter, which is supporting the load. A text message shall indicate if the battery charge is low or if the battery is installed but disconnected.

.4 ALARM: This shall indicate that the UPS detects an alarm condition, outlined in detail in the operator's manual.

.4 Control Panel Controls: The UPS control panel shall provide the following functions from front panel push buttons:

.1 EVENTS: Displays the list of Active System Events and a historical log of system events. Historical logs shall include a detailed time stamped list of the latest 500 events.

.2 METERS: Displays performance meters for the system or critical load. When selected, the front display shall show individual screens of input parameters, output parameters or bypass parameters including; voltage, current and frequency. In addition, the battery display shall show runtime remaining.

.3 CONTROLS: Displays a System Controls screen. Allows selection of operating mode, normal, bypass, charger on/off and Power Module on/off.

.4 SETUP: Allows display contrast, date and time information serial communication port configuration and display of firmware revision numbers.

.5 RETURN: Confirms selection or returns to previous screen.

.5 Interface panel: The UPS shall be equipped with an interface panel, located behind a protective cover, which provides the following signals and communication features in a Class 2 environment:

.1 Alarm contact: A dry contact for annunciating a summary alarm shall be provided for customer use. This contact shall be Form "C" capable of supplying both N/O and N/C contacts. Contact ratings shall be 5A max at a voltage not to exceed 28VDC or 277VAC.

.2 RS232 (EIA / TIA-232) communications interface: Circuitry shall be provided for one RS232 (EIA / TIA-232) communication port for connection to automated service department diagnostic tools. This port may be used with simple ("dumb") terminals to gain remote access to all unit operation information.

.3 Building alarms: Two inputs shall be provided for monitoring the status of external dry contacts. Building alarms shall be set up through the UPS configuration mode function on the RS232 (EIA / TIA-232) port.

.4 External EPO contacts: Shall be provided to connect an external remote emergency power off switch to shutdown the UPS and de-energize the critical load.

.5 Battery control contacts: Contacts shall be provided to connect the battery UVR and auxiliary signals from a battery breaker or battery disconnect switch.

.6 External bypass indicator connection: A connection point shall be provided to acknowledge that an external maintenance bypass has been closed around the UPS, placing the critical load on utility power.

2.7 COMMUNICATIONS

.1 Communications Bay: The UPS shall be equipped with field configurable communications bays that will accommodate two (2) communication devices. A communication bay upgrade shall be available to increase the quantity of communication devices up to four (4). The UPS shall include WEB/SNMP communication support as standard.

.2 Monitoring:

.1 The UPS shall have standard communication feature to provide basic or advance UPS monitoring, notification, management, and emergency computer shutdown capabilities.

.2 The UPS shall be able to be monitored locally or across a network. Monitoring of UPS status may also be performed through isolated dry contact Form C relays. Simultaneous monitoring of multiple UPSs shall be possible from one central location. Communication via modem for monitoring shall also be possible.

.3 Monitoring of the UPS shall also be possible through status indicators on the UPS or elsewhere in the same facility through a device that replicates these indicators.

The UPS should be able to integrate into any industry standard Building Management System (BMS) and/or Network Management System (NMS). The UPS must also be able to be monitored and managed via any standard internet browser (i.e. Internet Explorer and Netscape), PDA or cell phone.

All optional hardware interfaces shall be “Hot-swappable” (UPS maintains power to critical applications while changing interfaces).

.3 Shutdown:

.1 There shall be a mechanism that provides graceful, orderly, unattended, sequential shutdown of one or multiple computers powered by one UPS. This shutdown shall be performed via in-network or out-of-network means. The order of shutdown shall be user-defined, allowing the maximization of runtime on battery for more critical systems.

.2 Shutdown of AS/400 computers shall be possible through open-collector relay contacts or isolated, dry contact, Form-C relays.

.3 The UPS shall also be capable of interfacing with an operating system's built-in shutdown routine, e.g. Windows NT. This shall be done through a cable connection to the optional serial port on the UPS.

.4 Notification:

.1 There shall be a mechanism to send alerts to key personnel via email or SNMP traps. An alarm notification may also be sent by a network message.

.2 Dial-out to a computer for alarm notification may be performed. The user may respond by dialing-in to retrieve alarm history and a summary of current meter status.

.3 Management: A remote battery test may be performed via an Ethernet network. The UPS shall be tested through invoking a single command.

2.8 UPS MODULE PROTECTION

.1 Rectifier/Charger and Bypass protection shall be provided through individual fusing of each phase.

.2 Battery protection shall be provided by thermal-magnetic molded-case circuit breakers in each battery cabinet (if standard battery pack is provided) or external protective device for an external battery.

.3 Output protection shall be provided by electronic current limiting circuitry and fuses in the Inverter circuit.

.4 To comply with agency safety requirements, the UPS module shall not rely upon any disconnect devices outside of the UPS module to isolate the battery cabinet from the UPS module.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

3.2 SITE ACCEPTANCE TESTING

.1 The factory shall provide testing as follows:

.1 All tests as per .2 & .3 below.

.2 Pre-energize site visit to inspect installation and provide guidance to installers as required.

.3 Post-start-up site visit for alarm notification configuration, operator training, generator testing, etc.

.2 The following procedures and tests shall be performed by Field Service personnel during the UPS startup:

.1 Visual Inspection:

.1 Visually inspect all equipment for signs of damage or foreign materials.

.2 Observe the type of ventilation, the cleanliness of the room, the use of proper signs, and any other safety related factors.

.2 Mechanical Inspection:

.1 Check all the power connections for tightness.

.2 Check all the control wiring terminations and plugs for tightness or proper seating.

.3 Electrical Pre-check:

.1 Check the DC bus for a possible short circuit.

.2 Check input and Bypass power for proper voltages and phase rotation.

.3 Check all lamp test functions.

.4 Initial UPS Startup:

.1 Verify that all the alarms are in a “go” condition.

.2 Energize the UPS module and verify the proper DC, walkup, and AC phase on.

.3 Check the DC link holding voltage, AC output voltages, and output waveforms.

.4 Check the final DC link voltage and Inverter AC output. Adjust if required.

.5 Check for the proper synchronization.

.6 Check for the voltage difference between the Inverter output and the Bypass source.

.7 Perform full-load, step-load, and battery discharge tests using supplier furnished load bank.

.5 Operational Training: Before leaving the site, the field service Contract Administrator shall familiarize responsible personnel with the operation of the UPS. The UPS equipment shall be available for demonstration of the modes of operation.

.3 Tests shall be done for both the normal and bypass positions.

.1 Load Tests

.1 Measure the following at no load, 25%, 50%, 100%, 110% and 125% load:

.1 Input voltage (L-L)

.2 Input current

.3 Input power

.4 Input current harmonics

.5 Input power factor

.6 Output voltage (L-L)

.7 Output voltage (L-N)

.8 Output current

.9 Output power

.10 Output voltage harmonics (L-L)

.11 Output voltage harmonics (L-N)

.12 Output frequency

.13 Phase angle imbalance

.2 Transient Tests

.1 Measure voltage and current for following load steps:

.1 0-50%

.2 50-100%

.3 100-50%

.4 50-0%

.5 0-100%

.6 100-0%

.2 Measure voltage and current for the following transfer and loss of supply tests:

.1 Removal of input supply

.2 Restoration of input supply

.3 Load transfer from module to bypass

.4 Load transfer from bypass to module

.3 Instrument checks

.1 Carry out the following instrument checks at no load, 50% load and 100% load against a calibrated (and certified) meter:

.1 Input current (L-L)

.2 Input current

.3 Battery current

.4 Battery voltage

.5 Output voltage (L-L)

.6 Output voltage (L-N)

.7 Output current

.4 Battery discharge tests

.1 Measure the following at 20 minute intervals of battery autonomy with the UPS supplying full load:

.1 DC bus voltage

.2 DC bus current

.3 Overall autonomy

.5 Carry out a 2 hour system heat run test with the UPS supplying 100% load. Measure the parameters indicated in Section.2.

.6 Contractor shall tap internal transformers to suit best performance of the system in both the normal and bypass positions.

.7 Provide a load bank and connections and wiring for the load bank testing. (25%, 50%, 100%, 110%, 125% and 150%). Provide this test when fed from ‘Normal’ power and again when fed from emergency power (diesel generator).

.8 Demonstrate that battery charging is disabled when the supply voltage is from the emergency generator.

.9 Demonstrate a maximum battery charging rate of 25% of capacity.

3.3 WARRANTY

.1 All components of the UPS system (UPS module and bypass/distribution cabinet) shall be covered by a standard two-year limited factory warranty and service protection package.

.2 Two-year limited factory warranty shall include 5x8 on-site repair/replacement coverage for the UPS (parts and labor).

.3 Two-year service protection package shall include 5x8 on-site repair/replacement labor for batteries; one (1) on-site UPS performance check/preventive maintenance visit; 7x24 technical support coverage; and 7x24 remote monitoring service (with monthly reports for UPS and battery performance). Manufacturer shall also offer, as an option, 7x24 on-site service support with guaranteed response times of 8, 4, or 2 hours. Additional preventive maintenance visits shall be available as an option for both UPS and battery components.

.4 Manufacturer shall also include Start-up services consisting of: 5x8 Start-up service of UPS and batteries, On-site user training, Site Audit, installation and commissioning of monitoring service, and validation of two-year limited factory warranty.

.5 Manufacturer shall also offer an optional service plan to provide 7x24 on-site coverage (preventive and corrective) for UPS and batteries, guaranteed response time, remote monitoring, Web access to service site history, annual Site Audit, UPS and battery preventive maintenance visit, and discounts on upgrade and modification kits. Manufacturer shall also provide an optional battery service plan to provide parts-and-labor coverage for partial and full battery strings, either with preventive maintenance or replacement coverage.

End of Section

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-B72-M87(R1998), Installation Code for Lightning Protection Systems.

1.3 APPROVED MATER SUPPLIERS/INSTALLERS

.1 Western Lighting Protection.

1.4 DESCRIPTION OF SYSTEM

.1 System to consist of metallic air terminals, lightning conductors connecting air terminals to ground and interconnected ground electrodes, and/or ground cables.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate materials and methods of attachment of conductors to air terminals and electrodes.

.3 Provide full layout drawing of installation indicating all wire sizes, down conductors, weld locations etc.

1.6 REGULATORY REQUIREMENTS

.1 System subject to: approval by authority having jurisdiction.

Part 2 Products

2.1 MATERIALS

.1 Air terminals: solid rod.

.2 4/0 gauge, copper 98% conductivity, stranded lightning protection cables.

.3 Fastenings and attachment straps: aluminum or copper.

.4 Electrodes: 3 m x 20 mm diameter copper coated steel.

.5 Use aluminum conductors, terminals, connectors and fastenings for aluminum sheathed buildings use copper conductors, terminals, connectors and fastenings for buildings sheathed in other than aluminum.

.6 Connections: copper connections formed by thermit process.

.7 Earth enhancing compound shall be of the 2 part site mix gel type.

.8 Chemical additives for ground resistance reduction, shall be suitable for vertical or horizontal configurations.

Part 3 Execution

3.1 INSTALLATION

.1 Install lightning protection to CAN/CSA-B72.

.2 Bond discharge conductors to service mast or other non-current-carrying electrical parts.

.3 The lightning protection system shall be installed by an approved Subcontractor licensed to carry out such installation.

.4 Provide required modifications to ensure proper resistance ratings. If required, use Earth Enhancing or Chemical Rod treatment methods.

.5 All metal projections through or masses of metal above the roof shall be bonded to the lightning protection system. All high points of the roofs shall be covered by cables in addition to standard required spacing.

.6 All connections, cable to cable, and cable to steel or other metals shall be made using cadwelded copper connections or using specified mechanical methods, after proper cleaning and brightening.

.7 The roof cables shall form a crossed loop around the periphery of the roof run within 600mm of the edge, and shall be fastened at 1200mm centres, using manufactured bronze flat roof cable anchors.

.8 The base perimeter loop and roof cross loop shall be connected to building lightning protection system as indicated on drawings.

.9 At downlead cable locations, provide a suitable fitting as required.

.10 Connect all downlead conductors at grade to the grounding loop cable.

.11 All down conductors shall be installed in rigid PVC conduit with offsets, for cable strain relief.

3.2 INSPECTION

.1 Obtain inspection certificate from Contract Administrator for discharge conductor passing through any fire supporting membrane.

.2 Upon completion of the lightning protection system, the Contractor shall submit a certificate of installation and an inspector's report to the Contract Administrator.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 The Contractor shall furnish and install the Transient Voltage Surge Suppression (TVSS) equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability, the ac surge protection shall be integrated into electrical distribution equipment such as panelboards, busway and/or motor control centers.

.2 See drawing E3.0

1.2 RELATED SECTIONS

.1 Section 26 24 17 – Panelboards

1.3 REFERENCES

.1 TVSS units and all components shall be designed, manufactured and tested in accordance with the latest applicable UL Listed standards (UL 1449, 2nd Edition), UL 1283 and CSA certified per CSA 22.2.

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

.1 The following information shall be submitted to the Contract Administrator:

.1 Provide verification that the TVSS device complies with the required UL 1449 2nd Edition and CSA approvals

.2 Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41Category C3 & C1 (combination wave) and B3 (ringwave) tested in accordance with ANSI/IEEE C62.45

.3 Provide spectrum analysis of each unit based on MIL-STD-220A test procedures between 50 kHz and 200 kHz verifying the devices noise attenuation equal or exceeds 50 dB at 100 kHz

.4 For retrofit mounting applications, electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration

.5 Provide test report in compliance with NEMA LS1 from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the IEEE C62.41, 8 x 20 microsecond current wave. Note that test data on individual module is not accepted

.2 Where applicable the following additional information shall be submitted to the Contract Administrator:

.1 Descriptive bulletins

.2 Product sheets

1.5 SUBMITTALS – FOR CONSTRUCTION

.1 The following information shall be submitted for record purposes:

.2 Final as-built drawings and information for items listed in Section 1.04, and shall incorporate all changes made during the manufacturing process

1.6 QUALIFICATIONS

.1 The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

.2 For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

.3 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Contract Administrator, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

.1 The manufacturer may certify the equipment based on a detailed computer analysis of the entire assembly structure and its components. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment

.2 The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

.1 The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil Contract Administrator in the state. Mounting recommendations shall be provided by the manufacturer based upon approved shake table tests used to verify the seismic design of the equipment.

.2 The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.

.3 The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of manufacturer’s instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE MANUALS

.1 Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

Part 2 Products

2.1 VOLTAGE SURGE SUPPRESSION – GENERAL

.1 Electrical Requirements

.1 Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.

.2 Maximum Continuous Operating Voltage (MCOV) – The MCOV shall be 125% of the nominal system operating voltage.

.3 The suppression system shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge suppressor for the service entrance and other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

.4 Protection Modes – For a wye configured system, the device must have directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For a delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).

.5 UL 1449 2nd Edition Suppressed Voltage Rating (SVR) – The maximum UL 1449 2nd Edition SVR for the device must not exceed the following:

Modes	208Y/120	600Y/347
L-N; L-G; N-G	400 V	1200 V
L-L	800 V	1800 V

.6 ANSI/IEEE Cat. C3 Let-Through Voltage – The let through voltage based on IEEE C62.41 and C62.45 recommended procedures for Category C3 surges (20 kV, 10 kA) shall be less than:

Mode	208Y/120	600Y/347
L-N	560 V	1840 V

.7 ANSI/IEEE Cat. B3 Let Through Voltage – Let-through voltage based on IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. B3 ringwave (6 kV, 500 amps) shall be less than:

Mode	208Y/120	600Y/347
L-N	160 V	168 V

.2 TVSS Design

.1 Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating TVSS modules shall not be acceptable.

.2 Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method. Products not able to demonstrate noise attenuation of 50 dB @ 100 kHz shall be rejected.

.3 Extended Range Filter –The Surge Protective Device shall have a High Frequency Extended Range Tracking filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall have published high frequency attenuation rating in the attenuation frequencies.

Attenuation Frequency	50 kHz	100 kHz	500 kHz	1 MHz	10 MHz	100 MHz
Insertion Loss (ratio)	40	316	316	89	200	79
Insertion Loss (dB)	32	50	50	39	46	38

.4 Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.

.5 Monitoring Diagnostics – Each TVSS shall provide integral monitoring options:

.1 Each unit shall provide a green / red solid-state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light, shall indicate which phase(s) have been damaged.

.2 Remote Status Monitor – The TVSS device must include Form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.

.3 Audible Alarm – The TVSS shall provide an audible alarm with a reset pushbutton that will be activated under any fault condition.

.4 Push to Test – The TVSS shall be equipped with push-to-test feature designed to provide users with real time testing of the suppressor's monitoring and diagnostic system. A test button shall be provided to initiate a self test procedure. If the system is fully operational, the self test will activate all indicator lights.

.5 Non Volatile Memory – The TVSS monitoring system shall be able to save 1000 events, including surges, sags, swells, and outages.

.6 Event Counter – The TVSS shall be equipped with an LCD display system designed to indicate to the user how many surges, sags, swells and outages have occurred at the location. The event counter triggers each time under each respective categories after significant event occurs. A reset pushbutton shall also be standard allowing all counters to be zeroed.

.7 Voltage Monitoring – The TVSS shall display true root mean square (rms) voltage line-to-line.

.6 Overcurrent Protection Fusing: In order to isolate the TVSS under any fault condition, the manufacturer shall provide:

.1 Individual Fusing: MOVs shall be individually fused via Copper Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events.

.2 Thermal Protection: MOVs shall be equipped with Thermal Fuse Spring (TFS) Technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100 mA to 30 Amp, or if the occurrence is over a longer period of time, the TFS will

disconnect first. Manufacturers that utilize fuse trace only shall not be approved since there is no fault current protection between 100 mA to 30 A.

.3 All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.

.3 Minimum Repetitive Surge Current Capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992.

.1 The suppression filter system shall be repetitive surge tested in every mode utilizing a 1.2 x 50µsec, 20 kV open circuit voltage. 8 x 20µsec, 10 kA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10% deviation of clamping voltage at a specified surge current. The minimum repetitive surge current capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992 shall be:

.1 Service Entrance: 12000 impulse per mode.

.2 Distribution Panelboard: 10000 impulse per mode.

.3 Branch Location Panelboard: 9000 impulse per mode.

2.2 SYSTEM APPLICATION

.1 The TVSS applications covered under this section include distribution and branch panel locations, bus plugs, motor control centers (MCC), switchgear, and switchboard assemblies. The branch panel located TVSS shall be tested and demonstrate to be suitable for ANSI/IEEE C62.41 Category C1 environments.

.2 Surge Current Capacity -- The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

Minimum total surge current and withstand Capability with compliance to ANSI/IEEE C62.41 AND NEMA LS1			
APPLICATION	Per Phase	Per Mode	Surge Withstand Capabilities ANSI/IEEE C3 Wave (10 kA)
Service Entrance Locations (Switchboards, Switchgear, MCC Main Entrance)	250 kA	125 kA	12000
High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA	10000
Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA	9000

.3 Lighting and Distribution Panelboard Requirements

.1 The TVSS application covered under this section includes lighting and distribution panelboards. The TVSS units shall be tested to demonstrate suitability for ANSI/IEEE C62.41 Category C1 environments

.2 The TVSS shall not limit the use of Through-feed lugs, Sub-feed lugs and Sub-feed breaker options

.3 The TVSS shall be immediately installed on the load side of the main breaker

.4 The panelboard shall be capable of re-energizing upon removal of the TVSS

.5 A direct bus bar connection shall be used to mount the TVSS component to the panelboard bus bar to reduce the impedance of the shunt path

.6 The TVSS panelboard shall be constructed using a direct bus bar connection (cable connection between bus bar and TVSS device is not acceptable). TVSS units that use a cable connection do not meet the intent of this specification

.7 The TVSS shall be included and mounted within the panelboard by the manufacturer of the panelboard

.8 The TVSS shall be of the same manufacturer as the panelboard

.9 The complete panelboard including the TVSS shall be UL67 listed

.4 Switchgear, Switchboard, and MCC

.1 The TVSS application covered under this section is for switchgear, switchboard, MCC and Bus Plug locations. Service entrance located TVSS shall be tested and suitable for ANSI/IEEE C62.41 Category C3 environments

.2 The TVSS shall be of the same manufacturer as the switchgear, switchboard, MCC and Bus Plug

.3 The TVSS shall be factory installed inside the switchgear, switchboard, MCC and Bus Plug at the assembly point by the original equipment manufacturer

.4 Locate suppressor on load side of main disconnect device, as close as possible to the phase conductors and ground/neutral bar

.5 Provide a 30-amp disconnect. The disconnect shall be directly integrated to the suppressor and assembly bus using bolted bus bar connections

.6 The TVSS shall be integral to switchgear, switchboard, MCC and Bus Plug as a factory standardized design

.7 All monitoring diagnostics features shall be visible from the front of the equipment

2.3 ENCLOSURES

.1 All enclosed equipment shall have NEMA 1/ 3R general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:

.2 NEMA 1/3R rainproof enclosures intended for outdoor use primarily to provide protection against rain, sleet and damage from external ice formation

.3 NEMA 12 dust-tight enclosures intended for indoor use primarily to provide protection against circulating dust, falling dirt and dripping non-corrosive liquids. (Panelboards only)

.4 NEMA 4 watertight stainless steel intended for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing rain, hose-directed water, and damage from external ice formation. (Side Mounted Units Only.)

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 NEMA and UL standards.

3.2 INSTALLATION

.1 The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

3.3 WARRANTY

.1 The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any TVSS part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

End Of Section

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 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

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

.3 Photometric data to include: spacing criterion.

1.4 JOB MOCK-UP

.1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.

Part 2 Products

2.1 LAMPS

.1 Provide lamps as indicated.

.2 Incandescent lamps to be extended service type rates 2500 hours, 130 volts, inside frosted unless indicated otherwise.

.3 Fluorescent lamps (T5) shall be programmed start, 5000 lumens, rated 25,000 hours, 3500 K.

.4 Fluorescent lamps (T8) shall be rapid start, 2850 Lumens rated 20,000 hours, 3500 K.

.5 HID lamps shall be rated 20,000 hours with coating as designated and universal mounting.

.6 Metal Halide lamps shall be coated unless otherwise indicated.

2.2 BALLASTS

.1 Fluorescent ballast (T8 design): CBM and CSA certified, IC premium electronic and IC electronic dimmable design.

.1 Rating: 60 Hz voltage as indicated, for use with 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.
.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: remote or integral with Luminaire.
.14 Listed by Manitoba Hydro in Premium Rebate Program.

.2 Metal halide ballast: design.

.1 Rating: 60 Hz voltage as indicated, for use with pulse start metal halide lamp. Provide circuitry for standby light to provide light for starting and restart.
.2 Totally encased and designed for 40°C ambient temperature.
.3 Power factor: minimum 95 % with 95% of rated lamp lumens.
.4 Type: constant wattage auto-transformer isolated secondary solid state.
.5 Input voltage range: plus or minus 10% of nominal.
.6 Minimum starting temperature: minus 29°C at 90% line voltage.
.7 Mounting: indoor or outdoor, remote or integral with luminaire.
.8 Crest factor: 1.8 maximum current, 2.0 maximum voltage.

.3 Fluorescent ballast (T5 design): CBM and CSA certified, IC premium electronic and IC electronic dimmable design.

.1 Rating: 60 Hz voltage as indicated, for use with 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: 1.7 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.

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

.10 Total Circuit Power: 120 Watts.

.11 Ballast Factor: greater than 0.90.

.12 Sound rated: Class A.

.13 Mounting: remote or integral with Luminaire.

.14 Programmed rapid start.

.15 Listed by Manitoba Hydro in Premium Rebate Program.

2.3 FINISHES

.1 Baked enamel finish:

.1 Conditioning of metal before painting:

.1 For corrosion resistance conversion coating to ASTM F1137.

.2 For paint base, conversion coating to ASTM F1137.

.2 Metal surfaces of luminaire housing and reflectors finished with high gloss baked enamel or polyester powdercoat or alzak aluminum to give smooth, uniform appearance, free from pinholes or defects.

.3 Reflector and other inside surfaces finished as follows:

.1 White, minimum reflection factor 85%.

.2 Colour fastness: yellowness factor not above 0.02 and after 250 hours exposure in Atlas fade-ometer not to exceed 0.05.

.3 Film thickness, not less than 0.03 mm average and in no areas less than 0.025 mm.

.4 Gloss not less than 80 units as measured with Gardner 60E gloss meter.

.5 Flexibility: withstand bending over 12 mm mandrel without showing signs of cracking or flaking under 10 times magnification.

.6 Adhesion: 24 mm square lattice made of 3 mm squares cut through film to metal with sharp razor blade. Adhesive cellulose tape applied over lattice and pulled. Adhesion satisfactory if no coating removed.

.2 Alzak finish:

.1 Aluminium sheet fabricated from special aluminum alloys and chemically brightened, subsequently anodically treated to specifications established by Alcoa, to produce:

.1 Finish for mild commercial service, minimum density of coating 7.8 g/m^2, minimum reflectivity 83% for specular, 80.5% for semi-specular and 75% for diffuse.

.2 Finish for regular industrial service, minimum density of coating 14.8 g/m^2, minimum reflectivity 82% for specular and 73% for diffuse.

.3 Finish for heavy duty service, minimum density of coating 21.8 g/m^2, minimum reflectivity 85% for specular, 65% for diffuse.

2.4 LIGHT CONTROL DEVICES

.1 Design K12

.1 Lens thickness: as per Luminaire Schedule.

.2 Material: injection moulded clear prismatic virgin as per Luminaire Schedule.

.3 Light distribution: K12.

.4 Treatment: ultraviolet inhibited.

.5 Frame: hinged latched steel as per Luminaire Schedule.

Part 3 Execution

3.1 INSTALLATION

.1 Install luminaires at locations indicated, c/w lamps, all wiring, connections, fittings, hangers, aligners, box covers and accessories, as required.

.2 Install luminaires and lens materials in architectural details, as indicated.

.3 Install luminaires parallel with building lines. Wall mounted luminaires to be installed plumb.

.4 Review all ceiling types, construction details and mounting arrangements before placing luminaire orders and ensure that all mounting assemblies, frames, rings and similar features are included for and match the required installation.

.5 All luminaires and assemblies shall be properly secured and supported. Support luminaires independent of the ceiling construction c/w all fasteners, framing and hangers as may be required. Do not secure luminaires to mechanical ductwork or other vibration producing apparatus, unless specifically detailed on the drawings.

.6 Where luminaires are suspended from ceilings using self-aligning box covers and additional ground wire from the outlet box to the luminaires shall be provided.

.7 Co-ordinate the installation of luminaires with the work of other trades, ensuring that the necessary depths and mounting spaces are provided. Luminaires which cannot be installed due to a conflict with structural members, pipes or ductwork shall be relocated to a more suitable location, as directed by the Contract Administrator and/or Designer.

.8 Install post top, landscape and roadway luminaires plumb.

3.2 WIRING

.1 Connect luminaires to lighting circuits as indicated.

3.3 LAMPS

.1 Adjust lamp position in adjustable lampholder type luminaires to produce the proper beam distribution for the specified lamp.

3.4 TESTS

.1 Perform tests in accordance with Section 26 05 00.

3.5 CLEANING

.1 Prior to take-over of the project, clean the lenses and reflectors of all luminaires with a damp cloth to remove dust, smudges and fingerprints.

END OF SECTION

Part 1 General

1.1 RELATED WORK SPECIFIED ELSEWHERE

.1	Common Work Results-Electrical	Section 26 05 00
.2	Conduits, Conduit Fastenings and Conduit Fittings	Section 26 05 34
.3	Wires & Cables	Section 26 05 21
.4	Outlet Boxes, Conduit Boxes and Fittings	Section 26 05 32

1.2 DESCRIPTION OF SYSTEM

.1 Public address loudspeaker system to incorporate:

- .1 Voice paging.
- .2 Recorded music from radio or CD player.
- .3 Broadcast programs from am/fm tuner.
- .4 Additional features as specified.

.2 Operations:

- .1 Paging:
  - .1 Voice paging from any microphone overrides broadcast or recorded music reproductions.
  - .2 Selective area page to areas as indicated. (2 Zones)
  - .3 Emergency page to all areas.
- .2 Music:
  - .1 Music from either tape recorder, am/fm tuner, or external source.
  - .2 Speaker selection made via toggle switch and relay assembly.

1.3 CARE, OPERATION AND START- UP

.1 Provide instructions in accordance with Section 26 05 00.

.2 Manufacturer's factory service Contract Administrator to instruct:

- .1 Maintenance personnel in the maintenance of system.
- .2 Operating personnel in the use of system.

1.4 PRODUCT DATA AND SHOP DRAWINGS

.1 Submit product data and shop drawings in accordance with Section 26 05 00.

.2 Include, riser diagram, block diagram of complete public address system.

.3 Submit public address system design criteria for approval.

1.5 MAINTENANCE AND OPERATION DATA

.1 Provide data for incorporation into maintenance manual specified in Section 26 05 00.

.2 Include description of system operation.

.3 Include parts list, using component identification numbers standard to electronics industry.

1.6 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 26 05 00.

.2 Include: 3 spare speakers; 3 spare transformers.

Part 2 Products

2.1 MATERIALS

.1 Electronic equipment: to CSA C22.2No.1-M1981.

.2 Building wires: as indicated, to Section 26 05 21.

.3 Conduits: to Section 26 05 34.

2.2 MIXER/POWER AMPLIFIER

.1 Mixer/power amplifier shall deliver 50 watts of continuous power with less than 1% distortion from 20-20,000 Hz (direct). The signal-to-noise ratio shall be greater than 70 dB for auxiliary and telephone/page inputs. Signal-to-noise ratio for other inputs shall be greater than 60 dB for low impedance microphone and ceramic phono module inputs and greater than 70 dB for auxiliary and 55 dB for high impedance microphone modules. The frequency response shall be 20-20,000 Hz plus or minus 1 dB at 9 dB below rated output (direct) per EIA SE101A.

.2 Mixer/power amplifier shall have six (6) inputs. Inputs 1 through 4 shall use associated input modules listed under Optional Equipment. An auxiliary input (Input 5) and telephone/page input (Input 6) shall be fixed inputs. The mixer/power amplifier shall have both an electronic foldback and thermal overload protection circuit, both self-restoring. The mixer/power amplifier shall have at least 30 dB of muting. Individual controls for Inputs 1-5, tone controls, master control and illuminated power switch shall be front panel accessible. The telephone/page control shall be rear mounted.

.3 Auxiliary #2 (Input 5), Mixer Out, Tape Out, Amp In, and Preamp Out shall have RCA phono type connectors, and all other terminations shall be screw terminals.

.4 Mixer/power amplifier shall operate on 120 Vac, 60 Hz and consume (3.0) amperes at rated output. Mixer/power amplifier shall be rack mounted using specific rack mount kits.

.5 Mixer/power amplifier shall be finished in charcoal grey, baked enamel with a polycarbonate overlay on the front panel. The cover shall have a textured finish of the same color. The mixer/power amplifier shall weigh 27 pounds.

2.3 MICROPHONE

.1 The desk microphone shall be an omnidirectional, controlled magnetic type with a frequency range of 100 to 10,000 Hz. It shall offer dual, 150 or high, impedance operation with a selector switch. The output level measured as open circuit voltage shall be .28 mV (-71.0 dB) for low impedance operation and 2.25 mV (-53.0 dB) for high impedance operation where 0 dB = 1 volt per microbar. The power level shall be -50.5 dB where 0 dB = 1 mW per 10 microbar. The base and microphone case shall be made of high impact Armo-Dur. The microphone shall include an on/off switch operated by a finger-tip control bar. The bar shall provide momentary or lock on operation of the switch. The switch shall include contacts prewired for remote relay operation. The microphone shall be equipped with a non-detachable, 7' (2.1 m) long, four conductor cable having two conductors shielded. The microphone shall be 9-9/16" (23.6 cm) high, 4" (10.1 cm) wide, and 5-11/16" (14.4 cm) deep; 12-1/16" (30 cm) high when fully extended. It shall weigh 1 lb, 10 oz. (736 g) net.

2.4 VOLUME CONTROL

.1 The Area Speaker Volume Control shall provide control of area speaker volume on 70-volt speaker distribution lines supplying up to 10 watts of audio power. The unit shall be mounted on a single gang, stainless steel wall plate and require a minimum of 2-1/2" (6.4 cm) mounting depth.

2.5 AM/FM TUNER/CD PLAYER

.1 Controls and indicators, on front panel:

- .1 am/fm tuning control.
- .2 Power on/off switch.
- .3 Interchannel hush in/out switch.
- .4 am/fm selector switch.
- .5 Peak meter.
- .6 fm zero centre switch.
- .7 Bass, treble, volume controls.
- .8 Tuning meter for fm/am.

.2 Receptacles on rear of panel:

- .1 Audio output jack.
- .2 CD/am/fm antenna connections.

.3 fm channel.

- .1 Tuning range: 87.5 to 108.5 MHz.
- .2 Hum and noise level: 70 dB below 100% mod.
- .3 Frequency response: 20 to 20,000 Hz ±0.5 dB.
- .4 Antenna: 300 ohms balanced, 72 ohms unbalanced.
- .5 Typical sensitivity: 0.95 micro volts, for 20 dB quieting, 5.0 microvolts for 50 dB s/n.

.4 am channel:

.1 Tuning range: 530 to 1650 kHz.

.2 Hum and noise level: 56 dB below 100% mod.

.3 Frequency response: -6 dB at 4.0 kHz.

.4 Antenna: transformer with low impedance primary for use with external antenna wire.

.5 Typical sensitivity: 2 microvolts at 60% mod for 6 dB s/n.

.6 Distortion: less than 0.25% im at 100% mod.

.7 Preamplifier: silicon transistor with bass, treble, gain controls.

.8 Power requirement:

.1 Tuner: 120 Vac nominal, 60 Hz.

.2 Preamplifier: 19 V dc at 5 mA.

.9 Power consumption: 15 W.

2.6 ADDITIONAL FEATURES

.1 Leased wire background music source.

.2 Bridging control to provide facilities between local sound source and sound control rack.

.1 Three pole, three position, non-shorting type switch with positions marked '1', 'off', '2', to allow programmes to originate, remain in or terminate.

.2 Volume control to provide local volume regulations of programme received from console.

.3 Programme control relay.

.3 Notch filters for accoustic treatment.

2.7 SPEAKERS

.1 Type "A" - 8" Loudspeaker and Assembly

.1 The loudspeaker shall be furnished and installed as indicated on the plans. The loudspeaker shall be eight inch (20 cm), seamless cone type. The ceramic magnet shall weigh at least six ounces. The frequency range shall be from 50 to 14,000 Hz. The normal wattage rating shall be 8 watts with a program rating of 10 watts. The voice coil diameter shall be one inch, and the impedance of 8 ohms. Each speaker shall be fitted with a 70 volt matching transformer.

.2 The overall speaker diameter shall be a 8-1/32 inches (20.3 cm), and the speaker depth shall be 2-3/4" (7 cm). The net weight shall be 1 pound, 14 oz. (800 grams). All external parts shall be cadmium plated and conform to E1A standards.

.3 The Ceiling Backbox shall be constructed of heavy gauge galv. steel and shall measure 11-3/16 inches square and 4 inches deep. The baffle mounting holes shall be spaced on 11" centres. All standard 12-1/2" square flush ceiling baffles shall mount to the backbox with screws to the provided speed nuts. Four mounting slots shall be provided to mount the backbox. Four combination 1/2 - 3/4" knockouts shall be provided. A special sound dampening material shall be applied to the inside of the backbox.

.4 The Flush Ceiling Baffle shall be constructed of heavy gauge steel, finished in satin white baked enamel and shall measure 12-1/2" square and 3/16" deep. The 8" loudspeaker shall mount on concealed studs. Four holes shall be provided to mount the baffle to a backbox.

2.8 WIRING

.1 Speaker wiring shall be 2/C #18 JKTN with overall jacket similar to Allied A53182 or approved equal.

.2 Microphone wiring shall be 2/C #20 twisted shielded complete with overall jacket.

Part 3 Execution

3.1 GENERAL

.1 Locate, install, wire and connect all components and devices in accordance with the requirements of the manufacturer.

3.2 MOUNTING OF EQUIPMENT

.1 Mount equipment at heights as described in Section 26 05 00.

.2 Mount equipment square and plumb with building lines. Install devices flush and square with finished surfaces.

3.3 TERMINATION OF CONDUCTORS

.1 Terminate conductors directly to the terminals of each device.

3.4 IDENTIFICATION

.1 Identify equipment as per Section 26 05 00.

.2 Clearly identify zones on control panels, devices, etc.

.3 Identify wires and cables with wire markers to indicate zone numbers. Identify wiring in each box, panel, cabinet etc. Coding of identification to meet with the approval of the Contract Administrator.

3.5 WIRING AND CONDUIT

.1 Install wiring in an independent conduit system.

.2 Install speaker backboxes to form part of the conduit system. Conduit to be sized to accommodate the wiring being installed.

3.6 TESTING

.1 Perform tests in accordance with Section 26 05 00.

.2 Conduct intelligibility test.

.3 The complete system shall be tested in the presence of the Contract Administrator and City's representative on completion of the work. Tests shall demonstrate that the P.A. System will function in an acceptable manner.

3.7 INSTALLATION

.1 Install equipment in accordance with manufacturer's instructions.

End Of Section

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 26 05 21 - Wires and Cables (0-1000 V).

.3 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.2 No.141-M1985(R1999), Unit Equipment for Emergency Lighting.

1.4 SUBMITTALS

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

.2 Data to indicate system components, mounting method, source of power and special attachments.

1.5 WARRANTY

.1 For batteries, the 12 months warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: as indicated on drawings.

.3 Output voltage: as indicated on drawings.

.4 Operating time: as indicated on drawings.

.5 Battery: sealed, long life, lead acid or lead calcium maintenance free.

.6 Charger: solid state, multi-rate, pulse type, voltage/current regulated, inverse temperature compensated, short circuit protected, modular construction.

.7 Solid state transfer.

.8 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage c/w 2-fused DC output circuits.

.9 Signal lights: solid state, life expectancy 100,000 h minimum, for 'AC Power ON' and 'High Charge'.

.10 Lamp heads: integral on unit 360 deg. horizontal and 180 deg. vertical adjustment. Lamp type: tungsten-halogen, 12 W, glare free, (mini style).

.11 Cabinet: minimum 20 gauge steel cabinet c/w white polyester paint finish c/w knockouts for conduit.

.12 Auxiliary equipment:
- .1 Low voltage disconnect switch.
- .2 Lamp disconnect switch.
- .3 Test switch.
- .4 Time delay relay.
- .5 Battery disconnect device.
- .6 ac input and dc output terminal blocks inside cabinet.
- .7 Shelf where required.
- .8 Cord and 3-prong straight blade NEMA 5-15P plug connection for ac.

.13 Wall mounted battery banks to be direct wall mounted or with wall mounting shelf. Provide removable or hinged front panel for easy access to the batteries. LED diagnostics display and test switch mounted by side of enclosure.

2.2 MANUFACTURERS

.1 Acceptable Manufacturers: Dual-Lite, Emergi-lite, Lithonia, Lumacell, Luxnet, Uniglo.

2.3 REMOTE HEADS

.1 Remote micro heads fixture:
- .1 Double or triple heads as indicated.
- .2 Wall or ceiling mountable c/w mounting plate.
- .3 Molded thermoplastic housing and mounting plate.
- .4 Adjustable rotary collar and adjustable swivel heads for proper aiming of fixture.
- .5 Prismatic acrylic lens over lamp.
- .6 12 Watt quartz halogen lamp at voltage indicated.
- .7 Approved Manufacturers:
  - .1 Emergi-Lite: P18 series
  - .2 Lumacell: MQ series
  - .3 Luxnet: R1Q series

Part 3 Execution

3.1 INSTALLATION

.1 Install unit equipment for emergency lighting in accordance with CSA C22.1.

.2 Install conduit and wiring as indicated.

.3 Install unit equipment and remote mounted fixtures as indicated.

.4 Cut and re-cap cord to remove surplus.

.5 Direct heads indicated to provide maximum lighting level along means of egress routes.

.6 Mount double remote heads on outlet box such that the two heads will be horizontal with the building lines.

.7 Charge the batteries and test the system for proper operation (minimum of 35 or 65 minutes discharge time).

.8 Adjacent to each battery bank unit install a 120V duplex receptacle and wire to AC night lighting circuit.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Atomic Energy Control Board Regulations

.2 Canadian Code for Preferred Packaging

.3 Canadian Standards Association (CSA)

.1 CSA C22.2 No.141- M1985(R1992) , Unit Equipment for Emergency Lighting.

.2 CSA C860- 96 , Performance of Internally-Lighted Exit Signs.

.4 National Fire Protection Association (NFPA) requirements

1.2 SUBMITTALS

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

.2 Submit product data sheets for exit lights. Include product characteristics, performance criteria, physical size, limitations and finish.

.3 Manufacturer’s Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

Part 2 Products

2.1 EXIT LIGHTS - GENERAL (EXIT - SORTIE)

.1 Housing: Slim-Line 2.0 mm thick, heavy-duty extruded aluminum, white powder coat finish c/w snap-out directional arrows and universal canopy mount. Entire fixtures to meet CSA-C860.

.2 Extruded aluminum 2.00 mm thick stencil face, white powder coat finish.

.3 Lamps: LED light bar type c/w internally mounted transformers as required.

.4 Designed for 10 years of continuous operation without relamping.

.5 Letters: 153 mm high x 20 mm wide, white faceplate on red glass reading EXIT.

.6 No external holes or slots to eliminate light leaks.

.7 Face plate to remain captive for relamping.

.8 Units c/w punch-out directional arrows as required.

.9 Units c/w universal mounting canopies as required.

Part 3 Execution

3.1 INSTALLATION

.1 Install Exit signs.

.2 Connect fixtures to exit circuits.

.3 Ensure that exit sign circuit breaker is locked in on position.

END OF SECTION

Door Security Schedule

Project: East District Police Station
Job Number: 04-214-01

SMS ENGINEERING

Door	Intercom	Access Control\Monitoring	Card Reader	Local Key Switch	Mag Lock	Elect. Strike	Elect Retract	Request for Exit: Exit Device (Door Hardware)	Request for Exit: Exit Button (REX) (Division 16)	Request for Exit: Exit Detector (Division 16)	Elect Release Hold Open	Auto Door Equipment: Auto Operator	Auto Door Equipment: Push Button	Auto Door Equipment: Motion Detector	Door Position Monitor	Interlock Pushbutton	Notes
DG100A												●					
DG100B			●			●		●							● ●		
DG100C	●		●			●		●				●			●		
DG103			● ●			●									●		
DG104			●			●		●							●		
DG104A			● ●		●										●		
DG112			●			●		●							●		
DG119A			●			●		●				●			● ●		
DG119B			●			●				●					●		
DG119C			●			●		●							●		
DG119D															●		
DG127												●					
DG128			●			●				●		●			●		
DG131A															●		
DG132			●			●				●		●			●		
DG135B															●		
DG136															●		
DG137			●			●		●							●		
DG138A			●				●	●				●			● ●		
DG138B												●					
DG142A			● ●		●										●		
DG142B			● ●									●			●		Long Range Reader, Garage door note 1
DG150A			● ●		●										●		
DG150B			● ●									●			●		Long Range Reader, Garage door note 1
DG154															●		
DG154A			●			●		●							●		

Door Security Schedule

Project: East District Police Station
Job Number: 04-214-01

SMS ENGINEERING

Door	Intercom	Access Control\Monitoring	Card Reader	Local Key Switch	Mag Lock	Elect. Strike	Elect Retract	Request for Exit: Exit Device (Door Hardware)	Request for Exit: Exit Button (REX) (Division 16)	Request for Exit: Exit Detector (Division 16)	Elect Release Hold Open	Auto Door Equipment: Auto Operator	Auto Door Equipment: Push Button	Auto Door Equipment: Motion Detector	Door Position Monitor	Interlock Pushbutton	Notes
DG156			●			●		●							●		
DG157A			●			●		●							●		
DG157B			●			●		●							●		
DG158A			● ●		●							●			●		DG158 A & B Only
DG158B			● ●		●							●			●		1 Door Open at 1 Time
DG159			●			●		●							●		
DG159A			●			●		●							●		
DG160A			● ●		●										●		
DG160B			●			●		●							●		
DG176			●			●		●							●		
DG179A			● ●		●										●		
DG179C			●			●		●							●		
DG180															●		
DG180A															● ●		
DG186			●			●		●							●		
DG188			●			●		●							●		
DG190			●			●		●							●		
DG192			●			●		●							●		
DG205			●			●		●							●		
EXT-1A			●									●					Long Range Reader
EXT-1B			●									●					Long Range Reader
GEX100			●		●										●		Fence Mounted, Weather Proof
GEX101			●		●										●		Fence Mounted, Weather Proof
EXT-4A			●									●					Long Range Reader
EXT-4B			●									●					Long Range Reader

Note #1 DG142B & DG150B; Only 1 Door Can Be Open at a time.
Note #2

LUMINAIRE SCHEDULE

Projec WINNIPEG POLICE SERVICES
Projec 04-214-01

SMS ENGINEERING

FIXT. TYPE	LAMPS	VOLTAGE	DESCRIPTION	NOTES	APPROVED MANUFACTURERS
A	2 - T5HO 54W	120V	T5 STRIP C/W SOLID REFLECTOR, WIRE GUARD, CHAIN HUNG		CFI: SV-4-S-2-54-UNIV-PG-REFL
C	2 - T5HO 54W	120V	SUSPENDED DIRECT/INDIRECT FIXTURE IS AIRCRAFT CABLE SUSPENDED COLOUR AS DIRECTED BY ARCHITECT AT TIME OF SHOP DRAWINGS. DIMMING BALLAST		LIGHTOLIER: AG-F-4-P-XX-DS-2-12-PG
D	2 - T5 28W	120V	4' LONG INDIRECT PENDANT. AIRCRAFT CABLE HUNG, ONE CIRCUIT, WHITE FINISH.		LIGHTOLIER: AG-S-4-P-WH-DS-2-54-120-PG
E	2 - 26W QUAD 4 PIN	120V	OPEN POTLIGHT, CLEAR RELECTOR		LIGHTOLIER: 1142T26 CH/1102T26HF120
ED	2 - 26W QUAD 4 PIN	120V	OPEN POTLIGHT, CLEAR RELECTOR DIMMING BALLAST		LIGHTOLIER: 1142T26 CH/1102T26HF120-DIM
F	400W MH CLEAR	120V	WALL MOUNTED HID FIXTURE		INSIGHT: VV923-EXA-120-CL-SP
H	100 W MH COATED	347V	SURFACE MOUNTED FIXTURE ON METAL SOFFIT POLYCARBONATE LENS COLOUR AS DIRECTED BY ARCHITECT ON SHOP DRAWINGS		USAL : LUM-C-100MH-XX-LEX
VP	2-F32 T8	120V	SURFACE MOUNTED VAPOUR PROOF FIXTURE		GVA: FA - 2-32- PC -120 -PS - HP
VX	2-F32 T8	120V	CHAIN SUSPENDED ROW MOUNTED VAPOUR PROOF FIXTURE		GVA: FA - 2-32- PC -120 -PS - HP
M	2 - T5HO 54W	120V	SURFACE MOUNTED LINER FIXTURE, HIGH ABUSE MATTE WHITE FINISH, PEARLESCENT POLYCARBONATE LENS.		KENALL: MLHA8-48-F-MW-PP-2-54-PG-120
N	2 - 26W QUAD 4 PIN	120V	LENSED POTLIGHT, CLEAR LENS		LIGHTOLIER: 1126TWH-1102T26HF120
O	1-54W T5HO	120V	RECESSED 2x4 DIRECT AND INDIRECT		LIGHTOLIER: QHE2GPFOP154120PGR

LUMINAIRE SCHEDULE

Projec WINNIPEG POLICE SERVICES
Projec 04-214-01

SMS ENGINEERING

FIXT. TYPE	LAMPS	VOLTAGE	DESCRIPTION	NOTES	APPROVED MANUFACTURERS
Q	3-F32 T8	120V	2x4 SECURITY FIXTURE IN METAL TILE CEILING DIMMING BALLAST		KENALL: RGD40/0332PB120121RF
R	2-26W QUAD 4PIN	120V	SECURE POT LIGHT IN METALTILE CEILING DIMMING BALLAST		KENALL: RQCA0/0226QDE1201/21
S	4 - F32 T8	120V	2'x4' IN T-BAR CEILING		LIGHTOLIER: AA448-120-04-VB
T	3-F32 T8	120V	SURFACE MOUNTED 2'x4' C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS		CFI: SLB2SFSVB340 DAY-BRITE: 2SMC-332-FS12 LITHONIA: 2BX332FWA12125 METALUX: 2M-332A.125 PEERLESS: LX-24-332-12.125-HL
U	2-F32 T8	120V	SURFACE MOUNTED 1'x4' C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS		CFI: SLB1SFSVB240 DAY-BRITE: 1SMC-232-FS12 LITHONIA: BX232FWA12125 METALUX: MC-232A.125 PEERLESS: LX-14-232-12.125-HL
V	13W BIAX	120V	WALL MOUNTED SWING ARM LAMP, PLAIN SHADE SATIN CHROME FINISH		DAINOLITE: DMWL 800
W	13W BIAX 4 PIN	120V	PENDANT FIXTURE, STEM LENGTH AS DIRECTED ON SITE BY ATCHITECT		LIGHTOLIER: FS02
X	13W BIAX 4 PIN	120V	WALL SCONCE		LIGHTOLIER: FW01
Y	1 - 26W TT 4 PIN	120V	SHOWER LIGHT, DROPPED OPAL LEXAN LENS		LIGHTOLIER: 1178-1102P2632VG
AA	1 - 400W MH CLEAR	347	POLE MOUNTED FIXTURE, FULL CUT OFF. SINGLE HEAD, COLOUR AS DIRECTED BY ARCHITECT ON SHOP DRAWINGS, POLE COLOUR TO MATCH FIXTURE, POLE HEIGHT IS 30'.		US AL: AER-111-400MH
AB	2 - 400W MH CLEAR	347	POLE MOUNTED FIXTURE, FULL CUT OFF. DOUBLE HEAD, COLOUR AS DIRECTED BY ARCHITECT ON SHOP DRAWINGS, POLE COLOUR TO MATCH FIXTURE, POLE HEIGHT IS 30'.		TO MATCH 'AA' BUT 2 HEADS
BB	175W MH CLEAR		WALL PACK, FULL CUT OFF, COLOUR AS DIRECT AT TIME OF SHOP DRAWINGS PULSE START BALLAST		PREMIER LTG: WF52436 175MH
KE	1 - T5HO 54W	120V	T5 STRIP C/W WIRE GUARD, CHAIN HUNG		CFI: SV-4-S-1-54-UNIV-PG

LUMINAIRE SCHEDULE

Projec WINNIPEG POLICE SERVICES
Projec 04-214-01

SMS ENGINEERING

FIXT. TYPE	LAMPS	VOLTAGE	DESCRIPTION	NOTES	APPROVED MANUFACTURERS
MM	2-32W T8	120V	CORNER MOUNTED SECURITY FIXTURE TORX FASTNERS		KENALL: CC-4-0/0-2-32-PB-1-120-2/7-1
MD	2-32W T8	120V	CORNER MOUNTED SECURITY FIXTURE TORX FASTNERS DIMMING BALLAST		KENALL: CC-4-0/0-2-32-PB-1-120-2/7-1 -DIM
Z	1-26W QUAD 4PIN	120V	POTLIGHT, CLEAR REFLECTOR DIMMING BALLAST		LIGHTOLIER: 8031CLP-S6132BCU3-120-26
E1	LED	120	**EXIT & SORTIE** SINGLE FACE LED LIGHT BAR EXIT LIGHT C/W UNIVERSAL CANOPY & PUNCH OUT ARROWS METAL FINISH		EMERGI-LITE: LPEX52-W-EM LUMAID: EX-AL-1-LED READY-LITE: RX5000/5100L LED LUMACELL: LER450-WH DUAL-LITE: ASRW LED SERIES
E2	LED	120	**EXIT & SORTIE** DOUBLE FACE LED LIGHT BAR EXIT LIGHT C/W UNIVERSAL CANOPY & PUNCH OUT ARROWS METAL FINISH		EMERGI-LITE: LPEX53-W-EM LUMACELL: LER460-WH LUMAID: EX-AL-2-LED READY-LITE: RX5200L LED DUAL-LITE: ADRW LED SERIES

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	EMERG. POWER	REMARKS
					MAN	MAG	PL	HOA					
FC-1	Fan Coil Unit	Crawlspace	Frac.	120v	x		x		EA219	Adjacent to Stat	2#12	x	
FC-2	Fan Coil Unit	Crawlspace	Frac.	120v	x		x		EA220	Adjacent to Stat	2#12	x	
FC-3	Fan Coil Unit	Crawlspace	Frac.	120v	x		x		EA221	Adjacent to Stat	2#12	x	
FC-4	Fan Coil Unit	Crawlspace	Frac.	120v	x		x		EA119	Adjacent to Stat	2#12	x	
FC-5	Fan Coil Unit	Crawlspace	Frac.	120v	x		x		EA120	Adjacent to Stat	2#12	x	
FC-6	Fan Coil Unit	Crawlspace	Frac.	120v	x		x		EA511	Adjacent to Stat	2#12	x	
FC-7	Fan Coil Unit	Crawlspace	Frac.	120v	x		x		EA512	Adjacent to Stat	2#12	x	
FC-8	Fan Coil Unit	Crawlspace	Frac.	120v	x		x		EA513	Adjacent to Stat	2#12	x	
FC-9	Fan Coil Unit	Crawlspace	Frac.	120v	x		x		EA514	Adjacent to Stat	2#12	x	
FC-10	Fan Coil Unit	Crawlspace	Frac.	120v	x		x		EA515	Adjacent to Stat	2#12	x	
FC-11	Fan Coil Unit	Vestibule Near G138	Frac.	120v	x		x		EA521	Adjacent to Stat	2#12	x	
FC-12	Fan Coil Unit	Vestibule G119	Frac.	120v	x		x		EA520	Adjacent to Stat	2#12	x	
FC-13	Fan Coil Unit	Vestibule G100	Frac.	120v	x		x		EA121	Adjacent to Stat	2#12	x	
F-1	Meeting Room Transfer Fan	Meeting Room G193	Frac.	120v					NA221	Wall Mounted	2#12		Wall mounted speed controller with ON/OFF switch. Provided by DIV15 and installed by DIV16.

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	EMERG. POWER	REMARKS
					MAN	MAG	PL	HOA					
F-2	Meeting Room Transfer Fan	Meeting Room G200	Frac.	120v					NA117	Wall Mounted	2#12		Wall mounted speed controller with ON/OFF switch. Provided by DIV15 and installed by DIV16.
F-3	Washroom Exhaust Fan	Washroom G102	Frac.	120v	x		x		NA116	Wall Mounted	2#12		DDC Relay provided by DIV15 and installed by DIV16.
F-4	Interview Exhaust Fan	Roof Above G179	0.25HP	120v	x		x		NA220	Wall Mounted G180	2#12		DDC provided by DIV15 and installed by DIV16.
F-5	Detention Exhaust Fan	Roof Above G160	0.25HP	120v	x		x		NA321	Wall Mounted G160	2#12		DDC provided by DIV15 and installed by DIV16.
F-6	Officer Decon Exhaust Fan	Roof Above G141	0.25HP	120v	x		x		NA621	Wall Mounted G141	2#12		DDC provided by DIV15 and installed by DIV16.
F-7	Locker Room Exhaust Fan	Mechanical Room	1.5 HP	600v 3Ø		x	x	x	AA101,102, 103	Penthouse	3#12		
F-8	Crawlspace Exhaust Fan	Roof Above Mech Room	1HP	600v 3Ø		x	x	x	AA104,105, 106	Penthouse	3#12		
F-9	Electrical Room Ventilation (G125)	Corridor G120	Frac.	120v	x		x		EA519	Wall Mounted G123	2#12	x	Thermostat provided by DIV15 and installed by DIV16
F-10	Ceiling Downdraft Fan	Exercise Room G131	Frac.	120v					NA518	Wall Mounted	2#12		Speed controller supplied by DIV15 and installed by DIV16.
F-11	Ceiling Downdraft Fan	Exercise Room G131	Frac.	120v					NA519	Wall Mounted	2#12		Speed controller supplied by DIV15 and installed by DIV16.
F-12	Ceiling Downdraft Fan	Exercise Room G131	Frac.	120v					NA520	Wall Mounted	2#12		Speed controller supplied by DIV15 and installed by DIV16.
F-13	Ceiling Downdraft Fan	Exercise Room G131	Frac.	120v					NA521	Wall Mounted	2#12		Speed controller supplied by DIV15 and installed by DIV16.
F-14	Ceiling Downdraft Fan	Atrium Corridor G191A	Frac.	120v					NA118	Wall Mounted	2#12		Speed controller supplied by DIV15 and installed by DIV16.
F-15	Ceiling Downdraft Fan	Atrium Corridor G191A	Frac.	120v					NA119	Wall Mounted	2#12		Speed controller supplied by DIV15 and installed by DIV16.

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	EMERG. POWER	REMARKS
					MAN	MAG	PL	HOA					
F-16	Ceiling Downdraft Fan	Atrium Corridor G191	Frac.	120v					NA120	Wall Mounted	2#12		Speed controller supplied by DIV15 and installed by DIV16.
F-17	Ceiling Downdraft Fan	Atrium Corridor G191	Frac.	120v					NA121	Wall Mounted	2#12		Speed controller supplied by DIV15 and installed by DIV16.
F-18	Garage Supply Fan	Garage	2HP	600v 3Ø		x	x	x	SL-EA 37,38,39	G155	3#12	x	
F-19	Garage Supply Fan	Garage	2HP	600v 3Ø		x	x	x	SL-EA 40,41,42	G155	3#12	x	
F-20	Evidence Drying Exhaust Fan	Roof Above G159A	Frac.	120v	x		x		EA620	Adjacent Unit	2#12	x	
F-21	Evidence Drying Exhaust Fan	Roof Above G159	Frac.	120v	x		x		EA621	Adjacent Unit	2#12	x	
F-22	Garage Elec RM. Ventiation	G155	Frac.	120v	x		x		EA616	Adjacent Equip	2#12	x	
F-23	Washroom Exhaust	G146	Frac.	120v	x		x		NA620	Wall Mounted	2#12		
F-24	Washroom Exhaust	G147	Frac.	120v	x		x		NA620	Wall Mounted	2#12		
F-25	Ceiling Downdraft Fan	G142	Frac.	120v					NA618	Wall Mounted	2#12		Speed controller supplied by DIV15 and installed by DIV16.
F-26	Ceiling Downdraft Fan	G143	Frac.	120v					NA619	Wall Mounted	2#12		Speed controller supplied by DIV15 and installed by DIV16.
F-27	Equipment Decon Exhaust	Ceiling G144	Frac.	120v	x		x		EA614	Adjacent Equip	2#12	x	
F-28	Vestibule Exhaust	Roof Above G158	Frac.	120v	x		x		EA615	Adjacent Equip	2#12	x	
F-29	Celing Downdraft Fan	Ceiling G193	Frac.	120v					NA219	Wall Mounted	2#12		Speed controller supplied by DIV15 and installed by DIV16.

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	EMERG. POWER	REMARKS
					MAN	MAG	PL	HOA					
AHU-1 (S)	AHU Supply Fan	Mechanical Room	15HP	600v 3Ø					CDP-EE	60A-3P	3/C#6 DRIVE X	x	VFD Controlled, Shut down on Fire Alarm Signal
AHU-1 (R)	AHU Return Fan	Mechanical Room	7.5HP	600v 3Ø					CDP-EE	30A-3P	3/C#10 DRIVE X	x	VFD Controlled, Shut down on Fire Alarm Signal
AHU-2 (S)	AHU Supply Fan	Mechanical Room	15HP	600v 3Ø					CDP-EE	60A-3P	3/C#6 DRIVE X	x	VFD Controlled, Shut down on Fire Alarm Signal
AHU-2 (R)	AHU Return Fan	Mechanical Room	7.5HP	600v 3Ø					CDP-EE	30A-3P	3/C#10 DRIVE X	x	VFD Controlled, Shut down on Fire Alarm Signal
UH-1	Unit Heater	G143	Frac.	120v	x		x		EA619	Adjacent to stat	2#12	x	Thermostat provided by DIV15 and installed by DIV16.
UH-2	Unit Heater	Garage	Frac.	120v	x		x		EA618	Adjacent to stat	2#12	x	Thermostat provided by DIV15 and installed by DIV16.
UH-3	Unit Heater	G152	Frac.	120v	x		x		EA617	Adjacent to stat	2#12	x	Thermostat provided by DIV15 and installed by DIV16.
UH-4	Unit Heater	Mechanical Room	Frac.	120v	x		x		EE213	Adjacent to stat	2#12	x	Thermostat provided by DIV15 and installed by DIV16.
P-1	Heating Pump	Mechanical Room	7.5HP	600v 3Ø					EE101, 102,103	15A-3P	3/C#12 DRIVE X	x	VFD Controlled
P-2	Heating Pump	Mechanical Room	7.5HP	600v 3Ø					EE104, 105,106	15A-3P	3/C#12 DRIVE X	x	VFD Controlled
Open Number													Open Number
Open Number													Open Number
P-5	AHU-1 Coil Pump	Mechanical Room	1.5HP	600v 3Ø		x	x	x	EE107, 108,109	Adjacent Unit	3#12	x	
Open Number													Open Number
P-7	Domestic Water Recirculation Pump	Mechanical Room	1/6HP	120v	x		x		AA201	Adjacent Unit	2#12		
P-8	Sump Pump	Crawlspace	1/3HP	120v	x		x		EA509	Adjacent Unit	2#12	x	Wire P8/P9 to level controller. Alternator supplied by DIV15.
P-9	Sump Pump	Crawlspace	1/3HP	120v	x		x		EA510	Adjacent Unit	2#12	x	

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	EMERG. POWER	REMARKS
					MAN	MAG	PL	HOA					
P-10	Sump Pump	Crawlspace	1/3HP	120v	x		x		EA117	Adjacent Unit	2#12	x	Wire P10/P11 to level controller. Alternator supplied by DIV15.
P-11	Sump Pump	Crawlspace	1/3HP	120v	x		x		EA118	Adjacent Unit	2#12	x	
P-12	Garage Ventilation Coil Pump	Garage	1HP	600v		x	x	x	EE113, 114,115	Adjacent Unit	3#12	x	
P-13	AHU-2 Coil Pump	Mechanical Room	1HP	600v		x	x	x	AA107,108 ,109	Adjacent Unit	3#12		
P-14	Tank Circ. Pump	Penthouse	3/4HP	208v 1Ø	x		x		EE230,231	Penthouse	2#12	x	
COMP-1	Pre-action pipe mounted Air Compressor	Sprinkler Room	1/2HP	208v 1Ø	x		x		EA139,140	Adjacent Unit	2#12	x	Wire to pressure switch.
COMP-2	Fire Pre-action pipe mounted Air Compressor	Sprinkler Room	1/2HP	208v 1Ø	x		x		EA141,142	Adjacent Unit	2#12	x	Wire to pressure switch.
AC-1A	Air Conditioner Evaporator	Server Room G112	0.52	208v 1Ø	x		x		EA135,136	Adjacent Unit	2#12	x	Wire Controls
AC-1B	Air Conditioner Condensing Unit	Crawlspace	40A	208v 1Ø	x		x		EA137,138	Adjacent Unit	2#8	x	Wire Controls
AC-2A	Air Conditioner Evaporator	Server Room G112	0.52	208v 1Ø	x		x		EA131,132	Adjacent Unit	2#12	x	Wire Controls
AC-2B	Air Conditioner Condensing Unit	Crawlspace	40A	208v 1Ø	x		x		EA133,134	Adjacent Unit	2#8	x	Wire Controls
AC-3A	Air Conditioner Evaporator	Video Storage G180	.33	208v 1Ø	x		x		EA264,265	Adjacent Unit	2#12	x	Wire Controls
AC-3B	Air Conditioner Condensing Unit	Crawlspace	20A	208v 1Ø	x		x		EA266,267	Adjacent Unit	2#10	x	Wire Controls
AC-4A	Air Conditioning Evaporator	Penthouse	5.9A	600 3Ø	x		x		CDP-EE	Adjacent Unit	3#12	x	Wire Controls
AC-4B	Air Conditioner Condensing Unit	Penthouse Roof	4.8A	208 3Ø	x		x		EE125, 126,127	Adjacent Unit	3#12	x	Wire Controls
AC-5A	Air Conditioning Evaporator	Penthouse	5.9A	600 3Ø	x		x		CDP-EE	Adjacent Unit	3#12	x	Wire Controls
AC-5B	Air Conditioner Condensing Unit	Penthouse Roof	4.8A	208 3Ø	x		x		EE128, 129,130	Adjacent Unit	3#12	x	Wire Controls
CU-1	Condensing Unit	At Grade	58A	600v	x		x		CDP-EE	125A -3P	3#1		Provide fused disconnect

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	EMERG. POWER	REMARKS
					MAN	MAG	PL	HOA					
				3Ø									
CU-2	Condensing Unit	At Grade	58A	600v 3Ø					CDP-EE	125A -3P	3#1		Provide fused disconnect
H-1	Humidifier (Gas)	Mechanical Room	1A	120v	x		x		AA203	Adjacent Unit	2#12		control cct
B-1	Boiler	Mechanical Room	15A	208v 3Ø	x		x		EE207, 208	On Unit	3#12	x	Provide a 120V 20A circuit for boiler control panel.
B-2	Boiler	Mechanical Room	15A	208v 3Ø	x		x		EE209, 210	On Unit	3#12	x	Provide a 120V 20A circuit for boiler control panel.

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	EMERG. POWER	REMARKS
					MAN	MAG	PL	HOA					
CP-1	Control Panel		15A	120v 1Ø							2#12	x	
CP-2	Control Panel		15A	120v 1Ø							2#12	x	
CP-3	Control Panel		15A	120v 1Ø							2#12	x	
CP-4	Control Panel	G122	15A	120v 1Ø					EA516		2#12	x	
CP-5	Control Panel	G122	15A	120v 1Ø					EA517		2#12	x	
CP-6	Control Panel	G122	15A	120v 1Ø					EA518		2#12	x	
CP-7	Control Panel	G201	15A	120v 1Ø					EA433		2#12	x	
CP-8	Control Panel	G201	15A	120v 1Ø					EA434		2#12	x	
CP-9	Control Panel		15A	120v 1Ø							2#12	x	
CP-10	Control Panel		15A	120v 1Ø							2#12	x	
CP-11	Control Panel		15A	120v 1Ø							2#12	x	
CP-12	Control Panel		15A	120v 1Ø							2#12	x	
CP-13	Control Panel		15A	120v 1Ø							2#12	x	
B1-CP	Boiler Control Panel	Penthouse	20A	120v					EE211		2#10	x	
B2-CP	Boiler Control Panel	Penthouse	20A	120v					EE212		2#10	x	

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	EMERG. POWER	REMARKS
					MAN	MAG	PL	HOA					
CP-14	Control Panel		15A	120v 1Ø							2#12	x	
FF-1	Forcr Flow	Sprinkler Room G194	Frac.	120v 1Ø	x		x		NA115	Adjacent Unit	2#12	x	
FF-2	Forcr Flow	ST 135	Frac.	120v	x		x		AA204	Adjacent Unit	2#12	x	
HWT-1	Hot Water Tank (Glycol)	Penthouse	1A	120v	x		x		EE214		2#12	x	Control cct

PANEL: **SL-EA** LOCATION: G155

FED FROM: CDP-EE LOCATION: PENTHOUSE

Designation		Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation	
PARKING LOT LTG	X	1350	15	1	A	22	15	1000	XXX	INDIRECT LIGHTING G193A
PARKING LOT LTG	X	1350	15	2	B	23	15	2000	XX	INDIRECT LIGHTING ATRIUM
PARKING LOT LTG	X	1350	15	3	C	24	15	2500	XX	INDIRECT LIGHTING ATRIUM
PARKING LOT LTG	X	1800	15	4	A	25	15	500	XX	INDIRECT LIGHTING RM G101
PARKING LOT LTG	X	1800	15	5	B	26				
PARKING LOT LTG	X	1800	15	6	C	27				
PARKING LOT LTG	X	1350	15	7	A	28				
PARKING LOT LTG	X	1350	15	8	B	29				
PARKING LOT LTG	X	900	15	9	C	30				
WALL PACKS LTG	X	2100	15	10	A	31				
WALL PACKS LTG	X	2500	15	11	B	32				
WALL PACKS LTG	X	900	15	12	C	33				
ENTRY LTG	X	900	15	13	A	34				
SPARE			15	14	B	35				
SPARE			15	15	C	36				
SPARE			15	16	A	37	15	935		F-18
SPARE			15	17	B	38		935		
SPARE			15	18	C	39	3P	935		
				19	A	40	15	935		F-19
				20	B	41		935		
				21	C	42	3P	935		

VOLTAGE: **347/600V,3Ø,4W**

CAPACITY: 225 AMP

MOUNTING: SURFACE

REMARKS:

LOADS - PH.A 10870

PH.B 10870

PH.C 9320

TOTAL **31060**

X= Circuits controlled by controller/relays

XX= Circuits controlled by l.v. switch in room G206(S1)

XXX=Circuits controlled by l.v. switch in room G193A & G206(S2)

SMS ENGINEERING

SMS Engineering Ltd. Consulting Engineers

770 Bradford Street Winnipeg MB Canada R3H 0N3

Telephone 204.775.0291 Fax 204.772.2153

sms@smseng.com

PANEL SCHEDULE SL-EA

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **PL-EA** LOCATION: PARKING LOT

FED FROM: TR-PL-EA LOCATION: PARKING LOT

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
CAR		15				15		CAR
REC	1200		1	A	31		1200	REC
	1200	2P	2	B	32	2P	1200	
CAR		15				15		CAR
REC	1200		3	C	33		1200	REC
	1200	2P	4	A	34	2P	1200	
CAR		15				15		CAR
REC	1200		5	B	35		1200	REC
	1200	2P	6	C	36	2P	1200	
CAR		15				15		CAR
REC	1200		7	A	37		1200	REC
	1200	2P	8	B	38	2P	1200	
CAR		15				15		CAR
REC	1200		9	C	39		1200	REC
	1200	2P	10	A	40	2P	1200	
CAR		15				15		CAR
REC	1200		11	B	41		1200	REC
	1200	2P	12	C	42	2P	1200	
CAR		15				15		CAR
REC	1200		13	A	43		1200	REC
	1200	2P	14	B	44	2P	1200	
CAR		15				15		CAR
REC	1200		15	C	45		1200	REC
	1200	2P	16	A	46	2P	1200	
CAR		15				15		CAR
REC	1200		17	B	47		1200	REC
						15		CAR
	1200	2P	18	C	48		1200	REC
CAR		15						
REC	1200		19	A	49	2P	1200	
						15		CAR
	1200	2P	20	B	50		1200	REC
CAR		15						
REC	1200		21	C	51	2P	1200	
						15		CAR
	1200	2P	22	A	52		1200	REC
CAR		15						
REC	1200		23	B	53	2P	1200	
						15		SPARE
	1200	2P	24	C	54			
CAR		15						
REC	1200		25	A	55	2P		
CAR		15				15		SPARE
REC	1200		26	B	56			
CAR		15						
REC	1200		27	C	57	2P		
						15		SPARE
	1200	2P	28	A	58			
CAR		15						
REC	1200		29	B	59	2P		
						15		SPARE
		2P	30	C	60			

VOLTAGE: **120/208V,3Ø,4W**

CAPACITY: 400 AMP

MOUNTING: CUSTOM

REMARKS:

LOADS - PH.A 21600

PH.B 21600

PH.C 19200

TOTAL **62400**

SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE PL-EA

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **UPS-100** LOCATION: G201
FED FROM: CDP-UPS-A LOCATION: G123

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
DESK G208 SOUTH WALL	800	15	1	A	22	15	800	DESK G208 NORTH WALL
DESK G208 SOUTH WALL	800	15	2	B	23	15	800	DESK G208 NORTH WALL
DESK G208 SOUTH WALL	800	15	3	C	24	15	800	DESK G208 NORTH WALL
PRINTER SOUTH WALL	800	15	4	A	25	15	800	DESK G208 NORTH WALL
DESK G208 SOUTH WALL	800	15	5	B	26	15	800	DESK G208 NORTH WALL
DESK G208 SOUTH WALL	800	15	6	C	27	15	800	DESK G208 NORTH WALL
DESK G208 SOUTH WALL	800	15	7	A	28	15	15	COMPUTER RACK RM G112
DESK G208 CENTRE	800	15	8	B	29	15	15	COMPUTER RACK RM G112
DESK G208 CENTRE	800	15	9	C	30	15	15	COMPUTER RACK RM G112
DESK G208 CENTRE	800	15	10	A	31	15	15	COMPUTER RACK RM G112
DESK G208 CENTRE	800	15	11	B	32	15	15	COMPUTER RACK RM G112
DESK G208 CENTRE	800	15	12	C	33	15	15	COMPUTER RACK RM G112
DESK G208 CENTRE	800	15	13	A	34	15	15	COMPUTER RACK RM G112
DESK G208 CENTRE	800	15	14	B	35	15	15	COMPUTER RACK RM G112
DESK G208 CENTRE	800	15	15	C	36	15	15	COMPUTER RACK RM G112
DESK G208 CENTRE	800	15	16	A	37	15	15	COMPUTER RACK RM G112
DESK G208 CENTRE	800	15	17	B	38	15		SPARE
SPARE		15	18	C	39	15		SPARE
SPARE		15	19	A	40	15		SPARE
SPARE		15	20	B	41	15		SPARE
SPARE		15	21	C	42	15		SPARE

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225 AMP
MOUNTING: FLUSH
REMARKS:

LOADS - PH.A 6460
PH.B 6445
PH.C 5645
TOTAL **18550**

SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE UPS-100

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **UPS-200** LOCATION: G199

FED FROM: CDP-UPS-A LOCATION: G123

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
CCTV G106		15				15		G103
	200		1	A	22		300	2R REC
CCTV G105		15				15		G103
	200		2	B	23		300	2R REC
CCTV G198		15				15		G103
	200		3	C	24		300	2R REC
SPARE		15				15		G103
			4	A	25		300	2R REC
SPARE		15				15		G103
			5	B	26		500	1R REC
SPARE		15				15		G103
			6	C	27		500	1R REC
SPARE		15				15		G103
			7	A	28		500	1R REC
SPARE		15				15		G103
			8	B	29		500	1R REC
SPARE		15				15		G103 PRINTER
			9	C	30		600	1R REC
SPARE		15				15		G101
			10	A	31		300	1R REC
SPARE		15				15		G101
			11	B	32		300	1R REC
SPARE		15				15		SPARE
			12	C	33			
			13	A	34			
			14	B	35			
			15	C	36			
			16	A	37			
			17	B	38			
			18	C	39			
			19	A	40			
			20	B	41			
			21	C	42			

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 1600

CAPACITY: 225 AMP PH.B 1800

MOUNTING: FLUSH PH.C 1600

REMARKS: TOTAL **5000**

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SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE UPS-200

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **UPS-300 (PART 1)** LOCATION: G180
FED FROM: CDP-UPS-A LOCATION: G125

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)		Designation
DESK RM 192		15				15			RM G206
	800		1	A	22		480		LTG
DESK RM 192		15				15		COM RM	G176, G175, G174, G158
	800		2	B	23		765		LTG
DESK RM 192		15				15			RM G160
	800		3	C	24		480		LTG
DESK RM 192		15				15			RM G180
	800		4	A	25		360		LTG
DESK RM 192		15				15			SPARE
	800		5	B	26				
DESK RM 192		15				15			SPARE
	800		6	C	27				
DESK RM 192		15				15			SPARE
	800		7	A	28				
DESK RM 192		15				15			SPARE
	800		8	B	29				
DESK RM 192		15				15			SPARE
	800		9	C	30				
DESK RM 192		15				15			VIDEO VIEWER RM G188
	800		10	A	31		800	2R	REC
VIDEO VIEWER RM 190		15				15			VIDEO VIEWER RM G188
REC 2R	800		11	B	32		800	2R	REC
VIDEO VIEWER RM 190		15				15			VIDEO VIEWER RM G188
REC 2R	800		12	C	33		800	2R	REC
VIDEO VIEWER RM 190		15				15			VIDEO VIEWER RM G188
REC 2R	800		13	A	34		800	2R	REC
VIDEO VIEWER RM 190		15				15			VIDEO VIEWER RM G188
REC 2R	800		14	B	35		800	2R	REC
VIDEO VIEWER RM 190		15				15			VIDEO VIEWER RM G188
REC 2R	800		15	C	36		800	2R	REC
VIDEO VIEWER RM 190		15				15			VIDEO VIEWER RM G186
REC 2R	800		16	A	37		800	2R	REC
OFFICE G192A		15				15			VIDEO VIEWER RM G186
REC 2R	400		17	B	38		800	2R	REC
PRINTER RM G192		15				15			VIDEO VIEWER RM G186
REC 1R	400		18	C	39		800	2R	REC
SCANNER RM G192		15				15			VIDEO VIEWER RM G186
REC 1R	100		19	A	40		800	2R	REC
SPARE		15				15			VIDEO VIEWER RM G186
			20	B	41		800	2R	REC
SPARE		15				15			VIDEO VIEWER RM G186
			21	C	42		800	2R	REC

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 8940
CAPACITY: 225 AMP PH.B 8365
MOUNTING: FLUSH PH.C 8080
REMARKS: TOTAL **25385** NOT INCLUDING PART 2

SMS ENGINEERING
SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE UPS-300 (PART 1)

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **UPS-300 (PART 2)** LOCATION: G180
FED FROM: CDP-UPS-A LOCATION: G125

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
VIDEO RACKS RM 180		15				15		RM G206
REC 2R	1200		43	A	64		800	2R REC
VIDEO RACKS RM 180		15				15		RM G206
REC 2R	1200		44	B	65		800	2R REC
VIDEO RACKS RM 180		15				15		CCTV G163
REC 2R	1200		45	C	66		200	
VIDEO RACKS RM 180		15				15		CCTV G162
REC 2R	1200		46	A	67		200	
VIDEO RACKS RM 180		15				15		CCTV G161
REC 2R	1200		47	B	68		200	
VIDEO RACKS RM 180		15				15		CCTV G165
REC 2R	1200		48	C	69		200	
SPARE		15				15		CCTV G166
			49	A	70		200	
SPARE		15				15		CCTV G167
			50	B	71		200	
SPARE		15				15		CCTV G170
			51	C	72		200	
SPARE		15				15		CCTV G171
			52	A	73		200	
SPARE		15				15		CCTV G172
			53	B	74		200	
SPARE		15				15		CCTV G174, G175
			54	C	75		200	
SPARE		15				15		CCTV G181
			55	A	76		200	
SPACE						15		CCTV G182
			56	B	77		200	
SPACE						15		CCTV G185
			57	C	78		200	
SPACE						15		CCTV G187
			58	A	79		200	
SPACE						15		CCTV G189
			59	B	80		200	
SPACE						15		CCTV G183
			60	C	81		200	
SPACE						15		CCTV G184
			61	A	82		200	
SPACE						15		SPARE
			62	B	83			
SPACE						15		SPARE
			63	C	84			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225 AMP
MOUNTING: FLUSH
REMARKS:

LOADS		
TOTAL PH.A	4400	NOT INCLUDING PART1
TOTAL PH.B	4200	NOT INCLUDING PART1
TOTAL PH.C	3600	NOT INCLUDING PART1
TOTAL	**37585**	INCLUDING PART 1

SMS ENGINEERING
SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE UPS-300 (PART 2)

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **EA-100 (PART 1)** LOCATION: G199

FED FROM: CDP-EA LOCATION: G123

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
G207		15				15		RM G100
REC 2R	400		1	A	22		600	FACP
G203		15				15		G100
REC 2R	400		2	B	23		450	LTG
G204		15				15		G103
REC 2R	400		3	C	24		840	LTG
G200		15				15		G101, 102, 104, 194
REC 1R	100		4	A	25		675	LTG
G200		15				15		G105, G106, G109
REC 1R	100		5	B	26		600	LTG
CCTV G100, G101		15				15		G200
	200		6	C	27		540	LTG
ADO G100		15				15		G107
	300		7	A	28		480	LTG
ADO G100		15				15		G198
	300		8	B	29		250	LTG
SPARE		15				15		SPARE
			9	C	30		200	
SPARE		15				15		AC-2A
			10	A	31		576	
SPARE		15				2P		
			11	B	32		576	
SPARE		15				15		AC-2B
			12	C	33		3328	
SPARE		15				2P		
			13	A	34		3328	
SPARE		15				15		AC-1A
			14	B	35		576	
SPARE		15				2P		
			15	C	36		576	
CRAWLSPACE		15				15		AC-1B
LTG	204		16	A	37		3328	
P-10		20				2P		
	250		17	B	38		3328	
P-11		20				15		COMP-1
	250		18	C	39		228	
FC-4		15				2P		
	100		19	A	40		228	
FC-5		15				15		COMP-2
	100		20	B	41		228	
FC-13		15				2P		
	100		21	C	42		228	

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 10319

CAPACITY: 225 AMP PH.B 7158

MOUNTING: FLUSH PH.C 6890

REMARKS: TOTAL **24367** NOT INCLUDING PART 2

SMS ENGINEERING

SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE EA-100 (PART 1)

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **EA-100(PART 2)** LOCATION: G199

FED FROM: CDP-EA LOCATION: G123

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
SPARE		15	43	A	64	15		SPARE
SPARE		15	44	B	65	15		SPARE
SPARE		15	45	C	66	15		SPARE
SPARE		15	46	A	67	15		SPARE
SPARE		15	47	B	68	15		SPARE
SPARE		15	48	C	69	15		SPARE
SPARE		15	49	A	70	15		SPARE
SPACE			50	B	71			SPACE
SPACE			51	C	72			SPACE
SPACE			52	A	73			SPACE
SPACE			53	B	74			SPACE
SPACE			54	C	75			SPACE
SPACE			55	A	76			SPACE
SPACE			56	B	77			SPACE
SPACE			57	C	78			SPACE
SPACE			58	A	79			SPACE
SPACE			59	B	80			SPACE
SPACE			60	C	81			SPACE
SPACE			61	A	82			SPACE
SPACE			62	B	83			SPACE
SPACE			63	C	84			SPACE

VOLTAGE: **120/208V,3Ø,4W**

CAPACITY: 225 AMP

MOUNTING: FLUSH

REMARKS:

LOADS TOTAL PH.A 0 NOT INCLUDING PART1

TOTAL PH.B 0 NOT INCLUDING PART1

TOTAL PH.C 0 NOT INCLUDING PART1

TOTAL **24367** INCLUDING PART 1

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SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE EA-100(PART 2)

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **EA-200 (PART 1)** LOCATION: G180
FED FROM: CDP-EA LOCATION: G123

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)		Designation
DESK RM G192		15				15			VIDEO VIEWING ROOM G190
	800		1	A	22		500	2R	REC
DESK RM G192		15				15			VIDEO VIEWING ROOM G190
	800		2	B	23		500	2R	REC
DESK RM G192		15				15			VIDEO VIEWING ROOM G190
	800		3	C	24		500	2R	REC
DESK RM G192		15				15			VIDEO VIEWING ROOM G188
	800		4	A	25		500	2R	REC
DESK RM G192		15				15			VIDEO VIEWING ROOM G188
	800		5	B	26		500	2R	REC
DESK RM G192		15				15			VIDEO VIEWING ROOM G188
	800		6	C	27		500	2R	REC
DESK RM G192		15				15			VIDEO VIEWING ROOM G186
	800		7	A	28		500	2R	REC
DESK RM G192		15				15			VIDEO VIEWING ROOM G186
	800		8	B	29		500	2R	REC
DESK RM G192		15				15			VIDEO VIEWING ROOM G186
	800		9	C	30		500	2R	REC
DESK RM G192		15				15			G193A
	800		10	A	31		200	2R	REC
SHREDDER		15				15			G193A
REC 1R	100		11	B	32		200	2R	REC
RM 206		15				15			G193A TV
REC 2R	200		12	C	33		500	1R	REC
RM 206		15				15			G193A FLOOR
REC 2R	200		13	A	34		200	1R	REC
SPARE		15				15			G193A FLOOR
			14	B	35		200	1R	REC
SPARE		15				15			G192 TV
			15	C	36		400	1R	REC
SPARE		15				15			G193A PROJECTOR
			16	A	37		200	1R	REC
CRAWLSPACE		15				15			
REC 1R	100		17	B	38		400		
CRAWLSPACE		15				15			SPARE
LTG	136		18	C	39				
FC-1		15				15			SPARE
	100		19	A	40				
FC-2		15				15			SPARE
	100		20	B	41				
FC-3		15				15			SPARE
	100		21	C	42				

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 5600
CAPACITY: 225 AMP PH.B 5000
MOUNTING: FLUSH PH.C 5236
REMARKS: TOTAL **15836** NOT INCLUDING PART 2

SMS ENGINEERING
SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE EA-200 (PART 1)

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **EA-200 (PART 2)** LOCATION: G180
FED FROM: CDP-EA LOCATION: G123

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
G192		15				15		AC-3A
LTG	540		43	A	64		150	
G192		15						
LTG	540		44	B	65	2P	150	
G192, G191		15				20		AC-3B
LTG	360		45	C	66		1500	
G139A		15						
LTG	955		46	A	67	2P	1500	
G139A		15				15		SPARE
LTG	660		47	B	68			
G186		15				15		SPARE
LTG	420		48	C	69			
G188		15				15		SPARE
LTG	420		49	A	70			
G190		15				15		SPARE
LTG	420		50	B	71			
G183, G184,192A		15				15		SPARE
LTG	640		51	C	72			
G185, G187, G189		15				15		SPARE
LTG	600		52	A	73			
G181, G182, G182A		15				15		SPARE
LTG	465		53	B	74			
G179, G180		15				15		SPARE
LTG	605		54	C	75			
SPARE		15						SPACE
			55	A	76			
SPARE		15						SPACE
			56	B	77			
SPARE		15						SPACE
			57	C	78			
SPARE		15						SPACE
			58	A	79			
SPARE		15						SPACE
			59	B	80			
SPARE		15						SPACE
			60	C	81			
SPACE								SPACE
			61	A	82			
SPACE								SPACE
			62	B	83			
SPACE								SPACE
			63	C	84			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225 AMP
MOUNTING: FLUSH
REMARKS:

LOADS			
TOTAL PH.A	4165	NOT INCLUDING PART1
TOTAL PH.B	2235	NOT INCLUDING PART1
TOTAL PH.C	3525	NOT INCLUDING PART1
TOTAL	**25761**	INCLUDING PART 1

SMS ENGINEERING
SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE EA-200 (PART 2)

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **EA-300** LOCATION: G176

FED FROM: CDP-EA LOCATION: G123

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
G169		15				15		RM G157, G177, G178
REC 2R	300		1	A	22		565	LTG
G205 CHARGERS		15				15		RM G160
REC 2R	400		2	B	23		665	LTG
G205 CHARGERS		15				15		RM G170,171,172,173,173A
REC 2R	400		3	C	24		520	LTG
G205 CHARGERS		15				15		RM G165,166,167
REC 2R	400		4	A	25		390	LTG
G205 CHARGERS		15				15		RM G161,162,163,164
REC 2R	400		5	B	26		455	LTG
G205 CHARGERS		15				15		RM G168,169
REC 2R	400		6	C	27		210	
G205 CHARGERS		15				15		RM G206
REC 2R	400		7	A	28		350	LTG
G205 CHARGERS		15				15		RM G205
REC 2R	400		8	B	29			LTG
G205 CHARGERS		15				15		SPARE
REC 2R	400		9	C	30			
G205		15				15		SPARE
REC 1R	100		10	A	31			
CCTV G160A, B, C, D		15				15		SPARE
	400		11	B	32			
CCTV G176A, B, G178, G205		15				15		SPARE
	400		12	C	33			
SPARE		15				15		SPARE
			13	A	34			
SPARE		15				15		SPARE
			14	B	35			
SPARE		15						SPACE
			15	C	36			
SPARE		15						SPACE
			16	A	37			
SPARE		15						SPACE
			17	B	38			
SPARE		15						SPACE
			18	C	39			
SPACE								SPACE
			19	A	40			
SPACE								SPACE
			20	B	41			
SPACE								SPACE
			21	C	42			

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 2505

CAPACITY: 225 AMP PH.B 2720

MOUNTING: FLUSH PH.C 2330

REMARKS: TOTAL **7555** NOT INCLUDING PART 2

SMS ENGINEERING

SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE EA-300

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **EA-400 (PART 1)** LOCATION: G201
FED FROM: CDP-EA LOCATION: G123

Designation		Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation	
DESK SOUTH WALL	G208	800	15	1	A	22	15	800	G208	DESK NORTH WALL
DESK SOUTH WALL	G208	800	15	2	B	23	15	800	G208	DESK NORTH WALL
DESK SOUTH WALL	G208	800	15	3	C	24	15	800	G208	DESK NORTH WALL
PRINTER SOUTH WALL	G208	800	15	4	A	25	15	800	G208	DESK NORTH WALL
DESK SOUTH WALL	G208	800	15	5	B	26	15	800	G208	DESK NORTH WALL
DESK SOUTH WALL	G208	800	15	6	C	27	15	800	G208	DESK NORTH WALL
DESK SOUTH WALL	G208	800	15	7	A	28	15	400	2R	G118 REC
DESK CENTRE	G208	800	15	8	B	29	15	400	2R	G117 REC
DESK CENTRE	G208	800	15	9	C	30	15	400	2R	G116 REC
DESK CENTRE	G208	800	15	10	A	31	15	400	2R	G115 REC
DESK CENTRE	G208	800	15	11	B	32	15	400	2R	G113 REC
DESK CENTRE	G208	800	15	12	C	33	15	400	2R	CP-7
DESK CENTRE	G208	800	15	13	A	34	15	400	2R	CP-8
DESK CENTRE	G208	800	15	14	B	35	20	1000	G202 1R	COPIER
DESK CENTRE	G208	800	15	15	C	36	20	1000	G202 1R	COPIER
DESK CENTRE	G208	800	15	16	A	37	15	500	G202 1R	PRINTER
DESK CENTRE	G208	800	15	17	B	38	15	300	G202 1R	FAX
RM G203, 204, 207 LTG		600	15	18	C	39	15	300	G202 1R	SCANNER
SPARE			15	19	A	40	15			SPARE
SPARE			15	20	B	41	15			SPARE
SPARE			15	21	C	42	15			SPARE

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225 AMP
MOUNTING: FLUSH
REMARKS:

LOADS - PH.A 8100
PH.B 8500
PH.C 8300
TOTAL **24900** NOT INCLUDING PART 2

SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE EA-400 (PART 1)

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **EA-400 (PART 2)** LOCATION: G201
FED FROM: CDP-EA LOCATION: G123

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
RM G202		15				15		ROWDY MONITOR ROOM G208
LTG	720		43	A	64		400	1R
RM G202		15				15		ROWDY MONITOR ROOM G208
LTG	720		44	B	65		400	1R
RM G201,112		15				15		ROWDY MONITOR ROOM G208
LTG	932		45	C	66		400	1R
RM G201		15				15		ROWDY MONITOR ROOM G208
LTG	960		46	A	67		400	1R
RM G201		15						SPARE
LTG	960		47	B	68		15	
RM G201		15						SPARE
LTG	960		48	C	69		15	
RM G201		15						SPARE
LTG	960		49	A	70		15	
SPARE		15						SPARE
			50	B	71		15	
SPARE		15						SPARE
			51	C	72		15	
SPARE		15						SPARE
			52	A	73		15	
SPARE		15						SPARE
			53	B	74		15	
SPARE		15						SPARE
			54	C	75		15	
SPACE								SPACE
			55	A	76			
SPACE								SPACE
			56	B	77			
SPACE								SPACE
			57	C	78			
SPACE								SPACE
			58	A	79			
SPACE								SPACE
			59	B	80			
SPACE								SPACE
			60	C	81			
SPACE								SPACE
			61	A	82			
SPACE								SPACE
			62	B	83			
SPACE								SPACE
			63	C	84			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225 AMP
MOUNTING: FLUSH
REMARKS:

LOADS			
TOTAL PH.A	3470	NOT INCLUDING PART1
TOTAL PH.B	2125	NOT INCLUDING PART1
TOTAL PH.C	2337	NOT INCLUDING PART1
TOTAL	**32832**	INCLUDING PART 1

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PANEL SCHEDULE EA-400 (PART 2)

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **EA-500 (PART 1)** LOCATION: G131
FED FROM: CDP-EA LOCATION: G123

Designation		Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)		Designation
FRIDGE G137A			15				15			MENS LOCKER RM
	1R	600		1	A	22		1090		G127, G128, G129
FRIDGE G137A			15				15			EXERCISE RM
	1R	600		2	B	23		960		
FRIDGE G137A			15				15			CARD ACCESS RM G123
	1R	600		3	C	24		500		
VENDING G137			15				15			CARD ACCESS RM G123
	1R	300		4	A	25		500		
VENDING G137			15				15			PA RM G213
	1R	300		5	B	26		500		
VENDING G137			15				15			G123
	1R	300		6	C	27		100	1R	REC
COFFEE G137			15				15			G124
	1R	1000		7	A	28		100	1R	REC
MICROWAVE			15				15			G124
	1R	1200		8	B	29		100	1R	REC
P-8			20				15			SPARE
		250		9	C	30				
P-9			20				15			SPARE
		250		10	A	31				
FC-6			15				15			SPARE
		100		11	B	32				
FC-7			15				15			G122
		100		12	C	33		400	2R	REC
FC-8			15				15			CCTV G131A, B
		100		13	A	34		200		
FC-9			15				15			RM G137, G134, G134A, G132
		100		14	B	35		970		LTG
FC-10			15				15			RM G191A, G120, G136
		100		15	C	36		920		LTG
CP-4			15				15			RM G124
		300		16	A	37		226		LTG
CP-5			15							SPARE
		300		17	B	38				
CP-6			15							SPARE
		300		18	C	39				
F-9			15				15			CRAWLSPACE REC
		200		19	A	40		100	1R	
FC-12			15				15			CRAWLSPACE LTG
		100		20	B	41		272		
FC-11			15				15			EXIT SIGNS
		100		21	C	42		35		

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 4966
CAPACITY: 225 AMP PH.B 5502
MOUNTING: FLUSH PH.C 3705
REMARKS: TOTAL **14173** NOT INCLUDING PART 2

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SMS Engineering Ltd. Consulting Engineers
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PANEL SCHEDULE EA-500 (PART 1)

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **EA-500 (PART 2)** LOCATION: G131

FED FROM: CDP-EA LOCATION: G123

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
SPARE		15	43	A	64		15	SPARE
SPARE		15	44	B	65		15	SPARE
SPARE		15	45	C	66		15	SPARE
SPARE		15	46	A	67		15	SPARE
SPARE		15	47	B	68		15	SPARE
SPARE		15	48	C	69		15	SPARE
SPARE		15	49	A	70		15	SPARE
SPACE			50	B	71			SPACE
SPACE			51	C	72			SPACE
SPACE			52	A	73			SPACE
SPACE			53	B	74			SPACE
SPACE			54	C	75			SPACE
SPACE			55	A	76			SPACE
SPACE			56	B	77			SPACE
SPACE			57	C	78			SPACE
SPACE			58	A	79			SPACE
SPACE			59	B	80			SPACE
SPACE			60	C	81			SPACE
SPACE			61	A	82			SPACE
SPACE			62	B	83			SPACE
SPACE			63	C	84			SPACE

VOLTAGE: **120/208V,3Ø,4W**

CAPACITY: 225 AMP

MOUNTING: FLUSH

REMARKS:

LOADS		
TOTAL PH.A	45	NOT INCLUDING PART1
TOTAL PH.B	30	NOT INCLUDING PART1
TOTAL PH.C	30	NOT INCLUDING PART1
TOTAL	**14278**	INCLUDING PART 1

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PANEL SCHEDULE EA-500 (PART 2)

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **EA-600 (PART 1)** LOCATION: G150
FED FROM: CDPEA LOCATION: G125

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)		Designation
CCTV EXT-1		15				15			RM G150, 154, 156
	500		1	A	22		1073		EM LTG
CCTV EXT-2		15				15			RM G141 A/B/C, G144, G143
	500		2	B	23		770		LTG
CCTV EXT-3		15				15			NO DETECTOR
	500		3	C	24		300		
CCTV EXT-4		15				15			CO DETECTOR
	500		4	A	25		300		
CCTV EXT-5		15				15			AIR DRYER
	500		5	B	26		400	1R	REC
CCTV EXT-6		15				15			G142
	500		6	C	27		100	1R	REC
CCTV EXT-7		15				15			G142
	500		7	A	28		100	1R	REC
CCTV 150A, D		15				15			G159, 159A
	200		8	B	29		200	2R	REC
CCTV G154, G150C, B		15				15			G144
	300		9	C	30		100	1R	REC
CCTV G157, 158		15				15			FRIDGE G157
	200		10	A	31		600	1R	REC
G142		15				15			G157
AUTO DOOR OPENER	300		11	B	32		200	2R	REC
G158		15				15			G155
AUTO DOOR OPENER	300		12	C	33		100	1R	REC
EXIT SIGNS		15				20			COMPRESSOR
	10		13	A	34		746		3#10
F27		15							
	200		14	B	35		746		
F28		15							
	200		15	C	36	3P	746		
F22		15				15			GARAGE DOOR #1
	200		16	A	37		480		3#12
UH-3		15							
	100		17	B	38		480		
UH-2		15							
	100		18	C	39	3P	480		
UH-1		15				15			GARAGE DOOR #2
	100		19	A	40		480		3#12
F-20		15							
	100		20	B	41		480		
F-21		15							
	100		21	C	42	3P	480		

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 5789
CAPACITY: 225 AMP PH.B 5176
MOUNTING: FLUSH PH.C 4306
REMARKS: TOTAL **15271** NOT INCLUDING PART 2

SMS ENGINEERING
SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE EA-600 (PART 1)

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **EA600 (PART 2)** LOCATION: G150
FED FROM: CDP-EA LOCATION: G125

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
		15				15		SPARE
	500		43	A	64			
GATE 1A						15		SPARE
3/C #8 TECK	500		44	B	65			
						15		SPARE
	500	3P	45	C	66			
		15				15		SPARE
	500		46	A	67			
GATE 1B						15		SPARE
3/C #8 TECK	500		47	B	68			
						15		SPARE
	500	3P	48	C	69			
PERIMETER FENCE		15						SPACE
ALARM PANEL - G155	400		49	A	70			
SPARE		15						SPACE
			50	B	71			
SPARE		15						SPACE
			51	C	72			
SPARE		15						SPACE
			52	A	73			
SPARE		15						SPACE
			53	B	74			
SPACE								SPACE
			54	C	75			
SPACE								SPACE
			55	A	76			
SPACE								SPACE
			56	B	77			
SPACE								SPACE
			57	C	78			
SPACE								SPACE
			58	A	79			
SPACE								SPACE
			59	B	80			
SPACE								SPACE
			60	C	81			
SPACE								SPACE
			61	A	82			
SPACE								SPACE
			62	B	83			
SPACE								SPACE
			63	C	84			

VOLTAGE: **120/208V,3Ø,4W** LOADS TOTAL PH.A 1400 NOT INCLUDING PART1
CAPACITY: 225 AMP TOTAL PH.B 1000 NOT INCLUDING PART1
MOUNTING: FLUSH TOTAL PH.C 1000 NOT INCLUDING PART1
REMARKS: TOTAL **18671** INCLUDING PART 1

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SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE EA600 (PART 2)

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **EE-100** LOCATION: PENTHOUSE

FED FROM: CDP-EE LOCATION: PENTHOUSE

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
P-1		20				40		
	3117		1	A	22		8333	
								TR-EE-200
	3117		2	B	23		8333	
	3117	3P	3	C	24	3P	8333	
P-2		20				15		AC-4B
	3117		4	A	25		580	
	3117		5	B	26		580	
	3117	3P	6	C	27	3P	580	
P-5		15				15		AC-5B
	727		7	A	28		580	
	727		8	B	29		580	
	727	3P	9	C	30	3P	580	
P-6		15						
	484		10	A	31			
	484		11	B	32			
	484	3P	12	C	33			
P-12		15						
	727		13	A	34			
	727		14	B	35			
	727	3P	15	C	36			
			16	A	37			
			17	B	38			
			18	C	39			
			19	A	40			
			20	B	41			
			21	C	42			

VOLTAGE: **347/600V,3Ø,4W** LOADS - PH.A 17665

CAPACITY: 225 AMP PH.B 17665

MOUNTING: SURFACE PH.C 17665

REMARKS: TOTAL **52995**

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770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE EE-100

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **EE-200** LOCATION: PENTHOUSE

FED FROM: TR-EE-200 LOCATION: PENTHOUSE

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
		15				15		ELECTRICAL ROOM REC
SPARE			1	A	22		100	1R
						15		ELECTRICAL ROOM REC
			2	B	23		100	1R
						15		ELECTRICAL ROOM REC
		3P	3	C	24		100	1R
SPARE		15				15		ELECTRICAL ROOM REC
			4	A	25		100	1R
						15		MTS BACKBOARD
			5	B	26		460	
								MTS BACKBOARD
		3P	6	C	27	2P	460	
B-1		20				15		MTS BACKBOARD
	1000		7	A	28		460	
								MTS BACKBOARD
	1000	2P	8	B	29	2P	460	
B-2		20				15		P-14
	1000		9	C	30		250	
		2P						
	1000		10	A	31	2P	250	
B-1		20				15		SPARE
CONTROL PANEL	1000		11	B	32			
B-2		20				15		SPARE
CONTROL PANEL	1000		12	C	33			
UH-4		15				15		SPARE
	200		13	A	34			
HWT-1		15				15		SPARE
	100		14	B	35			
EMG LIGHTING- PENTHOUSE		15				15		SPARE
	390		15	C	36			
		15						SPACE
	500		16	A	37			
GATE 2A								SPACE
3/C#8 TECK	500		17	B	38			
								SPACE
	500	3P	18	C	39			
		15						SPACE
	500		19	A	40			
GATE 2B								SPACE
3/C#8 TECK	500		20	B	41			
								SPACE
	500	3P	21	C	42			

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 4110

CAPACITY: 225 AMP PH.B 4120

MOUNTING: SURFACE PH.C 4200

REMARKS: TOTAL **12430**

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770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE EE-200

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **NA-100** LOCATION: G199

FED FROM: CDP-NA LOCATION: G125

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)		Designation
G207		15				15			CRAWLSPACE LIGHTING
REC 2R	200		1	A	22		832	X	
G203		15				15			CRAWLSPACE REC
REC 2R	200		2	B	23		100		
G204		15				15			RM G107, G199, G157
REC 2R	200		3	C	24		1020		LTG
G200		15				15			RM G107, G137
REC 1R	100		4	A	25		610		LTG
G200		15				15			SPARE
REC 2R	200		5	B	26				
G199, G104, G191		15				15			SPARE
REC 4R	400		6	C	27				
G103		15				15			SPARE
REC 2R	200		7	A	28				
G101 FOUNTAIN		15				15			SPARE
REC 1R	300		8	B	29				
G101		15				15			SPARE
REC 1R	100		9	C	30				
G100		15							SPACE
REC 1R	100		10	A	31				
N.EXIT		15							SPACE
REC 1R	100		11	B	32				
AT. SPRINKLER RM		15							SPACE
REC 1R	100		12	C	33				
G194		15							SPACE
REC 1R	100		13	A	34				
G198		15							SPACE
REC 3R	300		14	B	35				
FF-1		15							SPACE
	200		15	C	36				
F-3		15							SPACE
	100		16	A	37				
F-2		15							SPACE
	100		17	B	38				
F-14		15							SPACE
	100		18	C	39				
F-15		15							SPACE
	100		19	A	40				
F-16		15							SPACE
	100		20	B	41				
F-17		15				15		1R	RAIN GAUGE RM G194
	100		21	C	42		100		

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 2342

CAPACITY: 225 AMP PH.B 1400

MOUNTING: FLUSH PH.C 2320

REMARKS: TOTAL **6062**

X= L.V. Controlled Circuit

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770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE NA-100

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **NA-200** LOCATION: G180
FED FROM: CDP-NA LOCATION: G125

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)		Designation
CRAWLSPACE LIGHTING X		15				15			G139A
	1024		1	A	22		200	2R	REC
CRAWLSPACE REC 2R		15				15			G139A
	200		2	B	23		100	1R	REC
SPARE		15				15			G139A
			3	C	24		200	2R	REC
SPARE		15				15			G139A
			4	A	25		100	1R	REC
SPARE		15				15			G139A FLOOR
			5	B	26		100	1R	REC
SPARE		15				15			G139A FLOOR
			6	C	27		100	1R	REC
SPACE						15			G139A FLOOR
			7	A	28		100	1R	REC
SPACE						15			G139A FLOOR
			8	B	29		100	1R	REC
SPACE						15			G192
			9	C	30		500	5R	REC
SPACE						15			DRINKING FOUNTAIN
			10	A	31		300	1R	REC
SPACE						15			G179, G180
			11	B	32		500	5R	REC
SPACE						15			G186, 188, 190
			12	C	33		300	3R	REC
SPACE						15			G192A
			13	A	34		200	2R	REC
SPACE						15			SPARE
			14	B	35				
SPACE						15			SPARE
			15	C	36				
SPACE						15			SPARE
			16	A	37				
SPACE						15			SPARE
			17	B	38				
SPACE						15			SPARE
			18	C	39				
F-29		15							SPACE
	200		19	A	40				
F-4		15							SPACE
	190		20	B	41				
F-1		15							SPACE
	100		21	C	42				

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 2124
CAPACITY: 225 AMP PH.B 1190
MOUNTING: FLUSH PH.C 1200
REMARKS: TOTAL **4514**

X=L.V. Controlled Circuit

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770 Bradford Street Winnipeg MB Canada R3H 0N3
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PANEL SCHEDULE NA-200

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **NA-300** LOCATION: G176
FED FROM: CDP-NA LOCATION: G125

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
G164, G160		15	1	A	22	15		RM G176, G157
REC 3R	300						720	LTG
G160		15	2	B	23	15		SPARE
REC 4R	400							
G176		15	3	C	24	15		SPARE
REC 2R	200							
G176, G177, G178		15	4	A	25	15		SPARE
REC 3R	300							
G206		15	5	B	26	15		SPARE
REC 2R	200							
G205 ATRIUM		15	6	C	27	15		SPARE
REC 4R	400							
G205		15	7	A	28	15		SPARE
REC 1R	100							
SPARE		15	8	B	29	15		SPARE
SPARE		15	9	C	30	15		SPARE
SPARE		15	10	A	31			SPACE
SPARE		15	11	B	32			SPACE
SPARE		15	12	C	33			SPACE
SPACE			13	A	34			SPACE
SPACE			14	B	35			SPACE
SPACE			15	C	36			SPACE
SPACE			16	A	37			SPACE
SPACE			17	B	38			SPACE
SPACE			18	C	39			SPACE
SPACE			19	A	40			SPACE
SPACE			20	B	41			SPACE
F-5		15	21	C	42			SPACE
	190							

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225 AMP
MOUNTING: FLUSH
REMARKS:

LOADS - PH.A 1420
PH.B 600
PH.C 790
TOTAL **2810**

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Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE NA-300

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **NA-400** LOCATION: G201
FED FROM: CDP-NA LOCATION: G125

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
G118		15				15		SPARE
REC 2R	200		1	A	22			
G117		15				15		SPARE
REC 2R	200		2	B	23			
G116		15				15		SPARE
REC 2R	200		3	C	24			
G115		15				15		SPARE
REC 2R	200		4	A	25			
G113		15				15		SPARE
REC 2R	200		5	B	26			
G201		15						SPACE
REC 3R	300		6	C	27			
G108		15						SPACE
REC 1R	100		7	A	28			
G106		15						SPACE
REC 3R	300		8	B	29			
G105		15						SPACE
REC 3R	300		9	C	30			
G208		15						SPACE
REC 2R	200		10	A	31			
G110, G202		15						SPACE
REC 3R	300		11	B	32			
G202 SHREDDER		15						SPACE
REC 2R	200		12	C	33			
G202		15						SPACE
REC 1R	100		13	A	34			
G202		15						SPACE
REC 1R	100		14	B	35			
G112		15						SPACE
REC 1R	100		15	C	36			
G208		15						SPACE
LTG	350		16	A	37			
G113, G115, G116		15						SPACE
LTG	960		17	B	38			
G117, G118		15						SPACE
LTG	480		18	C	39			
SPARE		15						SPACE
			19	A	40			
SPARE		15						SPACE
			20	B	41			
SPARE		15						SPACE
			21	C	42			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225 AMP
MOUNTING: FLUSH
REMARKS:

LOADS - PH.A 1150
PH.B 2060
PH.C 1580
TOTAL **4790**

SMS ENGINEERING
SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE NA-400

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **NA-500 (PART 1)** LOCATION: G131
FED FROM: CDP-NA LOCATION: G125

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
G130 4R		15				15		MENS LOCKER RM
REC	400		1	A	22		1080	LTG
G127, G128		15				15		MENS LOCKER RM
REC 2R	200		2	B	23		1080	LTG
G129		15				15		MENS LOCKER RM
REC 1R	400		3	C	24		1080	LTG
G129		15				15		MENS LOCKER RM
REC 1R	400		4	A	25		1080	LTG
SW. EXIT		15				15		MENS LOCKER RM
REC 1R	100		5	B	26		1080	LTG
G131		15				15		EXERCISE ROOM
REC 2R	200		6	C	27		960	LTG
G131		15				15		EXERCISE ROOM
REC 2R	200		7	A	28		960	LTG
G131		15				15		MEN W.R. SHOWERS & G127/128
REC 2R	200		8	B	29		950	LTG
G131		20				15		PATIO
REC 1R	200		9	C	30		100	1R REC
G131		20				15		N. WALL
REC 1R	200		10	A	31		100	1R REC
G131		20				15		MICROWAVE G137A
REC 1R	200		11	B	32		1000	1R REC
G131		20				15		TOASTER G137A
REC 1R	200		12	C	33		1000	1R REC
G131		20				15		DISHWASHER RM G137A
REC 1R	200		13	A	34		400	1R REC
G131		20				15		TOASTER G137A
REC 1R	200		14	B	35		1000	1R REC
G131		20				15		G134
REC 1R	200		15	C	36		100	1R REC
G131		20				15		G134
REC 1R	200		16	A	37		100	1R REC
G131		15				15		G134
REC 2R	200		17	B	38		300	1R REC
F-10		15				15		G134
	100		18	C	39		300	1R REC
F-11		15				15		DRINKING FOUNTAIN G191A
	100		19	A	40		300	1R
F-12		15				15		G132, G133
	100		20	B	41		200	2R REC
F-13		15				15		G131, G191A
	100		21	C	42		200	2R REC

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 5720
CAPACITY: 225 AMP PH.B 6810
MOUNTING: FLUSH PH.C 5140
REMARKS: TOTAL **17670** NOT INCLUDING PART 2

SMS ENGINEERING
SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE NA-500 (PART 1)

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **NA-500 (PART 2)** LOCATION: G131
FED FROM: CDP-NA LOCATION: G125

Designation		Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)		Designation
E. EXIT			15				15			ADO G128
	1R	100		43	A	64		300		
G136, G135			15				15			ADO G133
REC	4R	400		44	B	65		300		
G191A, G120, G125			15				15			ADO G136
REC	4R	400		45	C	66		300		
G120, G191, G122			15				15			ADO G138
REC	3R	300		46	A	67		300		
E. EXIT			15				15			ADO G119
REC	1R	100		47	B	68		300		
G121			15				15			ADO G127
REC	4R	400		48	C	69		300		
G123			15				15		X	CRAWLSPACE LIGHTING
REC	1R	100		49	A	70		693		
G124			15				15			G132
REC	1R	100		50	B	71		720		LTG
G124			15				15			G132
REC	1R	100		51	C	72		480		LTG
G137	3R		15				15			G133,G134, G134A
		300		52	A	73		800		LTG
G137 TV	1R		15				15			G191
		400		53	B	74		680		LTG
G137 BAR FRIDGE	1R		15				15			G125
		200		54	C	75		678		LTG
SPARE			15				15			G121
				55	A	76		400		LTG
SPARE			15				15			G120, G136, G122
				56	B	77		960		LTG
SPARE			15				15			G119
				57	C	78		250		LTG
SPARE			15				15			G137
				58	A	79		720		
SPACE							15			G137
				59	B	80		600		
SPACE							15			G137
				60	C	81		55		
SPACE							15			G140
				61	A	82		960		
SPACE							15			SPARE
				62	B	83				
SPACE							15			SPARE
				63	C	84				

VOLTAGE: **120/208V,3Ø,4W** LOADS TOTAL PH.A 4973 NOT INCLUDING PART1
CAPACITY: 225 AMP TOTAL PH.B 4560 NOT INCLUDING PART1
MOUNTING: FLUSH TOTAL PH.C 3163 NOT INCLUDING PART1
REMARKS: TOTAL **30366** INCLUDING PART 1

X= L.V. CONTROLLED LIGHTING

SMS ENGINEERING
SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE NA-500 (PART 2)

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **NA-600** LOCATION: G150
FED FROM: CDP-NA LOCATION: G125

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
G151		15				15		WASH BAY
REC 1R	200		1	A	22		720	LTG
G152		15				15		GARAGE
REC 1R	200		2	B	23		840	LTG
G146		15				15		GARAGE
REC 1R	100		3	C	24		720	LTG
G147		15				15		GARAGE
REC 1R	100		4	A	25		720	LTG
G150, G154		15				15		GARAGE
REC 5R	500		5	B	26		720	LTG
N. EXIT		15				15		WORK AREA & ELEC RM
REC 1R	100		6	C	27		600	LTG
S. EXIT		15				15		RM G146, 147, 148, 154
REC 1R	100		7	A	28		720	LTG
G142		15				15		SPARE
REC 2R	200		8	B	29			
G142, G156		15				15		SPARE
REC 2R	200		9	C	30			
G158		15				15		SPARE
REC 1R	100		10	A	31			
G144		15				15		SPARE
REC 1R	100		11	B	32			
G157		15				15		SPARE
REC 2R	200		12	C	33			
G157		15						SPACE
REC 2R	200		13	A	34			
G155		15						SPACE
REC 1R	100		14	B	35			
G150		15						SPACE
REC	500		15	C	36			
SPARE		15						SPACE
			16	A	37			
SPARE		15						SPACE
			17	B	38			
F25		15						SPACE
	200		18	C	39			
F26		15						SPACE
	200		19	A	40			
F23, F24		15						SPACE
	400		20	B	41			
F-6		15						SPACE
	190		21	C	42			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225 AMP
MOUNTING: FLUSH
REMARKS:

LOADS - PH.A 3060
PH.B 3060
PH.C 2810
TOTAL **8930**

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SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE NA-600

PROJECT: East District Police Station
FILE: 04-214-01
DATE: 19-Mar-07

PANEL: **AA-100** LOCATION: PENTHOUSE

FED FROM: LOCATION: PENTHOUSE

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
F-7		15				20		
	727		1	A	22		5000	
								TR-AA-200
	727		2	B	23		5000	
	727	3P	3	C	24	3P	5000	
F-8		15						
	484		4	A	25			
	484		5	B	26			
	484	3P	6	C	27			
P13		15						
	250		7	A	28			
	250		8	B	29			
	250	3P	9	C	30			
			10	A	31			
			11	B	32			
			12	C	33			
			13	A	34			
			14	B	35			
			15	C	36			
			16	A	37			
			17	B	38			
			18	C	39			
			19	A	40			
			20	B	41			
			21	C	42			

VOLTAGE: **347/600V,3Ø,4W**

CAPACITY: 225 AMP

MOUNTING: SURFACE

REMARKS:

LOADS - PH.A 6461

PH.B 6461

PH.C 6461

TOTAL **19383**

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SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE AA-100

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **AA-200** LOCATION: PENTHOUSE

FED FROM: TR-AA-200 LOCATION: PENTHOUSE

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
P-7	200	15	1	A	22	15	100	ROOF REC 1R
GF-1	100	15	2	B	23	15	100	ROOF REC 1R
H-1	100	15	3	C	24	15	100	ELECTRICAL ROOM REC 1R
FF-2	200	15	4	A	25	15	100	ELECTRICAL ROOM REC 1R
ELECTRICAL ROOM LIGHTING	260	15	5	B	26	15	100	MECHANICAL ROOM REC 1R
MECHANICAL ROOM LIGHTING	975	15	6	C	27	15	100	MECHANICAL ROOM REC 1R
SPARE		15	7	A	28	15	100	MECHANICAL ROOM REC 1R
SPARE		15	8	B	29	15		SPARE
SPARE		15	9	C	30	15		SPARE
SPACE			10	A	31	15		SPARE
SPACE			11	B	32	15		SPARE
SPACE			12	C	33	15		SPARE
SPACE			13	A	34	15		SPARE
SPACE			14	B	35			SPACE
SPACE			15	C	36			SPACE
SPACE			16	A	37			SPACE
SPACE			17	B	38			SPACE
SPACE			18	C	39			SPACE
SPACE			19	A	40			SPACE
SPACE			20	B	41			SPACE
SPACE			21	C	42			SPACE

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 700

CAPACITY: 225 AMP PH.B 560

MOUNTING: SURFACE PH.C 1275

REMARKS: TOTAL **2535**

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SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE AA-200

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **PLA** LOCATION: PARKING LOT

FED FROM: CDP-PLA LOCATION: PARKING LOT

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
PARKING LOT REC	1200	15	1	A	16	15	1200	PARKING LOT REC
	1200	2P	2	B	17	2P	1200	
PARKING LOT REC	1200	15	3	C	18	15	1200	PARKING LOT REC
	1200	2P	4	A	19	2P	1200	
PARKING LOT REC	1200	15	5	B	20	15		SPARE
	1200	2P	6	C	21	2P		
PARKING LOT REC	1200	15	7	A	22	15		SPARE
	1200	2P	8	B	23	2P		
PARKING LOT REC	1200	15	9	C	24			SPACE
	1200	2P	10	A	25			SPACE
PARKING LOT REC	1200	15	11	B	26			SPACE
	1200	2P	12	C	27			SPACE
PARKING LOT REC	1200	15	13	A	28			SPACE
	1200	2P	14	B	29			SPACE
SPARE		15	15	C	30			SPACE

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 8400

CAPACITY: 225 AMP PH.B 7200

MOUNTING: CUSTOM PH.C 6000

REMARKS: TOTAL **21600**

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SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE PLA

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **PLB** LOCATION: PARKING LOT

FED FROM: CDP-PLA LOCATION: PARKING LOT

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
PARKING LOT REC	1200	15	1	A	22	15	1200	PARKING LOT REC
	1200	2P	2	B	23	2P	1200	
PARKING LOT REC	1200	15	3	C	24	15	1200	PARKING LOT REC
	1200	2P	4	A	25	2P	1200	
PARKING LOT REC	1200	15	5	B	26	15	1200	PARKING LOT REC
	1200	2P	6	C	27	2P	1200	
PARKING LOT REC	1200	15	7	A	28	15	1200	PARKING LOT REC
	1200	2P	8	B	29	2P	1200	
PARKING LOT REC	1200	15	9	C	30	15	1200	PARKING LOT REC
	1200	2P	10	A	31	2P	1200	
PARKING LOT REC	1200	15	11	B	32	15	1200	PARKING LOT REC
	1200	2P	12	C	33	2P	1200	
PARKING LOT REC	1200	15	13	A	34	15	1200	PARKING LOT REC
	1200	2P	14	B	35	2P	1200	
PARKING LOT REC	1200	15	15	C	36	15	1200	PARKING LOT REC
	1200	2P	16	A	37	2P	1200	
PARKING LOT REC	1200	15	17	B	38	15		SPARE
	1200	2P	18	C	39	2P		
PARKING LOT REC	1200	15	19	A	40			SPACE
	1200	2P	20	B	41			SPACE
SPARE		15	21	C	42			SPACE

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 15600

CAPACITY: 225 AMP PH.B 14400

MOUNTING: CUSTOM PH.C 13200

REMARKS: TOTAL **43200**

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SMS Engineering Ltd. Consulting Engineers
770 Bradford Street Winnipeg MB Canada R3H 0N3
Telephone 204.775.0291 Fax 204.772.2153
sms@smseng.com

PANEL SCHEDULE PLB

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07

PANEL: **PLC** LOCATION: PARKING LOT

FED FROM: CDP-PLA LOCATION: PARKING LOT

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
PARKING LOT REC	1200	15	1	A	22	15		SPARE
	1200	2P	2	B	23	2P		
PARKING LOT REC	1200	15	3	C	24	15		SPARE
	1200	2P	4	A	25	2P		
PARKING LOT REC	1200	15	5	B	26	15		SPARE
	1200	2P	6	C	27			SPACE
PARKING LOT REC	1200	15	7	A	28			SPACE
	1200	2P	8	B	29			SPACE
PARKING LOT REC	1200	15	9	C	30			SPACE
	1200	2P	10	A	31			SPACE
PARKING LOT REC	1200	15	11	B	32			SPACE
	1200	2P	12	C	33			SPACE
PARKING LOT REC	1200	15	13	A	34			SPACE
	1200	2P	14	B	35			SPACE
PARKING LOT REC	1200	15	15	C	36			SPACE
	1200	2P	16	A	37			SPACE
PARKING LOT REC	1200	15	17	B	38			SPACE
	1200	2P	18	C	39			SPACE
PARKING LOT REC	1200	15	19	A	40			SPACE
	1200	2P	20	B	41			SPACE
PARKING LOT REC	1200	15	21	C	42			SPACE

VOLTAGE: **120/208V,3Ø,4W**

CAPACITY: 225 AMP

MOUNTING: CUSTOM

REMARKS:

LOADS - PH.A 8400

PH.B 8400

PH.C 8400

TOTAL **25200**

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PANEL SCHEDULE PLC

PROJECT: East District Police Station

FILE: 04-214-01

DATE: 19-Mar-07