END

1.1 General

.1 This Section covers items common to Sections of Division 16. This section supplements requirements of Division 1.

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

1.2 Time/Date Sensitive Electronic Equipment and Software

.1 All time/date sensitive electronic equipment and software provided on this project shall be year 2000 compatible and shall be based on the use of full, unabbreviated, unambiguous discrete time and date codes.

1.3 Codes and Standards

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

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

.3 Abbreviations for electrical terms: to CSA Z85.

.4 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.

.5 Notify the Contract Administrator of any discrepancies or conflictions with any regulation in accordance with B4. Failing such notification, meet all such requirements without change to the contract price.

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

1.4 Care, Operation and Start-up

.1 Upon completion of the project, demonstrate the operation of all equipment in the presence of the City of Winnipeg, or his representative, and the Contract Administrator. Obtain signed certification from the City of Winnipeg 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, calibrate, test and commission components as specified in subsequent sections.

.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 with all aspects of its care and operation.

.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 Submission.

1.5 Voltage Ratings

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

1.6 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.

1.7 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.

.6 Equipment Installation:
.1 Provide minimum 1000mm (39.4") clearance and access space at all equipment access doors/panels, breakers, switches, controls, etc.
.2 Equipment to be located away from pipe shafts and all fluid piping.
.3 Equipment and cable shall not restrict and/or interfere with necessary access space required to safely service mechanical equipment (ventilation fans, filters, etc.) which are existing and/or to be installed under this contract.
.4 Prior to equipment installation, confirm proposed installation location with Consultant.
.5 Provide scaled drawings for approval, showing layouts of electrical rooms. Drawings shall include dimensions of actual equipment being used and dimensioned locations of equipment. Submit these scaled drawings with shop drawings of electrical distribution equipment. Submit these scaled drawings with shop drawings of electrical distribution equipment.

1.8 Responsibility

.1 Be responsible for any damage caused the City of Winnipeg, 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.

1.9 Electric Motors, Equipment and Controls

.1 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.

.2 Control wiring and conduit is specified in Division 16 except for conduit, wiring and connections below 50V which are related to temperature control systems specified in Division 15 and/or shown on mechanical drawings.

1.10 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 Y1-1-1955.
.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks, and fastenings to prevent rusting.

1.11 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.

.5 All tradesmen shall carry all tools on their person at all times. Any tool not in use shall be under lock and key in an area authorized by the Contract Administrator.

1.12 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 of Winnipeg, 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 replaced or refinished if so designated by the Contract Administration.

1.13 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.

1.14 Request for Substitutes

.1 Applications for approval of substitutes, or alternate materials, or methods, as substitutions for those specified or shown, shall be submitted in accordance with B6.

1.15 Engineering Observations

.1 Contractor's work will be observed periodically by the City of Winnipeg, 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 the City of Winnipeg, 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.

1.16 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 of Winnipeg or their 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.

1.17 Identification of Equipment

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

.2 Nameplates:

.1 Lamacoid 3mm thick plastic engraving sheet, shall be white with black letters or as directed, mechanically attached with self tapping screws. Nameplates for equipment fed from emergency power or from emergency UPS power (increase nameplate size as required to suit wording) shall be white with red letters.

NAMEPLATE SIZES

Size 1	10 x 50mm	1 line	3mm high letters
Size 2	12 x 70mm	1 lines	5mm high letters
Size 3	12 x 70mm	2 lines	3mm high letters
Size 4	20 x 90mm	1 line	8mm high letters
Size 5	20 x 90mm	2 lines	5mm high letters
Size 6	25 x 100mm	1 line	12mm high letters
Size 7	25 x 100mm	2 lines	6mm high letters

.3 Labels:
.1 Embossed plastic labels with 6mm high letters unless specified otherwise.

.4 Fabrication details of all nameplates labels and wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.

.5 Allow an average of twenty-five (25) letters per nameplate and label.

.6 Room names and numbers used shall be actual room names and numbers that will be used on the project. Division 16 to co-ordinate and confirm with trades involved.

.7 Identification to be English.

.8 Co-ordinate names of equipment and systems with Division 15 to ensure that identical names are used.

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

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

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

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

.13 Nameplates for control devices: indicate equipment controlled.

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

.15 To match existing where applicable.

.16 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.

.17 All non-patient care receptacles in patient care areas shall have a "Housekeeping" lamacoid near top of cover plate.

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

1.18 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 Code: 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.

1.19 Conduit, Outlet Boxes 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.

1.20 Wiring Terminations

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

1.21 Manufacturers and CSA Certification Labels (or equivalent)

.1 Visible and legible after equipment is installed.

1.22 Warning Signs

.1 As specified and to meet requirements of Electrical Inspection Department and Contract Administrator.

.2 Decal signs, minimum size 175 x 250mm.

1.23 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 the City of Winnipeg's representative.

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

.3 At each remote annunciator provide a small scale floor plan c/w room numbers. Device tags shall utilize the as-built room numbers.

.4 Drawings: 600 x 900mm minimum size.

1.24 Location of Outlets

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

.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm, and information is given before installation.

.3 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

1.25 Load Balance

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltage at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test. Provide copy of report in all maintenance manuals.

1.26 Conduit and Cable Installation

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: Schedule 40 steel pipe, sized for free passage of conduit, and protruding 50mm each side.

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

.3 Install cables, conduit 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.

1.27 Field Quality Control

.1 Conduct and pay for following tests:
.1 Power distribution system including phasing, voltage, grounding and load balancing.
.2 Circuits originating from branch distribution panels.
.3 Lighting and its control.
.4 Motors, heaters, and associated control equipment including sequenced operation of systems where applicable.
.5 Systems: Fire alarm system, security system, communication systems.
.6 Any other electrical systems.

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

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

.4 Insulation resistance testing:
.1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
.2 Megger 350V - 600V circuits, feeders and equipment with a 1000V instrument.
.3 Check resistance to ground before energizing.

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

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

.7 Submit test results for Contract Administrator's review.

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

1.28 Co-ordination Study

.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. If any existing breakers must be adjusted for proper coordination, other breakers affected must be included in the study and adjusted as required for proper coordination. Hydro protective devices to be included in the study.
.1 For the new distributions include all existing upstream overcurrent protection.
.2 Drawings of existing distributions are not available. Visit site to obtain information.
.3 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 16 contractor to provide time-current curves of all breakers, fuses, etc.
.4 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.

.5 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.

.6 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.

.7 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.

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

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

.10 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.

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

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

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

.14 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, engineering 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.

.15 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.

.16 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 Submission price.

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

.18 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
.5 Cutler Hammer

1.29 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, an 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.

1.30 Shop Drawings, Product Data and Samples

.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 16 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 16 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.

1.31 Mounting Heights

.1 Mounting height of equipment is from finished floor to centre line 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 Nurse call and receptacles at bed locations: 1525mm.
.14 As per Architectural elevations.
.15 Heights as above or at bottom of nearest block or brick course.
.16 Heights to match existing where applicable.

1.32 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 five (5) 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 Record Drawings in ACAD format. 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.)

1.33 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.

1.34 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. Refer also to 4.1 Care, Operation and Start-Up.

.9

.1 Carry out on-site testing and commissioning of all high voltage and low voltage switchgear including:

- .1 Visual inspection
- .2 Operational tests
- .3 Meggar tests
- .4 Contact resistance tests
- .5 Phasing checks
- .6 Metering
- .7 Relay operation
- .8 Fluid levels
- .9 Hi-pot tests

.2 Submit a report that includes test results, observations, summary, etc. Test report to clearly state that all results are acceptable.

1.35 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 Div. 16 - Electrical in Bid Submission price. Division 16 - Electrical to employ and pay appropriate Subcontractor whose work is involved, for carrying out work described above.

.2 Perform all cutting and patching required for installing electrical systems.

.3 Division 16 shall retain services of Contractor to carry out actual work involved in cutting wall openings, floor openings and the like, and in patching up after installation has been completed.

.4 Division 16 shall mark all openings required for conduits, cables, ducts, and the like.

.5 Cutting to be 'neat' sizes. Patch all edges such as cover plates, etc. Hide cut edges.

.6 If, in the opinion of Contract Administrator, cutting of holes has been improperly performed (i.e. too large for conduits or cables) Division 16 - Electrical to do all patching as per original specifications and all costs will be borne by him.

1.36 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.

1.37 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.

1.38 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.

1.39 Security Fasteners and Hardware

.1 Refer to other sections of the specifications for Security Fasteners. Division 16 to install security fasteners required for Division 16 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.

1.40 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.

1.41 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 the City of Winnipeg 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.

1.42 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 Submission.

1.43 Demolition of Existing Electrical

.1 Remove all unnecessary existing electrical equipment, wiring, fixtures, in those portions of the existing building which are being remodelled or demolished. All devices/fixtures, etc. are not necessarily shown on the plans. The City of Winnipeg shall select from the materials and/or equipment remaining that which he wishes to retain, and the remainder shall be removed from the site. Any electrical equipment in remodelled sections or in structures removed or altered, adjacent to new work, necessary for the operation of existing building, shall be relocated as necessary. All existing equipment re-used shall be made good and guaranteed. Power interruptions to be kept to a minimum and shall be at a time suitable to the building occupant. Refer to Architectural plans for demolition areas/phasing.

.2 Drawings do not show all electrical requiring removal to accommodate renovations such as receptacles, switches, lights, starters, motors, nurse call systems, components, heaters, etc. Division 16 shall visit site, refer to architectural and electrical drawings and include all costs for demolition.

.3 Refer to Specification Section 16195 - Work in Existing Building.

1.44 Spare Parts

.1 The Contractor shall submit 15 calendar days after award of Contract 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.

1.45 CASH ALLOWANCES

.1 Refer to Contract Documents for UPS system cash allowance. All overhead, profit, labour, material, etc. for the installation of the UPS system shall be included in the Div. 16 price. Refer to 16610.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Cast-in-Place Concrete	Section 03300
.2	Electrical General Requirements	Section 16010
.3	Concrete Encased Duct Bank and Manholes	Section 16105
.4	Direct Buried Underground Cable Ducts	Section 16107
.5	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.6	Wires and Cables	Section 16122

PART 2 - PRODUCTS

2.1 Cable Protection

.1 38 x 140 mm planks pressure treated with coloured, 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" and name of electrical system 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 Section 02223 - Excavating, Trenching and Backfilling, 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 Maintain 150mm minimum separation between cables of different circuits. Maintain 300 mm horizontal separation between low and high voltage cables. When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position. At crossover, maintain 75mm minimum vertical separation between low voltage cables and 150mm between high voltage cables. Maintain 300mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position. Install treated planks on lower cables 0.6 m in each direction at crossings.

.6 After sand protective cover specified 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.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

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

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

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

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

3.3 Markers

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

.2 Mark underground splices.

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

3.4 Field Quality Control

.1 Perform tests in accordance with Section 16010 - Electrical General Requirements.

.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 terminating, perform insulation resistance test with 1000 V megger on each phase conductor. For mineral insulated (M.I.) cable co-ordinate meggar voltage rating with manufacturer.
.2 Check insulation resistance after each 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.
.3 High Potential (Hipot) Testing.
.1 Conduct hipot testing at 100% of original factory test voltage in accordance with IPCEA recommendations.
.4 Leakage Current Testing.
.1 Raise voltage in steps from zero to maximum values as specified by IPCEA for type of cable being tested.
.2 Hold maximum voltage for specified time period by IPCEA.
.3 Record leakage current at each step.

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

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

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Excavation and Backfilling Section 02223

.2 Electrical General Requirements Section 16010

.3 Wire and Cables Section 16122

PART 2 - PRODUCTS

2.1 PVC Ducts and Fittings

.1 Rigid PVC ducts for direct burial: with expanded flange ends, with minimum wall thickness at any point of 3.0 mm. Nominal length: 3 m plus or minus 12 mm.

.2 Rigid PVC split ducts.

.3 Rigid PVC couplings, reducers, bell end fittings, plugs, caps, adaptors as required to make complete installation.

.4 Rigid PVC 90 deg. and 45 deg. bends as required.

.5 Rigid PVC 5 deg. angle couplings as required.

.6 Expansion joints every 100 m and as required.

2.2 Solvent Weld Compound

.1 Solvent weld compound for PVC duct joints.

2.3 Fibreglass Ducts

.1 Fibreglass reinforced epoxy underground cable duct: watertight self-extinguishing type.

.2 Couplings, reducers, plugs, caps, adaptors, and supports as required to make a complete installation.

.3 Expansion joints every 100 m and as required.

2.4 Plastic Polyethylene Pipe

.1 Flexible plastic polyethylene pipe with approved couplings and fittings required to make a complete installation.

2.5 Cable Pulling Equipment

.1 6 mm stranded nylon pull rope tensile strength 5 kN.

2.6 Markers

.1 Concrete type cable markers: as indicated, with words: "cable", "joint" or "conduit" and name of electrical system impressed in top surface, with arrows to indicate change in direction of duct runs.

PART 3 - EXECUTION

3.1 Installation

.1 Install duct in accordance with manufacturer's instructions.

.2 Clean inside of ducts before laying.

.3 Ensure full, even support every 1.5 m throughout duct length.

.4 Slope ducts with 1 to 400 minimum slope.

.5 During construction, cap ends of ducts to prevent entrance of foreign materials.

.6 Pull through each duct wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.

.7 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.

.8 Install markers as required.

.9 Clearly show locations on Record Drawings c/w dimensions from building, curbs, property lines, etc.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

1.2 Location of Conduit

.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.

PART 2 - PRODUCTS

2.1 Conduits

.1 Rigid galvanized steel threaded conduit.

.2 Epoxy coated conduit: with zinc coating and corrosion resistant epoxy finish inside and outside.

.3 Electrical metallic tubing (EMT): with couplings. Minimum size shall be 19mm.

.4 Rigid pvc conduit.

.5 Flexible metal conduit and liquid-tight flexible metal conduit.

.6 FRE conduit: Size 75 mm and above.

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 U channel type supports for two or more conduits at 1500 mm oc. (Surface mounted or suspended).

.4 Six mm dia. galv. threaded rods to support suspended channels.

2.3 Conduit Fittings

.1 Fittings for raceways: to CSA C22.2 No. 18.

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

.3 Factory "ells" where 90 deg. bends are required for 25 mm and larger conduits.

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

.5 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.

.6 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 100 or 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 c/w 3m spare length at each conduit end.

PART 3 - EXECUTION

3.1 Installation

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

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

.3 Use rigid galvanized steel threaded conduit where specified.

.4 Use epoxy coated conduit in corrosive areas.

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

.6 Use rigid pvc conduit or FRE duct for underground installations.

.7 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.

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

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

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

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

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

.13 Mechanically bend steel conduit over 19 mm dia.

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

.15 Install fish cord in empty conduits.

.16 Run a minimum of 2-25 mm spare conduits up to ceiling space and 2-25 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.

.17 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.

.18 Dry conduits out before installing wire.

.19 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.

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

.21 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.

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

.23 Provide separate conduit system for emergency distribution.

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

.25 Refer to 16010 for identification requirements.

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

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 or surface channels.

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

.6 Do not locate conduits less than 150 mm parallel to steam or hot water lines with minimum of 75 mm at crossovers.

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

3.3 Concealed Conduits

.1 Do not install horizontal runs in masonry walls.

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

3.4 Conduits in Cast-in-place Concrete

.1 Except with the approval of the Structural Engineer, all conduit runs embedded in concrete shall not be larger in outside diameter than one quarter (1/4) the thickness of the slab, wall, or beam in which they are embedded, nor shall they be spaced closer than three diameters on centre, nor so located as to impair unduly the strength of the construction. Where installed in columns, the conduit shall be placed in the centre of the column and then offset to the outlet box. In no case shall the conduits be placed so that there is less than 25mm of concrete covering. All conduit runs in concrete shall be inspected and approved by Structural Engineer or his representative before concrete is poured. Conduit shall not be embedded in floating concrete slab construction unless specifically indicated otherwise.

.2 Protect conduits from damage where they stub out of concrete.

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

.4 Where conduits pass through waterproof membrane provide oversized sleeve before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Organize conduits in slab to minimize cross-overs.

3.5 Conduits Underground

.1 Slope conduits to provide drainage.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Electrical General Requirements	Section 16010
.2	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.3	Cabletroughs	Section 16114
.4	Fastenings and Support	Section 16191

PART 2 - PRODUCTS

2.1 Materials

.1 Conductors in Conduit:
- .1 Type: RW90
- .2 Conductors:
  - .1 Solid Copper #10 AWG and smaller.
  - .2 Stranded Copper #8 AWG and larger.
  - .3 Sized as indicated (Minimum # 12 AWG).
- .3 Insulation: cross link polyethylene (RW90), (RWU90), 90 deg. C.
- .4 Configuration: Single conductor.
- .5 Voltage Rating: Minimum 600V.
- .6 Certification: CSA C22.22 No. 38 or latest revision.

.2 Armored Cable (BX):
- .1 Type: AC90
- .2 Conductors:
  - .1 Solid Copper #10 AWG and smaller.
  - .2 Stranded Copper #8 AWG and larger.
  - .3 Sized as indicated (Minimum # 12 AWG).
- .3 Insulation: cross link polyethylene (XLPE), 90 deg. C.
- .4 Configuration: Multi-conductor, as required, c/w a separate bare CU ground wire.
- .5 Voltage Rating: Minimum 600V
- .6 Certification: CSA C22.22 No. 51 or latest revision.

.3 Armored Cable (TECK):
- .1 Type: TECK
- .2 Conductors:
  - .1 Solid Copper #10 AWG and smaller.
  - .2 Stranded Copper #8 AWG and larger.
  - .3 Sized as indicated (Minimum # 12 AWG).
- .3 Insulation: cross link polyethylene (RW90), 90 deg. C.
- .4 Configuration: Multi-conductor, as required, c/w a separate bare CU ground wire.

.5 Colour Code: Black, red, blue and white in 4/C cable. Cables of more than 4/C to be number coded.
.6 Voltage Rating: 1KV, 5KV, or 15KV as indicated.
.7 Inner Jacket:
.1 Black polyvinyl chloride (PVC)
.2 Low Flame Spread (LFS)
.3 Low Gas Emission (LGE)
.8 Armor: Inter-locked aluminum
.9 Outer Jacket:
.1 Black polyvinyl chloride (PVC), -40 deg. C
.2 Low Flame Spread (LFS)
.3 Low Gas Emission (LGE)
.10 Flame Rating: FT4
.11 Certification: CSA C22.22 No. 131 or latest revision.

.4 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.

.5 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.

.6 Low Voltage Control Cables:
.1 Type: LVT
.2 Conductor: Solid Copper #18 AWG
.3 Insulation: Thermoplastic, colour coded
.4 Configuration: single, two conductor - parallel, three or more conductors twisted
.5 Voltage Rating: 30V
.6 Outer Jacket: thermoplastic
.7 Certification: CSA C22.22 No. 35
.8 Flame Rating: FT4

.7 Mineral Insulated Cables:
.1 Type: M.I., two hour fire rated.
.2 Conductors:
.1 Solid Copper Sized as indicated
.3 Insulation: magnesium oxide
.4 Configuration: Single, two, three or four conductor as indicated.
.5 Voltage Rating: 600V
.6 Outer Jacket: copper
.7 Acceptable manufacturers: Pyrotenax (BICC Cables).

.8 Pressure type connectors, fixture type splicing connectors, cable clamps and lugs as required.

.9 RA90 Cables
.1 Single conductor RW90 insulation, minimum 600V, -40°C
.2 Stranded copper, size as indicated.
.3 Liquid and vapour tight corrugated aluminum sheath.
.4 Overall PVC jacket rated FT-4.

.10 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 Division 15.
.7 Installed as per manufacturer's instructions.

PART 3 - EXECUTION

3.1 General

.1 To Minimize Voltage Drop
.1 There shall be no joints in branch circuits feeding patient care receptacles.
.2 All branch circuits feeding patient care receptacles shall be minimum #10 AWG.
.3 All branch circuits feeding patient care receptacles shall be minimum #8 AWG for all circuits longer than 60 feet.
.4 All non-patient care 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.
.5 All branch circuit wiring and conduit shall be installed to minimize voltage drop. Install additional conduit runs as required to take the most direct and shortest route to outlets, light fixtures, etc.

3.2 Installation in Raceways

.1 Install wiring as follows:
.1 In conduit systems in accordance with Section 16111.
.2 In underground ducts in accordance with Section 16106.
.3 In wireways and auxiliary gutters in accordance with Section 16116.
.4 Ensure conduits are dry and free of debris before pulling cables.
.5 Colour coding and identification as per this section.
.6 Wires in outlet, junction and switch boxes, not having a connection within box shall not be spliced, but shall continue unbroken through the box.
.7 Branch circuits exceeding 21 metres shall be #10 AWG, branch circuits exceeding 35 metres shall be #8 AWG.

3.3 Installation of Single Conductor Cables

.1 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.

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

.3 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 Flexible Armoured Cable

.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.

3.5 Installation of Mineral - Insulated Cables

.1 Mineral insulated (MI) wiring shall have a minimum of two hour fire rating unless otherwise noted. Mineral insulated (MI) cables shall be as manufactured by (Pyrotenax) (BICC 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 Division 16 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. Division 16 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 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.

.4 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.

.5 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.

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

3.6 Installation in Equipment

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

3.7 Terminations

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

3.8 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 16010 for additional requirements.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

.2 Conduits, Conduit Fastenings and Conduit Fittings Section 16111

.3 Fastenings & Supports Section 16191

1.2 Location

.1 Locate splitters, junction and pull boxes as indicated or as needed for each system.

PART 2 - PRODUCTS

2.1 Splitters

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

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

.3 Minimum three spare terminals on each set of lugs in splitters.

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

.5 Weatherproof where installed outdoors.

.6 Enclosures in other areas to suit environment.

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.

.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 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard. Cabinets to be flush or surface mounted as indicated.

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

2.4 CUSTOMER SERVICE TERMINATION ENCLOSURE

.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 individual sub breakers. Refer to single line distribution schematic if required.

.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

.19 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.

.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 16010 - Electrical General Requirements.

.2 Identify splitters with size 7 nameplates.

.3 Identify junction and pull boxes with size 3 nameplates.

.4 Identify cabinets with size 5 nameplates.

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

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

.2 Conduits, Conduit Fastenings and Conduit Fittings Section 16111

PART 2 - PRODUCTS

2.1 Outlet and Conduit Boxes General

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

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

.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 c/w holes on centres to reject all other switches.

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

.7 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.

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

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

2.2 Sheet Steel Outlet Boxes

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

.2 Electro-galvanized steel device boxes for flush installation in drywall and minimum size 102mm square outlet boxes with extension and square cornered tile covers as required.

.3 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, sized as required for the installation.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

2.3 Masonry Boxes

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

2.4 Concrete Boxes

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

2.5 Floor Boxes

.1 Concrete tight electro-galvanized sheet steel floor boxes with gasket, floor plate, levelling screws and adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles.

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.

.4 Raised floor outlet boxes - Wiremould #AC10105-2 c/w all necessary outlets, faceplates and accessories. Carpet or tile flange as per Architectural.

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 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.

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

.7 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.

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

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

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

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

.12 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.

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

.14 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.

.15 Co-ordinate locations with millwork.

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

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

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

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

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

.21 Locate raised floor outlet boxes in coordination with the City of Winnipeg's furniture. Coordinate as required.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

.2 Outlet Boxes, Conduit Boxes and Fittings Section 16132

1.2 Submittals

.1 Submit shop drawings and product data in accordance with Section 16010.

PART 2 - PRODUCTS

2.1 Switches

.1 Toggle operated general purpose AC Switches 15A and 20A 120Vac and 347Vac single pole, double pole, three-way and four-way switches as indicated, with the following features:
.1 Terminal holes approved for No. 10 AWG wire.
.2 Silver alloy contacts.
.3 Urea molding.
.4 Suitable for back and side wiring.
.5 Brown toggle for normal power; red toggle for emergency power.
.6 Fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.2 Switches of one manufacturer throughout project.

.3 Switches to be premium specification grade.

.4 Acceptable manufacturers:

Manufacturer	120 Volt
Hubbell	1200 Series
Bryant	4800 Series
Leviton	1200 Series
Pass & Seymour	AG-1 Series
Smith & Stone	4-4800 Series
Slater	710 Series

2.2 Receptacles

.1 Duplex receptacles, CSA type 5-15 R, 125 Vac, 15 A, U ground, with following features:
.1 Nylon face, brown or ivory for normal power, red for emergency power.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Double wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 VAC, 15 A, U ground with following features:
.1 Nylon face, brown or ivory for normal power, red for emergency power.
.2 Suitable for No. 10 AWG for back and side wiring.

.3 Receptacles to be orange face isolated ground type where indicated. Provide a separate insulated ground wire and a separate neutral for each isolated ground circuit.

.4 Receptacles of one manufacturer throughout project.

.5 Acceptable manufacturers: Hubbell, Arrow Hart, Bryant, Pass & Seymour, Slater. Catalogue No. 5262 for all manufacturers.

.6 Acceptable manufacturers for ground fault receptacles shall be:
.1 Arrow Hart - GF 5242
.2 Bryant - GFR 52FT
.3 Hubbell - GF 5252
.4 Pass & Seymour - 1591-R

.7 Duplex safety receptacles in public waiting areas and public lounges shall be Hubbell #SG-62.

.8 Receptacles to be grey face type for all circuits connected to UPS circuits.

2.3 Special Wiring Devices

.1 Special wiring devices: as indicated on drawings.

.2 Pushbutton stations to be flush or surface mounted as required. Units to be complete with up/down or start/stop buttons, as required, and green pilot light.

.3 Range outlets to be NEMA #14-50, 125/250V, 50 Amp., black, c/w cordset.

2.4 Incandescent Lighting Dimmer Controls

.1 Dimmer control devices to have a calibrated linear slide control lever from 0% to 100%. A separate ON/OFF switch or the bottom position of slider to have a positive OFF switch to turn off current flow to lamps.

.2 Dimmers shall be rated at 1500, 1000 or 600 watts as required by connected load plus 20% spare capacity.

.3 Colour of dimmer snap-on cover to be as selected by the Contract Administrator or as indicated on the drawings.

.4 Provide a separate neutral wire for each dimmer circuit.

.5 Approved Manufacturers
.1 Lutron Nova NT-1 Series
.2 Leviton Monet MN-IL Series

2.5 Fluorescent Lighting Dimmer Controls

.1 Dimmer control devices to have a calibrated linear slide control lever from 5% to 100%. A separate ON/OFF switch or the bottom position of slider to have a positive OFF switch to turn off current flow to lamps.

.2 Colour of dimmer snap-on cover to be as selected by the Contract Administrator or as indicated on the drawings.

.3 Provide a separate neutral wire for each dimmer circuit.

.4 Approved ballasts: Lutron; Advance Mark X; Philips Ecotron

.5 Approved Manufacturers:
.1 Lutron Nova NTF-10 series rated at 16 Amps.
.2 Leviton Monet MNX-IL Series.

2.6 Cover Plates

.1 Cover plates from one manufacturer throughout project.

.2 Stainless steel cover plates for wiring devices mounted in flush-mounted outlet boxes to be minimum plate thickness of 1.0mm.

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

.4 Cast gasketted cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.5 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.6 Weatherproof cover plates complete with gaskets for single receptacles or switches as indicated.

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 specified in Section 16010 or as indicated.

.4 Where pilot lights are required, or shown on the drawings, install flush neon pilots in outlet box grouped with associated switch.

.5 Study the Architectural plans and co-operate with other trades so that the location and elevation of switch outlets shall not necessitate any unnecessary cutting of dadoes, tile, fitments, etc. If this is not done, this Contractor will be required to move these outlets at no additional cost to the Contract. Properly locate all switches with reference to door swing, regardless of indicated position or doorswing shown on electrical drawings.

.6 Where finished construction of walls consist of a symmetrical pattern of finish materials, install wall switches where directed by the Contract Administrator.

.7 Light switches in Kindergarten and Nursery Rooms shall be MTD at .9 (3'-0") above finished floor on the strike side of the door.

.8 Switches shall be mounted 1.4m (4'-6") above finished floor on the strike side of the door.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles horizontally at height specified in Section 16010 or as indicated.

.3 Install cordsets on ranges and dryers.

.4 Where switch and convenience outlets are shown close to one another, mount receptacles below and in line with the switch.

.5 Where finished construction of walls consist of a symmetrical pattern of wood or other panels, install and locate receptacles and switches as directed to suit the pattern.

.6 Suitably ground all receptacles with #12 green insulated wire to outlet box.

.7 Flush floor mounted duplex receptacle to be as specified but mounted in Thomas & Betts flush floor box complete with gaskets, floor plate, levelling screws and plate assembly.

.3 Coverplates:
.1 Install suitable common cover plates where wiring devices are ganged.
.2 Do not use cover plates intended for flush outlet boxes on surface-mounted boxes.
.3 Provide a coverplate on each outlet.

3.2 Identification

.1 Identify receptacles with size 1 nameplate indicating panel and circuit number. Nameplates to be mechanically fastened. Refer to Section 16010.

END

PART 1 - GENERAL

1.1 References

.1 CSA C22.2No.65-1956(R1965) Wire Connectors.

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

PART 2 - PRODUCTS

2.1 Materials

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors: 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.

PART 3 - EXECUTION

3.1 Installation

.1 Remove insulation carefully from ends of conductors and:
.1 Install pressure type wire connectors and tighten.
.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 C22.2 No.65.
.3 Install fixture type connectors and tighten. Replace insulating cap.
.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Basic Products/Workmanship	Section 01600
.2	Electrical General Requirements	Section 16010
.3	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.4	Cabletroughs	Section 16114
.5	Wires and Cables	Section 16122

PART 2 - PRODUCT

2.1 Support Channels

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended or set in poured concrete walls and ceilings or as required.
.1 Manufacturers: B-Line, Burndy, Electrovert, Unistrut, Pilgrim, Pursley.

PART 3 - EXECUTION

3.1 Installation

.1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with cast in or 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. Provide additional support as required.

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

.6 Fasten exposed conduit or cables to building construction or support system using straps.
.1 One-hole malleable iron 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 at 1500 mm oc spacing.

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

.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.

.14 Threaded rod to be minimum 6 mm diam. galv. or nickel plated. Black steel rod is not acceptable.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Mechanical Specifications	Division 15000
.2	Electrical General Requirements	Section 16010
.3	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.4	Wires and Cables	Section 16122
.5	Outlet Boxes, Conduit Boxes and Fittings	Section 16132
.6	Disconnect Switches - Fused and Non-Fused up to 1000V	Section 16440
.7	Motor Starters to 600V	Section 16811

1.2 System Description

.1 Provide complete electrical power and control connections for mechanical equipment, except as noted herein.

PART 2 - PRODUCTS

2.1 Materials

.1 Include motor starters, disconnects, conduit, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical equipment, unless otherwise indicated.

.2 Include pushbutton stations, motor protective switches, interlocks, conduit, wire, devices and fittings required to provide control wiring for mechanical equipment except for temperature/humidity control systems.

.3 Unless otherwise noted, motors and control devices shall be supplied by Div. 15. Motor horsepower ratings shall be as shown in the Div. 15 specifications. Motor voltage and phase ratings shall be as shown on the Div. 16 drawings.

2.2 Exterior Equipment

.1 All equipment mounted on the exterior of the building shall be weatherproof.

PART 3 - EXECUTION

3.1 Power Wiring

.1 Install power feeders, starters, disconnects and associated equipment and make connections to all mechanical equipment.

.2 Install branch circuit wiring for mechanical systems control panels, time clocks and control transformers. Control panels for equipment on emergency power to be connected to emergency branch circuits.

.3 Install main power feeders to starter/control panels furnished by Div. 15. Install branch circuit wiring for motors, electric coils, etc.

3.2 Controls

.1 Install all electrical controls except controls supplied under Division 15, unless otherwise noted herein. Controls which have both electrical and mechanical connections shall be installed by the trade supplying the control.

.2 Wire and connect remote thermostats, control panels, P/E switches, etc. for furnaces, condensing units, force flows, gas-fired unit heaters, electric heaters and rooftop HVAC units. Interlock rooftop units to condensing units as required.

.3 Wire and connect float switches, pressure switches, alternators, alarms, etc. for sump pumps, sewage pumps, domestic hot water recirculating pumps, booster pumps, jockey pumps and compressors.

.4 Wire and connect control transformers, sensors, solenoids for auto-flush urinals, electronic faucets and wash basins.

.5 Install, wire and connect controls which are an integral part of any packaged unit and are supplied by the trade supplying the packaged unit. Include wiring for controls for such items as roof-top air handling units, boilers, etc.

.6 Section 15900 shall supply and install all conduit, wire, devices and fittings required to wire and connect control systems specified in 15900. Control wiring shall be installed in conduit.

.7 Wire and connect electrical interlocks for starters supplied by Div. 16.

.8 Wire and connect hi-limit cutouts for remotely mounted electric heating coils provided by Div. 15.

.9 Wire and connect thermistor control devices, built-in to large motors, to motor starters as per wiring diagrams provided by Div. 15.

3.3 Fire Protection (Sprinkler and Standpipe)

.1 Wire and connect the flow, pressure and tamper switches, installed on the sprinkler and standpipe systems, to separate zones in the fire alarm control panel, as indicated. Refer to sprinkler shop drawings for the exact location of these switches.

.2 Wire and connect fire pump controller supervisory signals to fire alarm control panel.

.3 Provide an E.O.L.R. for each zone where required and locate adjacent to monitored device.

3.4 Coordination

.1 Refer to mechanical drawings for the exact location of motor control devices, and other mechanical equipment requiring an electrical connection.

.2 Obtain full information from Div. 15, regarding wiring, controls, overload heaters, equipment ratings and overcurrent protection. Notify the Div. 15 subcontractor, at once, if any information provided is incorrect or unsatisfactory.

.3 Coordinate control wiring requirements with Div. 15 and provide all control wiring and connections as required to make the control systems operate as specified.

.4 Refer to Div. 15 specifications for any further electrical requirements.

3.5 Shop Drawing Review

.1 Review Div. 15 equipment shop drawings and adjust breaker/feeder sizes as required.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Mechanical Specifications	Section 15000
.2	Electrical General Requirements	Section 16010
.3	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.4	Wires and Cables	Section 16122
.5	Outlet Boxes, Conduit Boxes and Fittings	Section 16132
.6	Wiring Devices	Section 16141
.7	Disconnect Switches - Fused and Non-Fused up to 1000V	Section 16440

1.2 System Description

.1 Make all required electrical connections to devices, equipment, appliances, etc. furnished by other trades or the City of Winnipeg, 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 where shown.

.2 Provide buzzers where shown.

.3 Provide 120/24V AC transformer where required.

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 Contract Administrator.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Electrical General Requirements	Section 16010
.2	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.3	Splitters, Junction, Pull Boxes and Cabinets	Section 16131
.4	Outlet Boxes, Conduit Boxes and Fittings	Section 16132
.5	Wiring Devices	Section 16141
.6	Fastenings and Supports	Section 16191

1.2 Coordination

.1 The building shall remain open and in normal operation during the construction period.

.2 Where existing services such as electrical power, fire alarm system, sound system, etc. are required to be disrupted and/or shut down, coordinate the shut-downs with the City of Winnipeg and carry out the Work at a time and in a manner acceptable to them. Carefully schedule all disruption and/or shut-downs and ensure that the duration of same is kept to the absolute minimum. Submit for approval a written, concise schedule of each disruption at least 120 hours in advance of performing Work and obtain the City of Winnipeg's written consent prior to implementing.

.3 Should any temporary connections be required to maintain services during Work in the existing building, supply and install all necessary material and equipment and provide all labour at no extra cost. Should any existing system be damaged, make full repairs without extra cost, and to the satisfaction of the City of Winnipeg and Contract Administrator.

.4 If existing equipment shown on drawings is defective it shall be brought to the Contract Administrator and the City of Winnipeg's attention prior to Work completion.

.5 Refer to General Conditions for phasing and staging of Work and adhere to that schedule. Comply with instructions regarding working hours necessary to maintain the building in operation.

.6 Coordinate complete installation of relocated utility services, if required, with Utilities to ensure minimum interruption of

service. Coordinate the transfer of the existing hydro service point to the new service point with the Hydro utility in order to keep power interruptions to a minimum.

1.3 Existing Devices in New Construction

.1 Where existing devices (receptacles, switches, etc.) presently mounted on a wall which will be covered with a new finish, provide an extension ring, coverplate, etc. or relocate as required to mount the device to the new wall.

.2 Where existing conduits pass vertically through a floor area, relocate those conduits to be installed concealed in a new wall or surface mounted in a service area. Extend conduit, wiring, etc. as required.

.3 Existing junction boxes in walls and ceiling spaces required to maintain existing circuits shall remain accessible.

.4 Where services are concealed within walls, floors or ceilings and cannot be visually identified, Contractor shall provide electronic scanning devices or other approved means to locate and identify concealed services prior to drilling.

1.4 Schedule of Work

.1 Carefully note and refer to the Contract Administrator's general schedule of Work and include for all requirements to conform to it.

PART 2 - PRODUCTS

2.1 Materials

.1 Provide all materials required for the complete interface and reconnection installation as herein described and as indicated on the drawings.

.2 New fire alarm devices, speakers, starters, panelboards, etc. required to be tied in to existing systems shall match the existing devices.

.3 New wiring required to interconnect new devices to existing systems shall be provided to suit the manufacturers requirements and instructions.

PART 3 - EXECUTION

3.1 Installation

.1 Install boxes, conduit and wiring through existing areas as required for the new installation.

.2 Add modules, switches, etc. in existing control panels, as required, to extend existing systems to new or renovated areas.

.3 Patch and repair walls and ceilings in existing areas that have been damaged or cut open due to the new electrical installation.

.4 Where new cables or conduits have been installed through existing fire rated walls, seal opening around cables and conduit to maintain fire rating.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

.2 Moulded Case Circuit Breakers Section 16477

1.2 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.

1.3 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 16010.

.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.

1.4 Maintenance Data

.1 Provide maintenance data for service entrance board for incorporation into manual specified in Section 16010.

1.5 Source Quality Control

.1 Refer to Section 16010.

1.6 Storage

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

1.7 Coordination and Short Circuit Study

.1 Switchboard manufacturer to provide a coordination and short circuit study as per section 16010 and submit to Contract Administrator with switchboard shop drawings.

PART 2 - PRODUCTS

2.1 Materials

.1 Service entrance board: to CSA C22.2 No. 31.

.2 Moulded case circuit breakers: to CSA C22.2 No.5.

.3 Fuse holder assemblies: to CSA C22.2 No. 39.

.4 HRC Fuses: to CSA C22.2 No. 106.

.5 Meters: to CSA C17.

.6 Meter mounting devices: to CSA C22.2 No. 115.

.7 Analogue instruments: to ANSI C39.1.

.8 Instrument transformers: to CSA C13.

.9 Aluminum for bus: to CSA HA.5.

2.2 Rating

.1 Service entrance switchboard rated 347/600V, 3 phase, 4 wire. grounded neutral, 60 Hz, or 120/208V, 3 phase, 4 wire, grounded neutral as indicated on drawings. Short circuit current rated at RMS symmetrical as indicated on the drawings.

2.3 Service Entrance Board

.1 Rating: Refer to drawings for Ampere rating.

.2 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.

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.

2.5 Main Breaker Section

.1 Type C:
.1 The main circuit breaker shall be a manually operable, fixed mounted, moulded case circuit breaker. Breaker to be c/w a removable handle, lock-out device, ground fault protection where required. Refer to the single line distribution schematic for the breaker size and additional requirements.

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 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 15 kVA and larger to be c/w fully adjustable LSI settings. The CDP type panelboard is to meet the requirements of 16426 Secondary Switchgear.

2.9 Finishes

.1 Apply finishes in accordance with Section 16010.
.1 Service entrance switchboard to be exterior gray.
.2 Supply 2 spray cans touch-up enamel.
.3 Treated to inhibit rusting.

2.10 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010.

.2 Nameplates:
.1 Size 7, to indicate voltage, amp rating and designation.
.2 Complete switchboard: labelled as above.
.3 Main disconnect: labelled "Main Breaker".
.4 Sub-breakers: labelled to indicate panel or equipment fed.

2.11 Shop Fabrication

.1 Assemble and wire complete service entrance board.

.2 Energize switchboard.

.3 Check meters and phase selector switches.

.4 Prepare switchboard for shipment to Site.

2.12 Manufacturers

.1 Cutler Hammer, Schneider, Square D, Seimens.

2.13 Future Energy Management

.1 Provide terminal board and wiring from customer CT's and PT's to facilitate the future installation of thermal demand, watt hour energy management equipment, recorders, etc.

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

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

.2 Moulded Case Circuit Breakers Section 16477

1.2 Shop Drawings Product Data

.1 Submit shop drawings and product data in accordance with Section 16010.

.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 16010.

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 16010, 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 LSI settings.

2.6 Finishes

.1 Apply finishes in accordance with Section 16010 - 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 16010 - 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 Metering

.1 Provide City of Winnipeg's metering where indicated on drawing. Metering to be equal to metering provided in main distribution (16421).

2.9 Manufacturers

.1 Cutler Hammer, 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

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

.2 Service Entrance Board Section 16421

.3 347/600V Main Distribution Switchboards (Air Ckt Brkrs (Main & tie) with CDP Dist'n) Section 16422

.4 347/600V Main Distribution Switchboard (Air Circuit Breaker Type) Section 16423

1.2 Product Data

.1 Submit product data in accordance with Section 16010.

.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: 4 kV.
.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: 4 kV.
.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 switchgear manufacturer.

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

PART 3 - EXECUTION

3.1 Inspection

.1 Inspect instrument transformers for damage and verify characteristics.

3.2 Installation

.1 Install instrument transformers and ensure accessibility.

END

PART 1 - GENERAL

1.1 Product Data

.1 Submit product data in accordance with Section 16010.

PART 2 - PRODUCTS

2.1 Disconnect Switches

.1 Fusible and non-fusible disconnect switch in CSA Enclosure and size as indicated. To suit the environment (i.e. weatherproof, watertight, dust-tight, general purpose, etc.)

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

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

.4 Fuses: size as indicated, to Section 16478 - Fuses - Low Voltage.

.5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action, heavy duty industrial grade.

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

.8 Disconnects used for service entrances shall be approved service entrance switches.

.9 Disconnects for two speed motors to be six pole. Refer to motor schedule and drawings for two speed motors and provide a six pole disconnect switch for each two speed motor.

2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Indicate name of load controlled and voltage on size 6 nameplate.

PART 3 - EXECUTION

3.1 Installation

.1 Install disconnect switches complete with fuses as indicated.

.2 Install additional brackets, supports, etc. required for mounting the disconnect switches.

.3 Install six pole disconnects at all two speed motors.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Electrical General Requirements	Section 16010
.2	Wires and Cables	Section 16122
.3	Service Entrance Board	Section 16421
.4	Dry Type Transformers up to 600V Primary	Section 16461

1.2 References

.1 Ground equipment to: CSA C22.2 No. 41.

.2 Copper grounding conductors to: CSA G7.1.

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

.4 Rod electrodes, galvanized steel 19 mm dia by minimum 3 m long. Threaded to accept 3m extensions if required.

.5 Plate electrodes, copper, surface area 0.2 m^2, 1.6 mm thick.

.6 System and circuit, equipment, grounding conductors, bare stranded copper, tinned, soft annealed, size as indicated.

.7 Insulated grounding conductors: green, type RW-90.

.8 Ground bus: copper, size 50 mm by 6 mm by 300 mm long complete with insulated supports, fastenings, connectors.

.9 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
.1 Grounding and bonding bushings.
.2 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.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 Installation General

.1 Install complete permanent, continuous, 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. Soldered joints not permitted.

.6 The main public metallic water service to a building shall be utilized as the main ground electrode where applicable. Where such a service does not exist, artificial grounding electrodes shall be provided to suit the requirements of the local inspection authorities.

.7 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.

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

.9 Install separate ground conductor to outdoor lighting standards.

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

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point street side of water pipe. Avoid loop connections.

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

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

.14 A minimum #3/0 AWG bare ground wire shall be installed in all cable trays.

3.2 System and Circuit Grounding

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

3.3 Equipment Grounding

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, frames of motors, motor control centres, starters, control panels, building steel Work, generators, elevator distributions, panels, outdoor lighting.

3.4 Grounding Bus

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

.2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections minimum size #3/0 AWG.

3.5 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 installer's requirements.
.2 Sound, fire alarm, intercommunication systems, etc. as per manufacturers installation instructions.

3.6 Field Quality Control

.1 Perform tests in accordance with Section 16010.

.2 Perform ground continuity and resistance tests using method appropriate to Site conditions and to approval of the local inspection authority. 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, if provided, during tests.

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

.6 Perform all tests as outlined in CSA Z32 for patient care areas.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Electrical General Requirements	Section 16010
.2	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.3	Secondary Switchgear (120/208V & 347/600V)	Section 16426
.4	Grounding - Secondary	Section 16450

1.2 Product Data

.1 Submit product data in accordance with Section 16010.

PART 2 - PRODUCTS

2.1 Transformers - Ventilated

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

.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; 150°C temperature rise above 40°C 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 16010 - Electrical General Requirements.

2.2 Transformers - Non-Ventilated

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

.2 3 phase, 600V Delta primary, 120/208V wye, secondary, 60 Hz.

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

.4 115 deg. temp. rise insulation system.

.5 Basic Impulse Level (BIL): standard.

.6 Hipot: standard

.7 Average sound level: standard

.8 Impedance at 75 deg.C: standard

.9 Enclosure: sealed

.10 Mounting: floor or wall as indicated.

.11 Finish: in accordance with Section 16010.

2.3 Electro-Statically Shielded Transformers

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

.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; 150°C temperature rise above 40°C 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 16010 - Electrical General Requirements.

2.4 Approved Manufacturers

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

.2 All transformers shall be of same manufacturer.

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

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

.2 Conduits, Conduit Fastenings and Conduit Fittings Section 16111

.3 Moulded Case Circuit Breakers Section 16477

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 16010.

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

1.3 Plant Assembly

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

PART 2 - PRODUCTS

2.1 Panelboards

.1 Panelboards: to CSA C-22.2 No. 29.

.2 Panelboards: product of one manufacturer.

.3 250V branch circuit panelboards: bus and breakers rated for 10kA (RMS symmetrical) interrupting capacity minimum or as indicated and 347/600V panels: bus and breakers rated for 14 ka (RMS symmetrical) or as indicated.

.4 Sequence phase bussing such that circuit breakers will be numbered in consecutive order, with each breaker identified by permanent number identification as to circuit number and phase.

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

.6 Provide panel covers for all panelboards and supply two keys for each panelboard and key panelboards alike.

.7 Aluminum bus with neutral of same ampere rating as mains.

.8 Mains: suitable for bolt-on 25mm wide breakers.

.9 Trim and door finish: baked grey enamel.

.10 Sprinkler proof to meet code requirements when located in sprinklered areas.

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.

.6 Metering as indicated, logging type c/w max/min values for Volts/Amp/KW/KVA/KVAD/KWD/PF. Meter to be by PML-ION 7300 Series or approved equal.

.7 As manufactured by J.R. Stephenson.

2.3 Breakers

.1 Breakers: to Section 16477 - Moulded Case Circuit Breakers.

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

.3 Lock-on devices for 5% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to the City of Winnipeg.

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

.5 Branch circuit breakers to be 15A single pole unless otherwise indicated on drawings.

2.4 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Nameplate for each panelboard size 5 engraved as indicated.

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

2.5 Manufacturers

.1 Acceptable Manufacturers: Cutler Hammer, 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 Except in public areas, install surface mounted panelboards on U-channels. Where practical, group panelboards on common U-channels.

.3 Mount panelboards to height specified in Section 16010 - Electrical General Requirements 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

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Electrical General Requirements	Section 16010
.2	Service Entrance Board	Section 16421
.3	Panelboards Breaker Type	Section 16471

1.2 Summary

.1 This Section describes the materials and installation requirements for transient voltage surge suppressors (TVSS) for the protection of all AC electrical circuits from the effects of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and/or capacitive load switching.

1.3 References

.1 Canadian Standards Association (CSA)

.2 Canadian Electrical Code (CEC)

.3 American National Standards Institute of Electrical and Electronic Engineers (ANSI/IEEE)

.4 Underwriters Laboratories Canada (ULC)

1.4 Submittal for approval

.1 Shop drawings, product data and manufacturer's installation instructions shall be submitted for review ten days prior to the bid date.

.2 The submittals shall include:
.1 Dimensional drawing of each TVSS unit.
.2 CSA Approval.
.3 UL Standard 1449 Listing, Standard for Safety, Transient Voltage Surge Suppressors, documentation.
.4 UL Standard 1283 Listing, Electromagnetic Interference Filters, documentation.
.5 IEEE C62.41-1991 Category C3 (20kV-1.2/50, 10kA-8/20us waveform) clamping voltage test results from an independent test lab. The test procedure shall be in accordance with IEEE C62.45-1987.

PART 2 - PRODUCT

2.1 Service Entrance Switchboard

.1 Suppressors shall be listed in accordance with UL 1449, Standard for Safety, Transient Voltage Surge Suppressors, and UL 1283, Electromagnetic Interference Filters.

.2 Suppressors shall be independently tested with the Category C3 high exposure waveform (20kV-1.2/50us, 10kA-8/20us) per ANSI/IEEE C62.41 - 1991.

.3 Suppressors shall provide redundant suppression modules between each phase conductor and the neutral conductor and between the neutral conductor and ground.

.4 Suppressor manufacturer shall provide certified test data confirming a "fail-short" failure mode.

.5 Visible indication of proper suppressor connection and operation shall be provided. The indicator lights shall indicate which phase as well as which module is fully operable.

.6 The suppressor shall incorporate copper bus bars for the surge current path. Small gauge round wiring or plug-in connections shall not be used in the path for surge current diversion. Surge current diversion modules shall use bolted connections to the bus bars for reliable low impedance connections.

.7 Suppressors shall meet or exceed the following criteria:
.1 Maximum single impulse current rating shall be no less than 320 kA per phase.
.2 Pulse life test: Capable of protecting against and surviving 5000 ANSI/IEEE C62.41 Category C transients without failure or degradation of UL 1449 clamp voltage by more than 10%.
.3 UL 1449 clamping voltage must not exceed the following:

VOLTAGE	L-N	N-G
120/208	400V	400V
277/480	800	800
347/600	1000	1000

.4 The ANSI/IEEE C-62.41 - 1991 Category C3 clamping voltage shall not exceed the following:

VOLTAGE	L-N	N-G
120/108	675V	675V
277/480	1250	1250
347/600	1500	1500

.8 The TVSS shall be constructed using surge current modules (MOV based). Each module shall be fused with user replaceable 200,000 AIR rated fuses. The status of each module shall be monitored on the front cover of the switchboard as well as on the module.

.9 The TVSS shall be equipped with an audible alarm which shall actuate when any one of the surge current modules has failed. An alarm on/off switch shall be provided to silence the alarm and an alarm push-to-test switch shall be provided to test the alarm. Both switches and audible alarm shall be located on the front panel of the switchboard.

.10 Terminals shall be provided for all of the necessary power and ground connections. Each terminal shall accommodate wire sizes of #8 to #1 AWG.

.11 The suppressor shall have a response time no greater than 5 nanoseconds for any of the individual protection modes.

.12 The suppressor will have a warranty for a period of five years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.

.13 The suppressor shall be equipped with the following optional items:
.1 TVSS units shall be equipped with a disconnect switch or circuit breaker.
.2 A transient voltage surge counter shall be located on the front cover of the switchboard. The counter shall be equipped with a manual reset and a battery to retain memory upon loss of AC power.
.3 A DB-9 connector shall be provided along with dry contacts (normally open or normally closed) to allow connection to a remote monitor or other system. The output of the dry contacts shall indicate a failure of a phase or the entire unit.
.4 A remote monitoring device shall be provided to directly connect to the suppressor with a DB-9 connector for simple installation. The device will have indicator lights to monitor each AC phase for a fault or good condition and include an audible alarm to indicate module failure.

2.2 Service Entrance Panelboard

.1 Integral Surge Suppressor
.1 Suppressors shall be component recognized in accordance with UL1449, Standard for Safety, Transient Voltage Surge Suppressors and UL 1283, Electromagnetic Interference Filters.
.2 Suppressors shall be independently tested with the category C3 high exposure waveform (20 kV - 1.2/50 us, 10 kA - 8/20 us) per ANSI/IEEE C62.41 - 1991.
.3 Suppressors shall incorporate copper bus bars for the surge current path. Small round wiring or plug-in connections shall not be used in the path for surge current diversion.
.4 Suppressors shall be constructed using surge current modules (MOV based). Each module shall be fused with user replaceable 200,000 AIR rated fuses. The status of each module shall be monitored on the front cover of the panelboard enclosure as well as on the module.

.5 Suppressors shall be equipped with an audible alarm which shall activate when any one of the surge current modules has failed. An alarm on/off switch shall be provided to silence the alarm and an alarm push-to-test switch shall be provided to test the alarm. The switches and alarm shall be located on the front cover of the panelboard enclosure.

.6 Suppressors shall meet or exceed the following criteria:

.1 Maximum single impulse current rating shall be no less than 120kA 200kA 320kA per phase.

.2 Pulse life test: Capable of protecting against and surviving 5000 ANSI/IEEE C62.41 Category C transients without failure or degradation.

.3 The clamping voltage shall not exceed the following:

VOLTAGE	L-N	N-G
120/208	400V	400V
277/480	800	800
347/600	1000	1000

.7 The suppressor shall have a response time no greater than five nanoseconds for any of the individual protection modes.

.8 Suppressors shall be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.

.9 Visible indication of proper suppressor connection and operation shall be provided. The indicator lights shall indicate which phase as well as which module is fully operable.

.10 Suppressors shall be manufactured in the United States. All major components shall also be of American manufacture.

.11 Suppressors shall have a minimum EFI/RFI filtering of 34dB at 100kHz with an insertion loss ratio of 50:1 using Mil Std. 220A methodology.

.12 Suppressors shall have a five year warranty, incorporating unlimited replacements of suppressor modules if they are destroyed by transients during the warranty period.

2.3 Secondary Service Surge Protected Panelboards

.1 Integral Surge Suppressor

.1 The panelboard shall be approved to CSA specification C22.2 No. 29-M1989. The TVSS device shall be UL 1449 Component Recognized. The TVSS device shall have passed all UL testing required by the UL 1449 standard. Panelboard markings shall include clamp voltage at the TVSS terminals as well as clamp voltage at the panelboard line terminals.

.2 Suppressors shall be independently tested with the category C3 high exposure waveform (20 kV - 1.2/50us, 10 kA - 8/20us) per ANSI/IEEE C62.41 - 1991.

.3 Suppressors shall incorporate copper bus bars for the surge current path. Small round wiring or plug-in connections shall not be used in the path for surge current diversion.

.4 Suppressors shall be constructed using surge current modules (MOV based). Each module shall be fused with user replaceable 200,000 AIR rated fuses. The status of each module shall be

monitored on the front cover of the panelboard enclosure as well as on the module.

.5 All encapsulated suppressors shall utilize an encapsulant that is UL listed and holds a 94-V2 fire retardant rating. No encapsulant compounds that incorporate epoxy shall be allowed.

.6 Suppressors shall be equipped with an audible alarm which shall activate when any one of the surge current modules has failed. An alarm on/off switch shall be provided to silence the alarm and an alarm push-to-test switch shall be provided to test the alarm. The switches and alarm shall be located on the front cover of the panelboard enclosure.

.7 Suppressors shall meet or exceed the following criteria:

.1 Maximum single impulse current rating shall be no less than 120 kA per phase (calculated from component manufacturer's specifications).

.2 Pulse life test: Capable of protecting against and surviving 5000 ANSI/IEEE C62.41 Category C transients without failure or degradation.

.3 The clamping voltage shall not exceed the following:

VOLTAGE	L-N	N-G
120/208	400V	400V
277/480	800	800
347/600	1000	1000

.8 The suppressor shall have a response time no greater than five nanoseconds for any of the individual protection modes.

.9 Suppressors shall be designed to withstand a maximum continuous operating voltage (MCOV) of not less than 115% of nominal RMS voltage.

.10 Visible indication of proper suppressor connection and operation shall be provided. The indicator lights shall indicate which phase as well as which module is fully operable.

.11 Suppressors shall have a minimum EFI/RFI filtering of 34dB at 100kHz with an insertion loss ratio of 50:1 using Mil Std. 220A methodology.

.12 Suppressors shall have a five year warranty, incorporating unlimited replacements of suppressor modules if they are destroyed by transients during the warranty period.

.13 Suppressors shall be equipped with the following optional items:

.1 TVSS units shall be equipped with a disconnect switch or circuit breaker.

.2 A transient voltage surge counter shall be located on the front cover of the suppressor. The counter shall be equipped with a manual reset and a battery to retain memory upon loss of AC power.

.3 A DB-9 connector shall be provided along with dry contacts (normally open or normally closed) to allow connection to a remote monitor or other system. The output of the dry contacts shall indicate a failure of a phase or the entire unit.

.4 A remote monitoring device shall be provided to directly connect to the suppressor with a DB-9 connector for simple installation. The device will have indicator lights to monitor each AC phase for a fault or good

condition and include an audible alarm to indicate module failure.

.2 Non-Linear Panelboard

.1 The panelboard shall be approved to CSA specification C22.2 No. 29-M1989. The TVSS device shall be UL 1449 Component Recognized. The TVSS device shall have passed all UL testing required by the UL 1449 standard. Panelboard markings shall include clamp voltage at the TVSS terminals as well as clamp voltage at the panelboard line terminals.

.2 The unit shall be top or bottom feed according to requirements. A circuit directory shall be located inside the door.

.3 The box shall be code gauge steel. The box size shall be as indicated on the associated schedules drawings.

.4 The main bus shall be aluminum and rated for the load current required.

.5 The unit shall be provided with branch circuit breakers. All available types of circuit breakers can be provided as required. No modification to the interior of the unit shall limit the selection of circuit breakers.

.6 The unit shall include a 200% rated neutral assembly with aluminum neutral bus.

.7 The unit shall be provided with an insulated ground bus and a safety ground bus.

.8 The field connections to the panelboard shall be main lug or main breaker.

.9 The unit shall be constructed with flush or surface mounted trim and shall be in a EEMAC 1 enclosure.

.10 The panelboard shall be supplied with the appropriate branch breaker positions and nominal current rating as indicated on the associated drawing.

.3 Approved Manufacturers

.1 Schneider Canada

.2 Cutler-Hammer

.3 Siemens

PART 3 - EXECUTION

3.1 Service Entrance

.1 Install one primary suppressor within the switchboard or panelboard at each utility service entrance to the facility, according to manufacturer's recommendations.

.2 The suppressor shall be installed on the load side of the service entrance.

.3 Conductors between suppressor and point of attachment shall be kept short and straight.

.4 The suppressor's ground shall be bonded to the service entrance ground.

3.2 Secondary Distribution Panels

.1 Install panelboards as required and according to manufacturer's recommendations. The surge suppression is integrated into the surge protected panelboards.

.2 Conductors between suppressor and point of attachment shall be kept short and straight.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Electrical General Requirements	Section 16010
.2	Service Entrance Board	Section 16421
.3	347/600V Main Distribution Switchgear (Air Ckt Brkrs (Main & tie) with CDP Dist'n)	Section 16422
.4	Secondary Switchgear (120/208V & 347/600V)	Section 16426
.5	Panelboards Breaker Type	Section 16471

1.2 Product Data

.1 Submit product data in accordance with Section 16010.

.2 Include time-current coordination characteristic curves for breakers.

PART 2 - PRODUCTS

2.1 Breakers General

.1 Moulded case circuit breakers: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 deg. C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 5-10 times current rating.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Minimum Interrupting Ratings (RMS Symmetrical) unless otherwise indicated:
.1 120/208 Volts - 10,000 Amps
.2 347/600 Volts - 14,000 Amps

2.2 Thermal Magnetic Breakers

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

2.3 Solid State Trip Breakers

.1 Moulded case circuit breaker to operate by means of a 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 and ground fault tripping.
.1 Each breaker shall have the following independent and fully adjustable curve shaping characteristics:
.1 Adjustable long time pickup
.2 Adjustable long time delay
.3 Adjustable short time pickup
.4 Adjustable short time delay with selective curve shaping
.5 Adjustable instantaneous pickup
.6 Adjustable ground fault pickup
.7 Adjustable ground fault delay with selective curve shaping

.2 Breakers feeding transformers 45 kVA and larger shall have solid state trips, fully and independently adjustable LSIG settings.

2.4 ARC Fault Circuit Interrupters (AFCI)

.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 Integrated processor which trips the breaker upon recognized unique current and/or voltage signatures associated with arcing faults.

2.5 Manufacturers

.1 Acceptable manufacturers: Cutler Hammer, Schneider, Square D, Siemens.

PART 3 - EXECUTION

2.5 Installation

.1 Install circuit breakers as indicated.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

1.2 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 16010.

.2 Submit fuse performance data characteristics for each fuse type and size above 30 A. Performance data to include: average melting time-current characteristics, I^2t (for fuse coordination), and peak let-through current.

1.3 Maintenance Materials

.1 Provide maintenance materials in accordance with Section 16010.

.2 Three spare fuses of each type and size installed above 600 A.

.3 Six spare fuses of each type and size installed up to and including 600 A.

1.4 Delivery and Storage

.1 Ship fuses in original containers.

.2 Do not ship fuses installed in switchboard.

.3 Store fuses in original containers in storage cabinet.

PART 2 - PRODUCTS

2.1 Fuses General

.1 Plug and cartrige fuses: to CSA C22.2 No. 59.

.2 Fuse type references L1, L2, J1 etc. have been adopted for use in this specification.

.3 Fuses: product of one manufacturer.

2.2 Fuse Types

.1 HRC-L fuses (formerly Class L), motor loads:
.1 Type L1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
.2 Type L2, fast acting.

.2 HRCI-J fuses (formerly Class J), Panel loads:
.1 Type J1, time delay, capable of carrying 500% of its rated current for 10 s minimum.
.2 Type J2, fast acting.

2.3 Fuse Storage Cabinet

.1 Fuse storage cabinet, manufactured from 2.0 mm thick aluminum 750 mm high, 600 mm wide, 300 mm deep, hinged, lockable front access door finished in accordance with Section 16010 - Electrical-General Requirements.

PART 3 - EXECUTION

3.1 Installation

.1 Install fuses in mounting devices immediately before energizing circuit.

.2 Ensure correct fuses fitted to physically matched mounting devices.
.1 Install Class R rejection clips for HRCI-R fuses.

.3 Ensure correct fuses fitted to assigned electrical circuit.

.4 Provide a fuse cabinet in each main and sub-electrical room where fuses are installed.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

1.2 Product Data

.1 Submit product data in accordance with Section 16010.

PART 2 - PRODUCTS

2.1 Contactors

.1 Contactors: to EEMAC No.1CS.

.2 Electrically held or Mechanically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.

.3 Complete with 2 spare normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.4 Mount in EEMAC '1' Enclosure unless otherwise indicated.

.5 Include following options in cover:
.1 Red indicating lamp. (Open)
.2 Green indicating lamp. (Closed)
.3 Hand-Off-Auto selector switch.

.6 Control transformer in contactor enclosure.

2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

.2 Size 4 nameplate indicating name of load controlled as indicated.

2.3 Manufacturers

.1 Acceptable Manufacturers: Allen Bradley, ASCO, Cutler-Hammer, Square D, Siemens.

PART 3 - EXECUTION

3.1 Installation

.1 Install contactors as indicated on drawings.

.2 Connect line and load side wiring.

.3 Connect controls as required.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

.2 Panelboards Breaker Type Section 16471

1.2 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.

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 16010 - Electrical - General Requirements.

.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

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Cast-in-Place Concrete Section 03300

.2 Painting - General Section 09900

.3 Electrical General Requirements Section 16010

1.2 Shop Drawings and Product Data

.1 Submit shop drawings in accordance with Section 16010.

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

.3 Submit list of replacement lamp data for each luminaire. Include lamp type, voltage, base type and order code.

1.3 Guarantee

.1 Replace:
.1 Incandescent and tungsten halogen lamps burnt out within 3 months of takeover.
.2 Fluorescent and HID lamps burning out within 12 months of takeover.
.3 Ballasts that fail or exceed their labelled noise level rating within 12 months of takeover.

1.4 Co-ordination

.1 Co-ordinate luminaire locations with Work of other trades.

.2 Co-ordinate luminaire types with ceiling finishes to ensure compatability.

.3 Luminaires to be c/w lamps, suspension devices, plaster rings and other attachments required for best appearance and proper mechanical installation.

.4 Every light outlet in the building shall be provided with a suitable fixture. In the event that the fixture type is not designed for any particular outlet, supply a suitable fixture for the application, as approved by the Contract Administrator.

PART 2 - PRODUCTS

2.1 Materials

.1 Incandescent and electric discharge fixtures: to CSA C22.2 No. 9.

.2 Socket screw-shell lampholders: to CSA C22.2 No. 43.

.3 Electric discharge lampholders: to CSA C22.2 No. 74.

.4 Incandescent lamps to: CSA C10 and CSA C22.2 No. 84.

.5 Tungsten halogen lamps: to CSA C22.2 No. 84.

.6 HID lamps: to ANSI C78 series.

.7 Fluorescent lamps: to ANSI C78 series.

.8 Ballasts: to CSA C22.2 No. 74.

.9 Plastic lenses and diffusers ULC labelled.

2.2 Luminaire Details

.1 Luminaires shall carry the CSA label.

.2 Provide supporting devices, plaster frames, junction boxes and outlet boxes where required.

.3 Provide lenses or diffusers of glass or acrylic material as indicated. Acrylic lenses used with fluorescent luminaires shall be a K-12 pattern with a minimum of .125" (3mm) thickness.

.4 Include finishes to Section 16010 and as indicated.

.5 Provide gasketting, stops and barriers to prevent light leaks.

.6 Recessed luminaires shall be suitable for mounting in the particular type of ceiling where the luminaires are to be mounted.

2.3 Lamps

.1 Provide lamps as indicated.

.2 Incandescent lamps to be extended service type rated 2500 hours, 130 volts, inside frosted unless indicated otherwise.

.3 Fluorescent lamps (T12) shall be rapid start, 3100 lumens, rated 20,000 hours, cool white unless other indicated.

.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.

2.4 Ballasts and Accessories

.1 Provide ballasts and accessories as indicated.

.2 Provide ballasts with non-PCB type capacitors with pressure sensitive devices to prevent rupturing.

.3 Fluorescent ballast: CBM certified, energy efficient electronic type, design. (Hybrid type not acceptable).
.1 Rating: 60 Hz, voltage as indicated, for use with 2-32 W, T-8, rapid start lamps.
.2 Totally encased and designed for 40 deg C ambient temperature.
.3 Power factor: minimum 90% with 95% of rated lamp lumens.
.4 Capacitor: non PCB, thermally protected.
.5 Thermal protection: non-resettable auto reset on coil.
.6 Sound rated: A.
.7 Mounting: remote integral with luminaire.
.8 Total harmonic distortion less than 20%.
.9 Ballast must be listed by Manitoba Hydro as acceptable by their "Power Smart" premium rebate program.
.10 Line amperes for ballast with two 4-foot T-8 lamps to be 0.6 Amps at 120 V maximum, 68 VA. volt-amperes for ballast with four 4-foot T-8 lamps to be 1.0 Amps at 120V maximum.

.4 Ballasts for high intensity discharge lamps shall be, HPF, auto-regulator type.

.5 Ballasts used in exterior luminaires shall be rated at -20 deg. C starting.

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.

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 16010.

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

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

.2 Lighting Equipment Section 16505

1.2 Product Data

.1 Submit product data in accordance with Section 16010.

PART 2 - PRODUCTS

2.1 Exit Lights - General

.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 Built-in switch-over relays for 12 Volt DC operation.

.8 Face plate to remain captive for relamping.

.9 Units c/w punch-out directional arrows as required.

.10 Units c/w universal mounting canopies as required.

.11 Shall comply with CSA-860.

PART 3 - EXECUTION

3.1 Installation

.1 Install exit lights as indicated.

.2 Connect fixtures to designated AC exit light circuits as indicated.

.3 Ensure that exit light circuit breaker is locked in on position.

.4 Connect fixtures to remote battery banks circuits as indicated.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Electrical General Requirements	Section 16010
.2	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.3	Wires and Cables	Section 16122
.4	Outlet Boxes, Conduit Boxes and Fittings	Section 16132
.5	Exit Lights	Section 16519

1.2 Product Data

.1 Submit product data in accordance with Section 16010.

.2 Data to indicate system components, mounting method, source of power and special attachments.

1.3 Operation and Maintenance Data

.1 Provide data for incorporation into Maintenance Manual specified in Section 16010.

.2 Operation and Maintenance Manual to include:
.1 Operation and maintenance instructions for complete battery system to permit effective operation and maintenance.
.2 Technical data - illustrated parts lists with parts catalogue numbers.
.3 Copy of approved shop drawings.

1.4 Maintenance Materials

.1 Provide maintenance materials in accordance with Section 16010.

.2 Include:
.1 Five spare lamps of each type supplied for remote heads.

1.5 Warranty

.1 Provide a written guarantee, stating that the battery for emergency lighting is guaranteed against defects in material and workmanship for a period of 10 years, with a no-charge replacement during the first lustrum and a pro-rate charge on the

second lustrum, from the date of the Final Acceptance from the City of Winnipeg.

1.6 System Description

.1 The system to include battery unit(s) controls, remote heads, wire and conduit etc. to provide backup emergency lighting in the event of a loss of AC power to the normal lighting system.

PART 2 - PRODUCTS

2.1 Equipment

.1 Supply voltage: 120 V, ac. as indicated.

.2 Output voltage: 12 V dc. as indicated.

.3 Operating time: 60 min. as indicated.

.4 Battery: sealed, long life, lead acid or lead calcium maintenance free.

.5 Charger: solid state, multi-rate, pulse type, voltage/current regulated, inverse temperature compensated, short circuit protected, modular construction.

.6 Solid state transfer.

.7 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage c/w 2-fused DC output circuits.

.8 Signal lights: solid state, life expectancy 100,000 h minimum, for 'AC Power ON' and 'High Charge'.

.9 Lamp heads: integral on unit 360 deg. horizontal and 180 deg. vertical adjustment. Lamp type: tungsten-halogen, 12 W, glare free, (mini style).

.10 Cabinet: minimum 20 gauge steel cabinet c/w white polyester paint finish c/w knockouts for conduit.

.11 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.

.12 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.

.13 T-bar mounted battery banks to be mounted in T-bar ceilings at locations shown. Units to be c/w flanges to access T-bar ceiling tiles. Units to be independently suspended from structure above. LED diagnostics display and test switch to be mounted on underside 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 Dual-Lite: MRH series
.2 Emergi-Lite: P18 series
.3 Lithonia: P18 series
.4 Lumacell: MQ series
.5 Luxnet: R1Q series
.6 Uniglo: MR series

.2 Recessed fixture:
.1 Single head, recessed in drywall or T-bar ceiling.
.2 Fully adjustable for tilt, rotation and tight beam control.
.3 Matte white finish.
.4 Minimum 12 watt quartz halogen lamp at voltage indicated.
.5 Acceptable manufacturers:
.1 Dual-Lite: EXT-122 series
.2 Emergi-Lite: EF15 series
.3 Lithonia: ELA RG series
.4 Lumacell: RS20 series
.5 Luxnet: R21 series
.6 Uniglo: MRR 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.

PART 1 - GENERAL

1.1 Summary

.1 This specification defines the electrical and mechanical characteristics and requirements for a continuous-duty, three-phase, solid-state, uninterruptible power supply (UPS) system. UPS shall provide high-quality AC power for sensitive electronic equipment loads.

.2 A cash allowance is provided in the front end specification for purchase of this equipment at a later date. Div. 16 to allow all material/handling/markups, overhead and profit, etc. in their bid.

.3 The UPS system will be supplied by Powerware.

.4 Refer to 16010 for Additional Information.

1.2 Standards

.1 UPS shall be designed in accordance with applicable sections of current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.
- .1 ANSI C62.41 (EEE.587)
- .2 CSA 22.2, No. 107.1
- .3 FCC rules Part 15, Class A
- .4 National Electrical Code (NFPA-70)
- .5 OSHA
- .6 UL Standard 1778

.2 UPS shall be UL listed per UL Standard 1778, and shall be CSA certified.

.3 UPS shall be tested to ANSI 62.41 Categories A & B with no damage to unit.

1.3 Description

.1 UPS Module.
- .1 Voltage: Input/output voltage of UPS shall be user selectable via front panel controls: 600 Volts.
- .2 Input 347/600 Volts, three-phase wye, 4-wire-plus-ground.
- .3 Output 120/208 Volts, three-phase wye, 4-wire-plus-ground.

.2 Output Load Capacity
- .1 Specified output load capacity of UPS shall be rated in kVA 0.7 lagging power factor. UPS shall supply rated kVA from 0.5 to 0.7 lagging power factor. UPS shall also supply rated kW from 0.7 lagging to 0.9 leading power factor.

.3 Battery Cabinet
.1 Battery Cells: Sealed, valve regulated lead acid.
.2 Reserve Time: 20 minutes at full load, with 25 deg. ambient temperature.
.3 Recharge time: to 95% capacity within ten (10) times discharge time. The battery charger shall be temperature compensated and be capable of recharging the battery at a slower (selectable) rate of 20 times the discharge time.

.4 Modes of Operation:
.1 UPS shall be designed to operate as an on-line reverse transfer system in the following modes:
.1 Normal: The critical AC load is continuously supplied by UPS inverter. Input converter derives power from utility AC source and supplies power to inverter while simultaneously float-charging to storage battery.
.2 Emergency: Upon failure of utility AC power, inverter obtains power from battery without interruption. There shall be no interruption in power to critical load failure or restoration of utility AC source.
.3 Recharge: Upon restoration of utility AC power, after utility AC power outage, converter shall automatically restart and assume inverter and battery recharge loads.
.4 Bypass: In case of internal fault, or should inverter overload capacity be exceeded, static transfer switch shall transfer load from inverter to bypass source with no interruption in power to critical AC load.

.5 AC Input to UPS
.1 Voltage Configuration: three-phase wye, 4-wire plug ground.
.2 Voltage Range: 468-762 VAC +27%, -18% at 600V nominal.
.3 Frequency: 45 to 65 Hz.
.4 Power Factor: 0.95 lagging minimum over entire load range of UPS.
.5 Inrush Current: 116A peak for one cycle maximum at nominal 208V input.
.6 Current Limit: 125% of nominal AC input current maximum.
.7 Current Distortion: 30% THE maximum from 50% load to full load.
.8 Surge Protection: Sustains input surges without damage per criteria listed in ANSI C62.41-1991, Categories A and B.

.6 AC Output, UPS Inverter
.1 Voltage Configuration: 120/208, three-phase, 4-wire plus ground.
.2 Voltage Regulation: +/- 1% three-phase RMS average for balanced three-phase load, +/- 1.5% for 100% unbalanced load, for combined variation effects of input voltage, connected load, battery voltage, ambient temperature, and load power factor.
.3 Frequency: Nominal 60 Hz.
.4 Frequency Slew Rate: 1.0 Hertz per second default. Field selectable from 0.3, 0.5, 1, 2 and 3 Hz per second.
.5 Phase Displacement: 120 deg +/-1 deg for balanced and unbalanced loads.

.6 Bypass Line Sync Range: From +/-0.1 to +/- 5.0 Hz in 0.1 Hz increments, user selectable.
.7 Voltage Distortion: 2% total harmonic distortion (THD) for linear loads at 208V. 3.5% THD maximum for 100% 3:1 crest factor load at 208V, with 3% maximum single harmonic at 100% non-linear loading.
.8 Load Power Factor Range: 0.9 leading to 0.5 lagging.
.9 Output Power Rating: Rated kVA from 0.5 to 0.7 lagging power factor, rated kW from 0.7 lagging to 0.9 leading power factor. Rated kW is rated kVA times 0.7 power factor.
.10 Overload Capability: (on inverter) 125% for 10 minutes, 150% for 30 seconds, 100% continuous rating.
.11 Inverter Output Voltage Adjustment: +/- 5% from nominal settings.
.12 Step-Load Transient Response: Voltage will not exceed +/- 1% of nominal rated voltage for linear step-load change up to 100% of UPS rating.
.13 Transient Recovery Time: to within 1% of output voltage within 1 cycle.
.14 Load Unbalance: Maximum 100% of rated phase current.
.15 Noise Attenuation: With isolated neutral. 80 dB up to 100 kHz, common mode, 60 dB up to 100 kHz, transverse mode.

.7 AC Output, Static Bypass
.1 Overload Capability: >2,000% static switch automatically shuts off. 2.000% - 2 cycles, 200% 30 seconds, 150% 10 minutes, 110% continuous rating.
.2 Surge Withstand Capability: ANSI C62.41, Categories A and B.
.3 Detect and Transfer Time: less than 1 millisecond for overloads, less than 4 milliseconds for faults.

1.4 Environmental Conditions

.1 The UPS shall be able to withstand the following environmental conditions without damage or degradation of operating characteristics:
.1 Operating Ambient Temperature:
.1 UPS Module: 32 to 104 deg F (0 to 40 deg C).
.2 Battery: 77 +/- 9 deg F (25 +/- 5 deg C).
.2 Storage/Transport Ambient Temperature.
.1 -4 to 158 deg F (-20 to 70 deg C) without batteries.
.2 -26 to +104 deg F (-32 to +40 deg C) with batteries.
NOTE: Maximum recommended storage temperature for batteries is 25 deg C for up to six months.
.3 Relative Humidity: 0 to 95%, non-condensing.
.4 Altitude: Operating to 6,000 ft. (2,000 meters) above Mean Sea Level. Derated 5% per kilometer above 2 km. Storage/Transport to 40,000 ft. (12,200 meters) above Mean Seal Level.
.5 Electrostatic Discharge: Withstand maximum 25kV spark discharge, also withstand minimum 5 kV with 5A/NS rise and 10A vertical transverse. UPS shall continue to operate without damage.

.6 Audible Noise: 57 dBA at 1 meter from surface of the UPS.

1.5 Quality Assurance

.1 Manufacturer Qualifications:
.1 Minimum of five year's experience in design, manufacture and testing of solid-state UPS systems is required. Manufacturer shall be ISO9001 certified.

.2 Factory Testing:
.1 Before shipment, manufacturer shall fully and completely test system to assure compliance with specifications.

PART 2 - PRODUCTS

2.1 Fabrication

.1 Materials
.1 All materials shall be new, of current manufacture, high grade, free from all defects and shall not have been in prior service except as required during factory testing.
.2 Maximum working voltage, current and di/dt of all solid-state power components and electronic devices shall not exceed 75% of ratings established by manufacturer. Operating temperature of solid-state component/sub-assemblies shall not be greater than 75% of ratings. Electrolytic capacitors shall be computer grade and be operated at no more than 95% of their voltage rating at maximum rectifier charging voltage.

.2 Wiring
.1 Wiring practices, materials and coding shall be in accordance with requirements of National Electrical Code (NFPA 70). All bolted connections of bus bars, lugs, and cables shall be in accordance with requirements of National Electrical Code and other applicable standards. All electrical power connections are to be torqued to required value.
.2 Provision shall be made for power cables to enter or leave from both top and bottom of UPS cabinet.

.3 Construction and Mounting
.1 UPS unit, comprised of front-end coverter, battery charger, high-frequency isolation transformer, inverter, and static transfer switch, shall be housed in single free-standing NEMA type 1 enclosure. Casters and leveling feet shall be provided for ease of installation. Front access only shall be required for expedient servicing, adjustments, and installation. UPS cabinet shall be structurally adequate for forklift handling.
.2 UPS cabinet shall be cleaned, primed, and painted with manufacturer's standard color. UPS shall be constructed of replaceable subassemblies. Like assemblies and like components shall be interchangeable.

.4 Cooling
.1 Cooling shall be by forced-air with internally-mounted, fans to minimize audible noise output. Fan power shall be provided by UPS.
.2 Thermal design, along with all thermal sensors, shall be coordinated with protective circuits before excessive component or internal cabinet temperatures are exceeded.
.3 Temperatures shall be displayed on front panel for input converter, inverter, and battery. Warning alarm shall be issued for high temperature readings. Automatic shutdown shall occur when manufacturer's maximum operating temperature is exceeded. Load shall be automatically transferred to bypass.

.5 Grounding
.1 AC output neutral shall be electrically isolated from UPS chassis. UPS chassis shall have equipment ground terminal. Provision for local bonding shall be provided.

2.2 Components

.1 Input Converter
.1 General
.1 The term input converter shall denote solid-state equipment and controls necessary to convert incoming AC power. Input converter shall be part of an assembly known as the Power Factor Corrector (PFC) which provides power to inverter while also actively improving input power usage to 95% (0.95 power factor).
.2 Input Protection
.1 UPS shall have built-in protection against undervoltage, overcurrent, and overvoltage conditions including low-energy surges, introduced on primary AC source and bypass source. UPS shall sustain category A & B input surges without damper per criteria listed in ANSI C62.41-1980 (IEEE 587).
.3 AC Input Current Limiting
.1 Input converter shall automatically limit input current. UPS output overloads shall be supplied from input converter. Battery charger shall draw no more than 25% of rated full load input current.
.4 Fuse Failure Protection
.1 Input lines shall be fused with fast-acting fuses, so loss of any one power semiconductor shall not cause cascading failures.
.5 DC Filter
.1 Battery charger shall have output filter to minimize ripple voltage into battery. Under no conditions shall ripple voltage into battery exceed 2% RMS.
.6 Automatic Restart
.1 Upon restoration of utility AC power, after a utility AC power outage and prior to UPS automatic end-of-discharge shutdown, input converter shall automatically restart, and assume inverter and battery recharge loads.

.2 Upon restoration of utility AC power, after utility AC power outage and after automatic end-of-discharge shutdown, input converter shall automatically restart, walk-in, and assume the inverter and battery recharge loads. UPS shall be configurable for automatic or manual restart. This function shall be user-selectable from UPS control panel or remote terminal.

.7 Battery Recharge

.1 Charger circuitry shall be capable of producing battery charging current sufficient to replace 95% of battery discharge power within 10 times the discharge time. After battery is recharged, charger shall maintain battery at full charge until next emergency operation. Battery recharge shall be temperature compensated and microprocessor controlled to prolong battery life.

.8 Overvoltage Protection

.1 There shall be DC overvoltage protection so that if DC voltage exceeds the pre-set limit, UPS will shutdown automatically and critical load will be transferred to bypass.

2.3 Inverter (Output Converter)

.1 General

.1 The term inverter shall denote solid-state equipment and controls to convert power from input convertor or battery to regulated AC power for supporting the critical load. At the output, there shall be three independently-controlled inverters; one for each phase. The inverters shall produce 50 or 60 hertz (selectable) using insulated gate bipolar transistors (IGBTs) switching at 20 kHz, above the audible frequency range and without low frequency magnetic components. Each inverter shall be of pulse with modulated (PWM) design capable of providing the specified AC output.

.2 Overload Capability

.1 The inverter shall be capable of supplying current at regulated voltage for overloads exceeding 100% and up to 150% of full load current. A visual indicator and audible alarm shall indicate overload operation. For greater currents, the inverter shall have electronic current-limiting protection to prevent damage to components. The inverter shall be self-protecting against any magnitude of connected output overload. Inverter control logic shall sense and disconnect the inverter from the critical AC load without the requirement to clear protective fuses. The UPS shall transfer the load to bypass when overload capacity is exceeded.

.3 Phase Balance

.1 Electronic controls shall be provided to regulate each phase so that an unbalanced loading will not cause the output voltage to go outside the specified voltage regulation or phase displacement.

.4 Fuse Failure Protection
.1 Each inverter unit shall be fused with fast-acting fuses, so that loss of any one power semiconductor will not cause cascading failures.

.5 Inverter Shutdown
.1 For rapid removal of the inverter from the critical load, the inverter control electronics shall instantaneously turn off the inverter transistors. Simultaneously, the static transfer switch shall be turned on to maintain continuous power to the critical load.

.6 Inverter DC Protection
.1 The inverter shall be protected by the following disconnect levels:
.1 DC Overvoltage Shutdowns
.2 DC Undervoltage Shutdowns (End of Discharge)

.7 Overdischarge Protection
.1 To prevent battery damage from overdischarging, the UPS control logic shall automatically raise the shutdown voltage setpoint as discharge time increases beyond fifteen (15) minutes. The automatic shutdown voltage adjustment ramp shall be a linear function starting with 1.63 volts per cell at 15 minutes and increasing to 1.83 volts per cell at 90 minutes after beginning of battery discharge. The shutdown voltage shall not be less than 1.67 volts per cell at 30 minutes and not less than 1.75 volts per cell at 60 minutes.

.8 Inverter Output Voltage Adjustment
.1 A manual control shall be provided to adjust the inverter output voltage from +/- 5% of the nominal value. Adjustment shall be made from the control pad on the front of the UPS.

.9 Output Frequency
.1 The output frequency of the inverter shall track input frequency (when input frequency is within limits) and be controlled by an ocscillator. When free-running, the oscillator shall be temperature compensated and hold the inverter output frequency to +/-0.1% for steady state and transient conditions. Drift shall not exceed 0.1% during a 24-hour period. Total frequency deviation, including short time fluctuations and drift, shall not exceed 0.1% from the rated frequency.

2.4 Static-Bypass Switch

.1 General
.1 A static transfer switch and bypass circuit shall be provided as an integral part of the UPS. That static switch shall be a naturally commuted high-speed static (SCR-type) device rated to conduct full load current continuously. The switch shall have an overload rating of 110% rated load continuously. 150% rated load for ten minutes, 200% rated load for 30 seconds, and 2,000%

rated load for two cycles. The static bypass shall shut down if these overload conditions are exceeded. The static transfer switch control logic shall contain an automatic transfer control circuit that senses the status of the inverter logic signals, and operating and alarm conditions. This control circuit shall provide an uninterrupted transfer of the load to an alternate bypass source (or normal input source). Transfers shall be made when an overload or malfunction occurs within the UPS, without exceeding the transient limits specified herein.

.2 Uninterrupted Transfer

.1 The transfer control logic shall automatically turn on the static transfer switch, transferring the critical AC load to the bypass source, after the transfer logic senses any of the following conditions:

.1 Inverter overload capacity exceeded
.2 Critical AC load overvoltage or undervoltage
.3 Battery protection period expired.
.4 UPS fault condition.

.2 Uninterrupted Retransfer

.1 Retransfer of the critical AC load from the bypass source to the inverter output shall be automatically initiated unless inhibited by manual control. The transfer control logic shall inhibit an automatic retransfer of the critical load to the inverter if one of the following conditions exists:

.1 Inverter out of synchronizations with bypass.
.2 Overload condition exists in excess of inverter full load rating
.3 UPS fault condition present
.4 More than 15 transfer attempts in a 20-minute period

.3 Display and Controls

.1 The UPS shall be provided with a microprocessor based unit status display and controls section designed for convenient and reliable user operation. All of the operator controls and monitors shall be located on the front of the UPS cabinet. The monitoring functions such as metering, status and alarms shall be displayed on a four line, 64 character alphanumeric liquid crystal display (LCD). The display unit includes a membrane overlay with tactile dome buttons for control, and a guarded, red pushbutton for local emergency power off. Additional features of the monitoring system shall include:

.2 Menu-driven display with text format
.3 Real time clock (time and date)
.4 Alarm history with time and date stamp
.5 Battery backed-up memory

.4 Metering

.1 The following parameters shall be displayed:

.1 Input AC voltage line-to-line
.2 Input AC current for each phase
.3 Input frequency
.4 Battery voltage

.5 Battery charge/discharge current
.6 Output AC voltage line-to-line and line-to-neutral for each phase
.7 Output AC current for each phase
.8 Output frequency
.9 Percent of rated load being supplied by the UPS
.10 Output kVA and kW for each phase
.11 Battery time remaining during battery operation
.12 Operating temperature of input converter, inverter, and internal battery.

.5 Status Messages

.1 The following UPS status messages shall be displayed:

.1 Normal operation
.2 UPS on battery, (and time remaining)
.3 System shutdown
.4 Start up sequence aborted
.5 Battery test enabled/disabled
.6 System time set by operator
.7 Load on bypass

.6 Alarm Messages

.1 The following alarm messages shall be displayed:

.1 Input voltage out of tolerance
.2 Bypass voltage out of tolerance
.3 UPS on battery
.4 Site wiring error
.5 Output undervoltage
.6 Output overvoltage
.7 Incorrect input frequency
.8 Output overload
.9 Overload Phase A
.10 Overload Phase B
.11 Overload Phase C
.12 Temporary overload
.13 Charger failure
.14 Battery failed test
.15 Cannot execute battery test: not recharged
.16 Cannot execute battery test at this time
.17 Logic error
.18 Memory failure ROM
.19 Memory failure RAM
.20 UPS overtemp
.21 External shutdown initiated (remote or local EPO activated
.22 Fan failure
.23 Charger battery voltage too high
.24 Charger battery voltage too low
.25 Charger blown fuse
.26 Low battery shutdown
.27 Low battery warning (adjustable 1 to 99 minutes)
.28 DC bus overvoltage
.29 PFC bus voltage high
.30 PFC bus voltage low
.31 PFC hardware shutdown
.32 System shutdown impending due to over temperature

.33 Inverter fault
.34 Inverter failure
.35 System shutdown: loss of control power
.36 Over temperature shutdown
.37 System output overloaded
.38 Bypass overload
.39 Fault load transferred to bypass
.40 Bypass power supply failure
.41 Bypass out of sync
.42 Bypass SCR open
.43 Bypass SCR short
.44 Bypass sensing failure
.45 Load on bypass
.46 Excessive retransfers attempted.
.47 An audible alarm shall be provided and activated by any of the above alarm conditions.

.7 RS-232C Interface Port

.1 An RS-232C interface port shall be provided for remote display of UPS status information at a computer terminal (by others). The format of the remote display shall mimic the alpha-numeric display panel located on the UPS.

.8 LAN Interface Port

.1 A DB25F interface port shall be provided for signalling of UPS status information to a computer (by others) using software for unattended shutdown. The signals shall include; power fail, on battery, low battery and on bypass.

.9 Event Logging

.1 The UPS monitoring shall have the capability of capturing the following:
.1 Input brownouts, blackouts and transients
.2 Frequency variations
.3 UPS alarms
.4 UPS external "on" and "off" commands
.5 UPS total ON time

.2 Information will bee categorized into two sections:
.1 Alarm History
.1 Event type
.2 Event date and time
.2 Input disturbance counter (resettable)
.1 Sum number of brownouts
.2 Sum number of blackouts
.3 Sum number of transients
.3 The number of events that shall be stored is 512, after which the events will enter and leave the buffer in first-in-first out order.

.10 Controls

.1 UPS start-up and shutdown operations shall be accomplished via the from LCD panel. An advisory display and menu-driven user prompts shall be provided to guide the operator through system operation without the use of additional manuals. Push buttons shall be provided to display the status of the UPS and to test and reset visual

and audible alarms. A guarded, red pushbutton switch for local emergency power off shall also be provided.

.11 On-Line Battery Test

.1 The UPS shall be provided with a menu driven On-Line Battery Test feature. The test shall ensure the capability of the battery to supply power to the inverter while the load is supplied power in the normal mode. The battery test feature shall have the following user selectable options, accessible from the LCD panel and/or RS232C port:

.1 DC bus voltage threshold (pass/fail value)
.2 Interval between tests (2 to 9 weeks)
.3 Duration of test (30 to 900 seconds; factory default is 30 seconds)
.4 Date and time of initial test
.5 Enable/disable test

.2 If the battery fails the test; the system shall automatically do the following:

.1 Transfer the load to bypass
.2 Restart the rectifier/charger
.3 Display a warning message
.4 Sound an audible alarm
.5 Retransfer the load back to normal mode

2.5 Maintenance Bypass Switch

.1 Maintenance Bypass Switch - 600V, 3 Phase Input/120-208V, 3 Phase, 4W Output

.1 A manually operated three-phase maintenance bypass switch shall be incorporated into the UPS cabinet to directly connect the critical load to the input AC power source, completely bypassing the input converter, inverter, static transfer switch, all control and monitoring circuits, and all printed circuit boards. The internal maintenance bypass switch and its terminals shall be physically barrier and isolated from these components.

.2 Dual-Input Configuration

.1 This configuration alternative shall provide input terminals for an alternate source to the static transfer switch (bypass) separate from the feeder to the input converter. The inverter output shall synchronize to the bypass source which may be different from the input converter source. The internal Maintenance Bypass Switch shall also be fed from the alternate source.

.3 Input Coverter with 3% Input Current THD

.1 Added dynamic power factor correction circuitry shall reduce the input current distortion to 3% maximum at all load levels. Input power factor shall be corrected to 0.99 minimum.

.4 The maintenance bypass shall have integral transformer for 600V, 3 phase, 3 wire input, 120/208V, 3 Phase, 4 wire output. The transformer shall be c/w taps to raise/lower the voltage if required.

2.6 Accessories (Communications Options)

.1 Communication interfaces will be provided by printed circuit boards installed in the slot area of the UPS cabinet.
.1 Programmable Relays
.1 A programmable relay board with eight (8) double-pole, double-throw relays shall be provided. The relays shall be individually programmable to activate based on a selection of a number of UPS events. Each relay shall be programmable to function based on any one alarm or any combination of alarms from the UPS. Any alarm or group of alarms shall be able to trigger multiple relays.
.2 The UPS shall accept up to two alarm board (16 total relays). EAch relay shall have two sets (2A/2B) of form C contacts rated for 2 Amps at 30 VDC, 0.6 Amps at 125 VAC.
.2 Input Contact Isolator
.1 The Input Contact Isolator option shall accept eight (8) normally-open customer relay inputs. These inputs shall be treated like other UPS alarms. The UPS shall be programmable to act on these alarms exactly like internally generated alarms. The user shall be able to program the name of the input alarm through the LCD panel or RS232 port.
.3 SiteScan Interface
.1 The SiteScan Interface shall provide communication capability with Liebert Site monitoring (SiteScan or Sitemaster 200) products.
.4 Provide programmed inputs to disable battery charging when the emergency generator is running (contact input from the ATS).

2.7 External Accessories

.1 The Remote Status Panel's (2) shall be provided in a NEMA 1 enclosure for wall mounting with the following features:
.1 Load on UPS indicator (Green LED)
.2 Battery Discharge Alarm (Red LED)
.3 Low Battery Reserve Alarm (RED led)
.4 Load on Bypass Alarm (Red LED)
.5 UPS Alarm Condition (Red LED)
.6 New Alarm Condition (Red LED)
.7 Audible Alarm
.8 Lamp Test/Reset Pushbutton

PART 3 - EXECUTION

3.1 Field Quality Control

.1 The following inspections and test procedures shall be performed by factory trained field service personnel during the UPS startup.
  .1 Visual Inspection
    .1 Inspect equipment for signs of damage
    .2 Verify installation per drawings
    .3 Inspect cabinets for foreign objects
    .4 Verify neutral and ground conductors are properly sized and configured
    .5 Inspect battery cases
    .6 Inspect battery for proper polarity
    .7 Verify all printed circuit boards are configured properly
  .2 Mechanical Inspection
    .1 Check all control wiring connections for tightness
    .2 Check all power wiring connections for tightness
    .3 Check all terminal screws, nuts, and/or spade lugs for tightness
  .3 Electrical Inspection
    .1 Check all fuses for continuity
    .2 Confirm input voltage and phase rotation is correct
    .3 Verify control transformer connections are correct for voltage being used
    .4 Assure connection and voltage of the battery string(s).

3.2 Site Acceptance Testing

.1 The Contractor shall arrange for Powerware to conduct the following tests on the UPS installation:

Note: Powerware will quote this testing to Div. 16 as it is not part of the equipment cash allowance.

.2 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 A.

.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%).

.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 Manufacturer's Field Service

.1 Service Personnel
.1 The UPS manufacturer shall directly employ an organization, consisting of factory trained field service personnel dedicated to the start-up, maintenance, and repair of UPS and power

equipment. The organization shall consist of regional and local offices.

.2 The manufacturer shall provide a fully automated national dispatch centre to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours/day, 7 days/week, 365 days/year. If emergency service is required, response time for a return call from the responding field engineer shall be 20 minutes or less.

.3 An automated procedure shall be in place to insure that the manufacturer is dedicating the appropriate technical support resources to match escalating customer needs.

.2 Replacement Parts Stocking

.1 Parts shall be available through an extensive network to ensure around-the-clock parts availability throughout the country.

.2 Customer Support Parts Coordinators shall be on-call 24 hours a day, 7 days a week, 365 days a year for immediate parts availability.

3.4 Maintenance Contracts

.1 A complete offering of preventive and full service maintenance Contracts for both the UPS system and battery system shall be provided. An extended warranty and preventive maintenance package shall be provided for a period of 2 years after warranty period. Warranty and preventive maintenance service shall be performed by factory-trained service personnel.

END

PART 1 - GENERAL

1.1 Related Work

.1	Installation of anchor devices, setting templates:	Section 03300
.2	Electrical General Requirements	Section 16010
.3	Conduit	Section 16111
.4	Wire and Cables	Section 16122
.5	Automatic Load Transfer	Section 16627

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 16010.

.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 16010.

.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 At end of 6 hour run increase load to 110% rated value, and take readings every 15 min for 1 h. (Prime power units only).

.3 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.

.4 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: 1 phase, 120/240V, 3 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.
.1 Spring type isolators with adjustable side snubbers and adjustable for levelling.

.3 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 16 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 60 amp 120/240 Volt combination panel and breakers, 5kW heater, two incandescent light fixtures complete with 100 watt lamps, one light switch, and one convenience GFI duplex receptacle. 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 16010 - Electrical - General Provisions.

.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.

3.2 Testing

.1 Perform tests in accordance with Section 16010 - Electrical - General Provisions and "Site Tests" in Part 1.

.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 4 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

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Electrical General Requirements	Section 16010
.2	Service Entrance Board	Section 16421
.3	Secondary Switchgear (120/208V & 347/600V)	Section 16426
.4	Power Generation Diesel	Section 16622

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 16010.

.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 16010.

.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.
.4 In-phase monitor operation (where provided).

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 to ensure that the transfer or re-transfer only takes place when both the normal and emergency sources are within tolerances.

.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.

.5 'Elevator Emergency Mode Bypass' Keyswitch (local):
.1 A keyswitch shall be provided to bypass the elevator emergency mode during testing only. This will allow the elevators to function normally during a transfer switch test.

.6 For each elevator controller, provide the following auxiliary contacts:
.1 Two auxiliary contacts that are closed when on normal power and open when on emergency power.
.2 One auxiliary contact that is closed except for an adjustable period of time (0 to 50 seconds adjustment, set initially at 15 seconds) prior to power supply transfer in either direction, from normal to emergency or from emergency to normal.

.7 Provide a contact output to each UPS (2) 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 Acceptable Manufacturer

.1 Thompson Technology Incorporated. Series TS870SE automatic transfer switches with bypass.

2.7 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical General Requirements.

2.8 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 16010 - Electrical General Requirements.

.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

PART 1 - GENERAL

1.1 REFERENCE

.1 Section 16010.

1.2 RELATED WORK

.1 Comply with relevant sections of this and other Divisions of the specification, including Section 16010 Electrical General Requirements.

.2 Comply with the requirements of the latest edition of CSA-B72 for the specific installation class of the building and the results of the grounding study.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 98% conductivity, commercial lighnting protection cables shall be high grade copper cables, size as shown minimum #4/0 unless shown otherwise.

.2 Ground electrodes shall be copper clad 20mm (3/4") diameter x 3000mm long (3/4" x 10 ft.) rods and/or 1m sq. (36") x 20 ga. copper plates.

.3 Connectors shall be cadweld or thermoweld or Burndy `High Press'.

.4 Earth enhancing compound shall be of the 2 part site mix gel type.

.5 Chemical additives for ground resistance reduction, shall be suitable for vertical or horizontal configurations.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 The lightning protection system shall be installed by an approved Subcontractor licensed to carry out such installation. (Western Lightning Protection)

.2 Provide required modifications to ensure proper resistance ratings. If required, use Earth Enhancing or Chemical Rod treatment methods.

.3 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.

.4 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.

.5 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.

.6 The base perimeter loop and cross loop shall be connected to building lightning protection system as indicated on drawings.

.7 At downlead cable locations, provide a suitable fitting as. required.

.8 Connect all downlead conductors at grade to the grounding loop cable.

.9 All down conductors shall be installed on face of building in rigid PVC conduit with offsets, for cable strain relief.

.10 Upon completion of the lightning protection system, the Contractor shall submit a certificate of installation and an inspector's report to the Contract Administrator.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Electrical General Requirements	Section 16010
.2	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.3	Wires and Cable	Section 16122
.4	Outlet Boxes, Conduit Boxes and Fittings	Section 16132
.5	Work in Existing Building	Section 16195

1.2 References

.1 CAN/ULC-S524 Installation of Fire Alarm Systems

.2 ULC-S525 Audible Signal Appliances, Fire Alarm

.3 CAN/ULC-S526 Visual Signal Appliances for Fire Alarm Systems

.4 CAN/ULC-S527 Control Units, Fire Alarm

.5 ULC-S528 Manually Actuated Signalling Boxes, Fire Alarm

.6 CAN/ULC-S529 Smoke Detectors, Fire Alarm

.7 ULC-S530 Heat Actuated Fire Detectors, Fire Alarm

.8 CAN/ULC-S531 Smoke Alarms

.9 CAN/ULC-S536 Inspection and Testing of Fire Alarm Systems

.10 CAN/ULC-S537 Verification of Fire Alarm Systems

.11 Manitoba Building Code

1.3 Description of System

.1 This specification provides the requirements for the supply and installation, programming, testing, commissioning and verification of a complete Addressable Analog Fire Detection System. The system shall include, but not be limited to: control panels, amplifiers, DGPs, Printer, remote annunciators, graphic annunciators, input and control modules, alarm initiating and indicating peripheral devices, conduit, wire and accessories,

etc. required to furnish a complete operational system. Provide 120V circuits for equipment as required.

.2 System Includes:
.1 Microprocessor based addressable control panel to carry out fire alarm and protection functions including receiving alarm signals, initiating first stage and general alarm, supervising system continuously, actuating zone annunciators, initiating trouble signals, performing fire control functions, etc.
.2 Trouble signal devices.
.3 Power supply facilities.
.4 Manual alarm stations.
.5 Automatic alarm initiating devices.
.6 Audible signal devices.
.7 Visual alarm signal devices.
.8 End-of-line devices.
.9 Annunciators.
.10 System Chart Printer.
.11 Ancillary devices.
.12 Standby batteries.
.13 Auxiliary control.
.14 Data gathering panels.
.15 Intelligent environmental compensation.
.16 System degrade operation.
.17 Other features, components, etc. as required.

.3 The loading of device loops shall be based on approximately 80% load. Provide additional loops to comply with this loading where required or directed.

.4 The loading of speaker circuits, strobe circuits and chime circuits shall not exceed 75% circuit capacity. Provide additional circuits to comply with this loading where required or directed.

1.4 Requirements of Regulatory Agencies

.1 The equipment and installation shall comply with the current ULC and Building Code requirements.

.2 Manitoba Building Code.

.3 Local and Municipal By-Laws.

.4 Authorities having jurisdiction.

1.5 Shop Drawings

.1 Submit shop drawings in accordance with Section 16010 for the complete Fire Alarm system including:
.1 All devices.
.2 Control panels, DGP's, amplifiers, graphic annunciators, LCD annunciators, printer, accessories, etc.
.3 Zoning System, including isolator locations.
.4 Programming of the Fire Alarm System.
.5 Connection to fire suppression system.
.6 All other components of the fire alarm system.
.7 Description of the operational sequences of the system.
.8 Complete set of drawings, indicating location of all devices, including analogue and signalling devices, control and annunciator panels, all interconnections to mechanical equipment, to fire suppression systems and to existing computer room system, all conduit routing and sizes, all wire sizes, types, number and a riser for each control panel indicating all of the above.
.9 Pictorial drawings of control equipment indicating the location of the components and parts and their respective catalogue number and electrical characteristics.
.10 Interconnecting diagrams and cable manual.
.11 System descriptions of the actual installation.
.12 Maintenance instructions.
.13 Recommended spare parts list.
.14 Provide name, address and telephone number of the manufacturer's service representative to be contacted during the warranty period.

.2 This information is to be revised to "as-built" after construction is completed. Insert as part of the Operating and Maintenance Manuals.

1.6 Operation and Maintenance Data

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual specified in Section 01730 - Operation and Maintenance Manual and in Section 16010.

.2 Include:
.1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
.2 Technical data - illustrated parts lists with parts catalogue numbers.
.3 Copy of as-built shop drawings.

1.7 Warranty

.1 Warranty all Equipment, Sensors, materials, peripherals, installation, workmanship, etc. for one (1) year from the date of final acceptance of the system.

.2 Provide a complete inspection and testing of the fire alarm system 1 year after final acceptance. Inspection tests to conform to be ULC-S536. Submit inspection report to Engineer.

.3 Provide all programming of system as directed during the warranty period at no cost to Owner.

1.8 Maintenance

.1 Provide one year's free maintenance with two inspections by manufacturer during year. The second inspection can be done at the same time as the ULC-S536 inspection and testing specified in 1.7 Warranty.

1.9 Training

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

.2 Provide video tape (3 copies) of all training provided.
.1 Provide training sessions which will explain general system operation to staff.
.2 Provide training sessions for staff to explain detailed operating and maintenance procedures.

1.10 Maintenance Materials

.1 Provide maintenance materials in accordance with Section 16010.

.2 Include:
.1 Ten spare glass rods for manual pull box stations.
.2 Ten spare lamps for Main Control Panel.

.3 Provide a lockable metal cabinet to be installed as directed by the Owner.
.1 Provide 6 spare devices of each type used in unopened cartons and clearly labelled as to type of device (smoke detectors/heat detectors/dual strobes/bell strobes/addressable relays/detector bases/pull stations, etc.

1.11 Service

.1 The supplier of the system must employ factory trained technicians and maintain a service organization within driving distance of the job site.

1.12 Materials

.1 The system and components must be supplied by one manufacturer of established reputation and experience who must have produced similar apparatus for a period of at least five (5) years and who must be able to refer to similar installation rendering satisfactory service. All references to model numbers and other pertinent information herein is intended to establish minimum standards of performance, quality and construction.

.2 Any equipment proposed as equal to that specified herein must conform to the standards herein. All equipment must be of one manufacturer. In addition, the contractor must obtain the Consultant's approval in writing five (5) working days prior to bidding other than as specified. The manufacturer's name, model numbers, and three copies of working drawings and engineering data sheets shall be submitted for approval along with a point by point comply/non-comply cross reference listing, item by item, of the specification for compliance. Refer to Requests for Equals in Section 16010 as well. Approval of other manufacturers does not relieve the contractor from meeting the specification requirements.

.3 Manufacturers

.1 Approved manufacturers:

.1 Edwards

.2 Simplex

.3 Cerberus/Siemens

.4 Notifier

.2 Approved manufacturers must use factory trained personnel for all sales, installation, programming, testing, verification, inspection, service, etc.

PART 2 - PRODUCTS

2.1 Materials

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Power supply: to CAN/ULC-S524.

.3 Audible signal devices: to ULC-S525.

.4 Control unit: to CAN/ULC-S527.

.5 Manual fire alarm stations: to ULC-S528.

.6 Thermal detectors: to ULC-S530.

.7 Smoke detectors: to CAN/ULC-S529.

.8 Smoke alarms: to CAN/ULC-S531.

.9 Visual alarms: to CAN/ULC-S526.

2.2 Fire Alarm Design Features

.1 The Fire Alarm System shall be a zoned, two stage, non-coded, electronically supervised, addressable, microprocessor based, networked system. Supply complete with all hardware and software necessary for this installation.

.2 Manual override switches, Actions, Sequences, and Time Controls shall have the ability to be software disabled to prevent unauthorized operation during non alarm condition. Switches shall be automatically enabled during alarm condition to allow manual control by authorized personnel.

.3 When all active events that initiated the SET or RESET of an output have returned to normal, only then shall the output be allowed to restore.

.4 Visually indicate at the control panel LCD, the addressable device or the circuit of alarm initiation. When the control panel goes into the alarm condition the green NORMAL LED shall extinguish, the red ALARM LED shall light and the BUZZER shall pulsate. The first line of the 80 character LCD shall indicate the REAL TIME, the number of MESSAGES WAITING, the TYPE of ALARM, the ALARM ZONE NUMBER, and the TIME THAT THE ALARM OCCURRED. The second line shall display the user specified message.

.5 The system shall be capable of setting the sensitivity of all analog sensors by point and be capable of displaying the analog value of the sensor by device and/or traditional input and vectoring the value to the printer. The system shall automatically identify any analog sensor which becomes dirty (maintenance alert) prior to false alarming.

.6 The operator shall acknowledge the alarm by pressing the NEXT/ACK button, and the buzzer will silence providing there is not an additional alarm pending. If there are additional alarms waiting, the operator shall acknowledge all pending alarms before the buzzer will silence. To silence audible devices, the operator shall press the ALARM SILENCE button. A new alarm shall cause the audibles to respond. To reset the system the operator shall press the RESET button.

.7 Print a record of alarm on the system printer by Time, Alarm zone or device number, alarm type, and the user specified message. All restorations shall likewise be recorded, except the user specified message shall not be repeated.

.8 Activation of a sprinkler supervisory condition shall automatically:
.1 Display on the control panel LCD the zone or the addressable device. During the SUPERVISORY condition the amber SUPERVISORY LED shall light, the NORMAL LED shall go out, and the BUZZER shall pulsate. The LCD shall indicate SUPERV. SHORT and the zone/device number. The operator shall silence the BUZZER by acknowledging all messages and pressing the TROUBLE SILENCE button.

2.3 Sequence of Operation

.1 On activation of any alarm initiating device on the fire alarm system, the system goes into alarm as follows:
.1 Signal all horns or speakers and activate strobes throughout the building to sound at stage one alarm rate.
.2 Annunciate the location of the alarm initiating device on all annunciators and control panel. All annunciators and control panel shall display identical zone descriptions.
.3 Shut down all fans, etc. in the building as indicated.
.4 Unlock electrically locked doors.
.5 All magnetically held doors throughout the entire facility shall be released.
.6 Signal elevators to home.
.7 Activate preaction sprinkler system from devices in the preaction sprinkler zone.
.8 The alarm signal continues to sound throughout the facility until:
.1 Tones are manually silenced; horns and speakers remain silenced until a subsequent zone is activated.
.2 Alarm initiating device / devices are reset / cleared and the system is reset.
.9 Transmit a signal to the Fire Department.
.10 Other auxiliary functions as specified.
.11 Stage two alarm activation via pullstation key switch activation or 5 minute stage one alarm time out will cause all audible and visual alarms to go into general evacuation rate.

.2 If the system is being tested by staff, all annunciators and control panel shall display "TEST IN PROGRESS" in addition to the initiating devices being tested.

2.4 Control Panel

.1 The control panel shall be modular in construction with multi tasking microprocessor-based technology, distributed processing, and include a watchdog circuit per individual module processor to monitor the proper operation of every system processor. Systems with one watchdog circuit for all the modules are not considered equal. All components must be housed in an approved enclosure, behind a cylinder locked, removable hinge door with a viewing window. Opening of the panel door must not expose live components

or wiring. The door must be easily removable without tools to prevent any obstruction to the operator during fire alarm management procedures or during system maintenance procedures.

.2 The base system board must provide the number of addressable loops as shown on the drawings plus 25% spare, signal circuits of 1.5 A each as shown on the drawings plus 25% spare, alarm relays, trouble relays, programmable relays, communication network port, alphanumeric LCD annunciator driver port, auxiliary power limited 24 VDC supply, communication active LED, programming port, digitally controlled battery supervision circuit and charger, etc.

.3 The system must be fully field programmable. Perform any required logical sequence for fan and damper control. Provide 99 software timers accurate to one second for any required timing functions. The timers may be individually programmed from one second to four hours.

.4 The system software must fully integrate all of the system functions including annunciation, alarm management sequence, fan and damper control.

.5 The system must be capable of providing alarm indication in degrade mode by activating the addressable loop alarm led.

.6 The total system one way response to an alarm shall be no more than 2.5 seconds on a system configured to the maximum capacity.

.7 System communication between transponders if supplied must be in DCLB via copper wires.

.8 The system addressable loops must be DCLB with loop isolation between alarm zones. The addressable loop must not be loaded more than 80% of full system capacity.

.9 The control panel shall have a two line by forty character backlit supertwist (for any required viewing angle) alphanumeric LCD display.

.10 The operator control panel must be intuitive in design. It must be fully bi-lingual in English and French and must have all the following standard indications and control buttons clearly labelled in English and French. A programmable key may be used to toggle the system prompts and printouts between the English and French languages.

.11 Detection line circuit monitoring shall be provided by a Conventional Zone Module. This module shall be system interconnected by a card edge connector and shall be operated by the control panel. Each circuit shall be capable of Class "A" or Class "B" wiring. Each zone shall accommodate up to thirty (30) ionization or photoelectric detectors, flame and beam detectors, as well as any quantity of shorting type contact devices.

.12 An output circuit for operation of DC audible devices, or city tie, shall be provided by Controllable Signal Module. This module shall be system interconnected by a card edge connector, capable of operating with either Class "A" or Class "B" wiring, and shall be operable by the control panel. The module shall be supervised by the control unit for open and shorted circuits. Open and short circuits shall report trouble only and respond with circuit identification. The module shall contain two (2) programmable open collector outputs capable of sourcing 250 ma at 40 VDC for relay or LED activation.

.13 The system shall require no manual input to initialize in the event of a complete power down condition. It shall return to an on line state as an operating system performing all programmed functions upon power restoration. Systems requiring battery backed-up memory devices shall not be acceptable.

.14 Selectable history event logging shall be stored in flash memory and displayed, printed or downloaded by classification for selective event reports.

.1 Shall allow selection of events to be logged, including; inputs, as alarms, troubles, supervisory, securities, status changes and device alarm verification; outputs, as audible control and output activation; actions, as reset, set sensitivity, arm/disarm, override, password, set time and acknowledge.

.2 Data format for downloading shall be compatible with the data base handling program, allowing custom report generation to track alarms, troubles and maintenance.

.3 Audible and visual indications shall be generated when memory is 80% and 90% full to allow downloading of data. The system shall be programmable circular logging, assuring that at least the last 800 events will always be stored in non-volatile memory.

.15 The system shall support intelligent analog smoke detection, conventional smoke detection, manual station, water flow, supervisory and status monitoring devices. The system shall also be capable of supporting future amplifiers, future voice/visual circuits and a firefighter's telephone system.

.16 The panel must be capable of measuring the sensitivity of connected intelligent analog ionization and photoelectric smoke detectors.

.1 The measurements shall be discrete voltage readings, accurate to .01 VDC. The readings shall be dynamic, providing a constant display of voltage shifts when in the sensitivity voltage list mode.

.2 The control panel shall provide a display and a printed list of these sensitivity measurements as a permanent record of the required sensitivity testing.

.3 When programmed, any system connected, ionization or light refraction style smoke detector shall be capable of automatic sensitivity drift compensation up or down. This adjustment shall

keep the relationship between the sensing chamber voltage and the programmed alarm threshold voltage constant throughout the life of the detector to prevent false indications or failure to alarm in the presence of smoke.

.4 The control panel shall place each detector in the system in an alarm condition, transparent to the system user, every twenty four hours as a dynamic check of the accuracy of the alarm threshold setting. Upon reception of the alarm report, the system detector shall be restored to it's pretest state.

.5 The system shall be capable of monitoring the state of detectors and display a message when a detector is approaching the limits of adjustment as a result of contaminants. A second message shall be displayed when the detector reaches the limits of adjustment due to these contaminants.

.6 The system shall be capable of recognizing that a detector has been cleaned, initiating a series of tests to determine if the cleaning was successful and display a detector cleaned message, readjusting that detectors normal sensitivity setting reference.

.17 The system shall recognize initiating of an alarm and indicate the alarm condition in a degrade mode of operation, in the event of processor failure or the loss of system communications to the circuit interface panels.

.1 Each circuit interface panel shall be capable of operation in its own degrade mode. In this mode, the system shall receive an alarm from any intelligent analog or conventional initiating device. It shall activate local indicating appliances and remote or auxiliary connect circuits.

.2 The system shall indicate a trouble condition during degrade mode operation and shall give a visual indication of an alarm condition.

.3 Detector operation in the degrade mode shall continue at the alarm threshold previously programmed. Systems returning detectors to a common default value in degrade mode shall not be acceptable.

.18 The system shall be capable of reporting alarms from devices whether programmed or not. Alarm reports from these devices shall activate indicating appliance circuits.

.19 The system shall perform time based control functions including automatic changes of specified smoke detector sensitivity settings.

.1 Time based functions shall be controlled by specifying time periods or actual dates. It also shall provide the ability to control these functions on an exception basis using a holiday schedule.

.20 The system shall provide a one person field test of either the complete system or a specified area, maintaining full function of areas not under test.

.1 Field test shall be usable in a silent or audible mode. When in the audible mode, the signals shall audibly annunciate alarms, troubles and device types.
.2 All field test activity shall be logged to the system printer and historical memory.

.21 The system shall be provided with eight levels of password protection with up to forty passwords.

.22 Provide a cost savings software verification Compare program. The program shall instruct the technician as to what software changes have been made from one software revision to another and what points require verification.

.23 The system must be capable of reading and displaying at the control panel the sensitivity of remote intelligent/analog ionization and photoelectric detection devices. Individual intelligent/analog detection device alarm threshold must be adjustable form the control panel.

.24 The detection system must remain 100% operational and capable of responding to an alarm condition while in either routine operator maintenance mode or during programming by the manufacturer.

.25 Dynamic supervision of system electronics, wiring, detection devices and software must be provided by the control system. Failure of system hardware or wiring must be indicated by type and location on the alphanumeric display.

.26 The control mode must permit the arming and disarming of individual detection or output devices. Status of these devices must be displayed upon command from the control panel.

.27 The address, type of device and sensitivity setting of each addressable device must be field setable by a simple programming device and stored in the addressable device in non-volatile memory. Loss of both A/C power and batteries in the control panel will not affect the system device programming.

.28 The system must be programmed in the field only via laptop computer. Burning of EPROMs is not acceptable. System programming must be password protected. The final system program must be available on hardcopy and included in the owner's manuals.

.29 The printer or alphanumeric display must be capable of listing upon request:
.1 Alarms and troubles with time, date and location.
.2 Status of output functions.
.3 Sensitivity of intelligent /analog smoke detectors.
.4 Detection device number, type and location.
.5 Status of remote relays.
.6 Acknowledgement time and date.
.7 Signal silence time and date.
.8 Reset time and date.

.9 Battery voltage, A/C voltage and battery charge current.

.30 The system must be capable of:
.1 Counting the number of intelligent/analog devices within a "zone" which are in alarm.
.2 Counting "zones" which are in alarm.
.3 Counting the number of intelligent/analog detectors which are in alarm on the system.
.4 Differentiating among types of intelligent/analog detectors such as smoke detectors, manual stations, water-flow switches, thermal detectors, cross zoning,etc...

.31 Provide a suitable dot matrix printer (located at security desk) to log all system activity, print reports, etc.

2.5 Power Supply

.1 120 VAC, 60 Hz input, 24 VDC output standby power from gel cell batteries sized as per NBC-90 requirements.

.2 System to include system power supplies, including necessary transformers, rectifiers, regulators, filters and surge protection required for system operation. The system devices shall display normal and alarm conditions consistently whether operating from normal power or reserve (standby) power.

.3 The Power Supply/Chargers, shall provide 24 Vdc operating and emergency power to the system. The power supply shall be of switch mode design with a minimum efficiency of 80% with transient protection (up to 6 KV) including the EMI filter, spark gaps, transzorbs, and varistors. The power supply shall provide required current outputs of fully regulated, power limited 24 Vdc. The power supply shall provide diagnostic LEDs to notify the operator upon AC power and/or the control unit CPU failure. The power supply shall have brown out, low battery, and system ground fault features. It shall be capable of charging from 5 AH to 60 AH batteries of either gel electrolyte or nickel cadmium types. Upon AC power failure, the power supply shall transfer the system to battery back-up and power the system for 24 hours and then drive all bells, horns and strobes for a minimum of 30 minutes (or as required to meet code for the particular building occupancy).

.4 The system shall have the capability of polling any system power supply to determine battery voltages and current accurate to within .01VDC.

2.6 Data Gathering Panel (Main FACP)

.1 Where shown on drawings, DGPs shall be equipped with an 80 character backlit LCD display to annunciate all zones and system condition. The DGPs shall be equipped with a power supply and battery back-up capable of operating the system under normal conditions for 24 hours and after 24 hours be capable of operating all the horns, speakers and strobes for a minimum of 30 minutes. DGP to be complete with zone modules, loop modules, relay modules, etc. as required. DGP to be capable of supporting future amplifiers for signalling devices.

.2 Each DGP shall contain non-volatile EEPROM memory, and easy load, edit or change field programmable software. Each DGP shall have a RS-232 Printer/Programming port. Each DGP shall have Reset, Alarm Silence, and Trouble Silence to be used during degraded stand alone mode. The DGP shall enter stand alone mode upon loss of communication with the network master. When in the stand alone mode, the DGP shall be capable of performing all it's preprogrammed Actions, Sequences, Time Controls, Guard Patrols and fully support it's zone cards. The DGP shall have 4 Digit LED Diagnostic display that shall display up to eleven internal trouble conditions.

.1 The Data-Line Format shall be RS-485 @ 9600 BPS up to a maximum of 7,000 ft. over a minimum #18 AWG twisted pair cable, Class "A" or "B". All external connections of the slave controller shall withstand 6 Kilovolts voltage transients to chassis ground.

2.7 Alarm Signalling

.1 Provide a programmable tone module. It shall be field programmable for any one of 9 tones. 1000 Hz, slow whoop, fast whoop, slow siren, fast siren, beep, shutter, tone, pulsed at 120 bursts per minute, temporary code 3-3-3. System software shall select alert or evacuation tones as required. Tone modules may be used as primary or standby tones for other signal sources. Provide a 4 bit frequency adjust switch to allow custom tone frequencies defined by this project. Owner to select 1st stage / 2nd stage tones.

.2 Provide amplifiers sized for the speaker/horn load connected plus 25% spare capacity; provide one amplifier for each speaker circuit (total of 4 required). Each amplifier shall have a suitable output to connect a strobe circuit in the related area.

.3 Provide standby amplifier programmed to automatically take over the load on any failed amplifier.

.4 Provide all-call paging microphone located in main fire alarm panel.

.5 Wire speakers and strobe as class B circuits.

2.8 Detectors

.1 General

.1 Detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires shall be eliminated by digital filters. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable.

.1 Each detector shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and analog loop controller.

.2 Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total analog loop response time for detectors shall be 0.5 seconds.

.3 Each detector shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication with the analog loop controller. A red LED shall flash to display alarm status. Both LEDs on steady shall indicate alarm-standalone mode status.

.4 Both LEDs shall be visible through a full 360 degree viewing angle.

.5 The detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.

.6 Each detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level.

.7 Each detector microprocessor shall contain an Environmental Compensation algorithm which identifies and sets ambient "Environmental Thresholds" approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminates as well as detector aging. The process shall employ digital compensation to adapt the detector to long term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 50% and 100% of the allowable environmental compensation value.

.8 Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the "learned base line sensitivity". The base line sensitivity information shall be permanently stored at the detector approximately once every hour.

.9 Each detector may be individually programmed to operate at any one of five sensitivity settings.
.10 The intelligent analog device and the analog loop controller shall provide increased reliability and inherent survivability through intelligent analog conventional operation. The device shall automatically change to stand alone, conventional device operation in the event of a loop controller polling communications failure. In the analog conventional detector mode, the analog detector shall continue to operate using sensitivity and environmental compensation information, stored in its microprocessor at the time of communications failure. The analog loop controller shall monitor the loop and activate a loop alarm if a detector reaches its alarm sensitivity threshold.
.11 Each device shall be capable of automatic electronic addressing and/or custom addressing without the use of DIP or rotary switches. Devices using DIP or rotary switches for addressing, either in the base or on the detector shall not be acceptable.
.12 It shall be possible to program the analog devices into a minimum of 16 groups with a minimum of 32 devices per group. It shall also be possible to link groups to program activities.
.13 The intelligent analog detectors shall be suitable for mounting on any detector mounting base.

2.9 Heat Detectors

.1 Fixed Temperature Heat Detectors

.1 The intelligent heat detector shall have a thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm.
.2 The integral micro-processor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable.
.3 The heat detector shall have a nominal rating of 135°F (57°C). 190° detectors to be provided in the Boiler Room or where indicated on plans.
.4 The heat detector shall have a minimum linear spacing rating of 60 foot (21.3m) centers and be suitable for wall mount applications.
.5 Heat detectors noted or specified as "WP" or moisture proof shall be an epoxy sealed moisture proof type detector c/w dedicated addressable monitor module SiGA-CT1/CT2.

2.10 Ionization Smoke Detectors

.1 The intelligent analog ion detector shall utilize a unipolar ionization smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable.

.2 The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a Laptop Computer.

.3 The ion smoke detector shall operate in constant air velocities from 0 to 75 ft./min. (0-0.38 m/sec.) and with intermittent air gusts up to 300 ft./min (1.52m/sec) for up to 1 hour and meet the following standards:
.1 ULC Smoke Sensitivity Range 0.61 - 1.83 % Obscuration/ft (305mm).

.4 The ion detector shall be suitable for operation in the following environment: Temperature: 32°F to 120°F (0°C to 49°C) Humidity: 0-93% RH, non-condensing Elevation : Up to 5000 ft. (1,524 m)

.5 The ion detector shall be rated for ceiling installation at a minimum of 30 foot (9.1m) centers and be suitable for wall mount applications.

.6 Each detector shall be capable of Intelligent Analog-Conventional operation to provide inherent survivability in the event of a communication failure with the Analog Loop Controller.

2.11 Photoelectric Detector

.1 The intelligent analog photoelectric detector shall use a light scattering type photo sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable.

.2 The photo detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a Laptop Computer.

.3 The photoelectric smoke detector shall be suitable for area protection and direct insertion into air ducts up to 3 feet

(0.91m) high and 3 feet (0.91m) wide with air velocities up to 5000 ft./min. (0-25.39 m/sec.) without requiring specific duct detector housings or supply tubes and meet the following standards:

.1 ULI Smoke Sensitivity Range 0.67 - 3.77 % Obscuration/ft (305mm).

.2 ULC Smoke Sensitivity Range 0.67 - 3.77 % Obscuration/ft (305mm).

.3 Provide a lamacoid nameplate which describes the new fan system for all duct smoke detectors.

.4 The photo detector shall be suitable for operation in the following environment: Temperature: 32 deg F to 120 deg F (0 deg C to 49 deg C) Humidity: 0-93% RH, non-condensing Elevation : no limit

.5 The photo detector shall be rated for ceiling installation at a minimum of 30 foot (9.1m) centers and be suitable for wall mount applications.

.6 Each detector shall be capable of Intelligent Analog-Conventional operation providing inherent survivability in the event of a communication failure with the Analog Loop Controller.

2.12 Detector Bases

.1 General

.1 Detector Bases shall be suitable for mounting on North American 1 gang, 3-1/2" or 4" octagon box, 4" square box.

.2 Standard Base

.1 The base shall contain no electronics and shall support all detector types.

.2 Removal of the respective detector shall not affect communications with other detectors.

.3 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

.4 The standard detector base shall be capable of supporting one Red Remote Alarm Indicator.

.3 Relay Base

.1 The relay base shall support all detector types and have the following minimum requirements:

.1 The relay shall be a bi-stable type and selectable for normally open or normally closed operation.

.2 The position of the contact shall be supervised.

.3 The relay operation shall be exercised by the detector processor on power up.

.4 The relay shall automatically de-energize when a detector is removed.

.5 The operation of the relay base shall be controlled by its respective detector processor.

.6 Form "C" Relay contacts shall have a minimum rating of 1 amp. @ 24 vdc and be listed for "pilot duty".

.2 Each detector shall be capable of Intelligent Analog Conventional operation providing inherent survivability in the event of a communication failure with the Analog Loop Controller. This operation shall ensure the operation of the relay. Relay bases not controlled by the detector micro-processor shall not be acceptable.
.3 Removal of the respective detector shall not affect communications with other detectors.
.4 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.

.4 Isolator Base
.1 The isolator base shall support all detector types and have the following minimum requirements:
.1 The operation of the isolator base shall be controlled by its respective detector processor. Isolators which are not controlled by a detector processor shall not be accepted.
.2 The isolator shall operate within a minimum of 23 msec. of a short circuit condition on the communication line.
.3 Following a short circuit condition, each isolator/detector shall be capable of performing an internal self-test procedure to re-establish normal operation. Isolator/detectors not capable of performing independent self tests shall not be acceptable.
.2 When connected in Class A configuration the Loop Controller shall identify an isolated circuit condition and provide communications to all non isolated analog devices. Loop wiring shall be Class 'A', T-tapping is allowed between isolator bases / modules only. Isolator bases to be provided when a loop is used between floors, between areas which have fire separations. Do not exceed 12 devices on a branch without an isolator.
.3 Terminal connections shall be made on the room side of the base. Bases which must be removed to gain access to the terminals shall not be acceptable.
.4 Show isolator base locations on a floor plan as part of shop drawings. Fire separations are to be shown on these floor plans as well.
.5 The Loop Controller shall support up to 96 isolator bases.

2.13 Modules

.1 Single Input Module
.1 The intelligent Single Input Module shall be capable of a minimum of 4 personalities, each with a distinct operation.
.2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.

.3 The single input module shall support the following circuit types:
.1 Alarm Latching, Manual Station, Conventional Heat, Waterflow
.2 Delayed Waterflow
.3 Non-Latching Monitor
.4 Supervisory
.4 Input circuit wiring shall be supervised for open and ground faults.
.5 The input module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.
.6 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.
.7 The single input module shall be suitable for mounting on North American 2 1/2" (64mm) deep 1 gang, 1 1/2" (38mm) deep 4" square box with 1 gang cover.
.8 The input module shall be suitable for operation in the following environment:
.1 Temperature: 32°F to 120°F (0°C to 49°C)
.2 Humidity: 0-93% RH, non-condensing
.9 It shall be possible to address each module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.

.2 Dual Input Module
.1 The intelligent Dual Input Module shall provide two (2) supervised input circuits capable of a minimum of 4 personalities, each with a distinct operation.
.2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.
.3 The dual input module shall support the following circuit types:
.1 Alarm Latching, Manual Station, Conventional Heat, Waterflow
.2 Delayed Waterflow
.3 Non-Latching Monitor
.4 Supervisory
.4 Input circuit wiring shall be supervised for open and ground faults.
.5 The dual input module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.
.6 The dual input module shall be suitable for mounting on North American, 2 1/2" (64mm) deep 1 gang, 1 1/2" (38mm) deep 4" square box with 1 gang cover.

.7 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.
.8 The input module shall be suitable for operation in the following environment:
.1 Temperature: 32°F to 120°F (0°C to 49°C)
.2 Humidity: 0-93% RH, non-condensing
.9 It shall be possible to address each module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.

.3 Single Input Signal Module
.1 The intelligent Single Input Riser/Signal Module shall provide one supervised output circuit. The output circuit shall be suitable for any of the following operations:
.1 24 vdc, polarized audible and visible signal appliances
.2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.
.3 Circuit wiring shall be supervised for open and ground faults.
.4 The signal module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.
.5 The signal module shall be suitable for mounting on North American 2 1/2" (64mm) deep, 2 gang or 1 1/2" (38mm) deep, 4" square boxes.
.6 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.
.7 The signal module shall be suitable for operation in the following environment:
.1 Temperature: 32°F to 120°F (0°C to 49°C)
.2 Humidity: 0-93% RH, non-condensing
.8 It shall be possible to address each module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.

.4 Control Relay Module
.1 The intelligent micro-processor based Control Relay Module shall provide one form "C" dry relay contact rated at 2 amps. @ 24 Vdc. to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. Provide auxiliary relays (wired for fail safe operation) where amp rating of Control Relay Module is exceeded.
.2 The position of the relay contact shall be confirmed by the system firmware.

.3 The control relay module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.
.4 The control relay module shall be suitable for mounting on North American; 2 1/2" (64mm) deep, 1 gang, 1 1/2" (38mm) deep, 4" square box with 1 gang cover.
.5 The module shall be suitable for operation in the following environment:
.1 Temperature: 32°F to 120°F (0°C to 49°C)
.2 Humidity: 0-93% RH, non-condensing
.6 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.
.7 It shall be possible to address each module without the use of DIP switches. Devices using DIP switches for addressing shall not be acceptable.

.5 Universal Class A/B Module
.1 The intelligent Universal Class A/B Module shall be capable of a minimum of 15 distinct operations.
.2 The personality of the module shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the ZAS-2, Analog Loop Controller. Single function modules or modules requiring Eprom, ROM or PROM changes or DIP switch/jumper changes shall not be acceptable.
.3 The Universal Class A/B module shall support the following circuit types:
.1 Two Class B or one Class A Initiating Device Circuits (IDC) capable of delayed waterflow alarm operation.
.2 One Class A or B Indicating Device (Signal) Appliance Circuit (IAC)
.3 One Class A or B Circuit for 2 wire Smoke Detectors (Verified or non-verified).
.4 One Form "C" (NO/NC) Dry Output Contact Relay
.4 Input/Output circuit wiring shall be supervised for open and ground faults.
.5 The universal Class A/B module shall have a minimum of 2 diagnostic LEDs mounted behind finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes.
.6 The module shall be suitable for mounting on North American 2 1/2" (64mm) deep, 2 gang or 1 1/2" (38mm) deep, 4" square boxes.
.7 Terminal connections shall be accessible from the room side of the assembly. Devices which must be removed to gain access to the wiring terminals shall not be acceptable.
.8 The universal Class A/B module shall be suitable for operation in the following environment:
.1 Temperature: 32°F to 120°F (0°C to 49°C)
.2 Humidity: 0-93% RH, non-condensing

.9 It shall be possible to address each module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable.

2.14 Fire Alarm Stations

.1 Intelligent Two Stage Fire Alarm Station

.1 Provide intelligent single action, two stage non-coded, fully addressable fire alarm stations. The fire alarm station shall be of metal construction, semi-flush mounting in finished portions of the building and surface mounting in unfinished areas. Provide a locked test feature. Finish the station in red with silver "PULL IN CASE OF FIRE" lettering.

.2 The intelligent fire alarm station shall have a minimum of 2 diagnostic LEDs. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The fire alarm station shall be capable of storing up to 24 diagnostic codes.

.3 The module shall be suitable for mounting on a North American 1 1/2" (38mm) deep, 4" square box with 1/2" (13mm) raised cover.

.4 It shall be possible to address each module without the use of DIP switches. Devices using DIP switches for addressing shall not be acceptable.

.5 Provide tamper resistant covers for all manual alarm stations located in resident wings B, C, D and E.

.2 Duct Detector Mounting Plate

.1 Provide a mounting plate assembly suitable for mounting a detector for direct insertion into a duct 3 feet (0.91m) high and 3 feet (0.91m) wide. Mounting plate shall be code gauge steel with corrosion resistant red enamel finish.

.2 The duct detector mounting plate shall support an intelligent analog photoelectric detector (SIGA-PS), and a standard detector base. Locate duct detector according to NFPA 72 recommendations.

.3 Remote Alarm LED

.1 Provide a Remote LED Alarm indicator (SIGA-LED) as indicated on plans. LED shall have a 180 degree viewing angle and mount on a standard single gang box.

.2 Finish shall be high impact white plastic and clearly marked as an alarm device.

.3 Provide lamacoid to identify fan system or room name and number as required at each remote indicating light.

2.15 Signal Paging Devices

.1 Use 8 inch eight ohm cone type loudspeakers with matching transformers parallel connected to supervised 70 volt signal/page circuits. Provide input power taps 1/4, 1/2, 1, 2 and factory set to 1 watt. Provide axial sensitivity of 85 db at 10 feet for a 2

watt input over a frequency range of 50 to 13000 Hz. Provide a flat white baked enamel finish. Coat the speaker backboxes with a resonance damping material. Flush mounted speakers to be Type 1, surface mounted speakers to be Type 2.

.2 Use eight ohm re-entrant horn speakers with matching transformers parallel connected to supervised 70 volt signal/page circuits. Provide input power taps at 1, 2, 4, 7.5 Watts. Provide axial sensitivity of 88 db at 10 feet for a 2 Watt input over a frequency rage of 400 to 4000 Hz. Mount flush or surface as shown on the plans.

.3 Strobes: shall be ULC listed and operate on supervised alarm circuits at 20 to 24V DC. Strobe shall have a red filter.

.4 End of Line Devices
.1 Provide high impact plastic red end of line plates with screw terminations as required for all conventional circuits & bell circuits.

2.16 As-Built Riser Diagram

.1 Remote alarm system riser diagram: Refer to Section 16010 - Electrical General Requirements.

PART 3 - EXECUTION

3.1 Installation

.1 Install systems in accordance with CAN/ULC-S524, DFC-410(M), manufacturer's requirements, authorities having jurisdiction, etc.

.2 Install main control panel, annunciators, etc. and connect to AC power supply as indicated on drawings.

.3 Locate and install manual alarm stations and connect to alarm circuit wiring.

.4 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts (co-ordinate with Division 15).

.5 Connect alarm circuits to main control panel or DGP's.

.6 Connect signalling circuits to main control panel.

.7 Install end-of-line devices where required.

.8 Install remote annunciator panels and connect to annunciator circuit wiring.

.9 Locate and install door releasing devices.

.10 Locate and install relay units to control fan shut down, etc.

.11 Locate and install intelligent modules as required.

.12 Fire Suppression System: wire alarm switches, supervisory switches, solenoids, etc. and connect to control panel.

.13 Connect sprinkler switches.

.14 Connect to Building Management System (alarm/trouble).

3.2 Verification, Data and Testing

.1 System Verification

.1 Upon completion of all wiring and installation of all equipment, devices, etc., do complete verification of the fire alarm system. Verification shall be in accordance with current edition of Standard CAN/ULC-S537 "The Verification of Fire Alarm Systems" and following requirements. Even if permitted by Code and recognized standards and regulations, grade of work shall in no case be lower than specified in the project specifications. Verify all new initiating and signal/ solenoid zones and circuits, etc. Verify that every component installed, is working and functions as intended.

.2 Manufacturer with assistance of electrical contractor shall do a complete verification of system to ULC S-537 to ensure:

.1 That system is installed as per plans and specifications and is operative and acceptable to all authorities having jurisdiction.

.2 That system is installed as per recommendations of manufacturer.

.3 That system is electrically supervised, including all zone lamps. To accomplish this, manufacturer with assistance of electrical contractor shall:

.1 remove each and every device from its applicable circuit by disconnecting circuit wiring

.2 verify presence of the applicable trouble signal and indications at control panel and remote annunciators.

.4 That all devices are operative. Check each switch, device, etc. for proper operation.

.5 That all system functions are operating as intended, including:

.1 all main control circuits,

.2 all remote annunciator circuits,

.3 all manual and automatic initiating devices,

.4 all audible and visual alarm signals,

.5 all ancillary controls, including fan shutdown, door release, etc.

.6 All existing systems functions (such as alarm signals, ancillary controls, etc.) that are not modified, but are required to operate from any new zones added, shall be verified for correct operation.

.7 When fire alarm system is verified, Contractor shall measure and record all loop or circuit resistance values at the fire alarm panel when end-of-line resistor is shorted. Contractor shall highlight all values which exceed the manufacturer's recommendations and report them to the Consultant for action to correct this deficiency.

.3 Any necessary changes required to conform to the above shall be completed by the electrical contractor with technical assistance provided by the system manufacturer.

.4 During the period of this inspection, the electrical contractor shall assist the manufacturer with the services of electricians.

.5 To assist the electrical contractor in preparing his bid, the manufacturer shall indicate in his tender the number of hours required to complete this inspection.

.6 Upon completion of the above inspection, including any changes required, the manufacturer shall submit the following documentation to the Consultant.

.1 Certification of Verification

.2 A complete report of all equipment verified, including:

.1 sprinkler system switches

.2 automatic detectors

.3 alarm signals

.4 annunciators

.5 door hold open devices

.6 fan shutdown

.7 the number and type of devices connected to each circuit

.7 For each piece of equipment verified, the following information shall be included in the report:

.1 Catalogue number and type of device

.2 Location of device

.3 Zoning or circuit devices including ancillary devices

.4 Supervision test results

.5 Operation of device

.6 Inspection date

.7 Serial number of every smoke detector

.8 Sensitivity reading of every smoke detector, including duct detectors

.9 Record the time delay of all sprinkler flow switches

.10 Zone circuit loop resistance

.11 Fire alarm system supplier shall verify that alarm descriptions match and are consistent at each of following reporting locations:

.1 Fire alarm control panel

.2 Fire alarm remote annunciators

.8 Report shall also indicate operation of ancillary functions such as remote alarm indicators, door release, fan shutdown, etc. which are required to be activated. Operation shall be verified by actual observation of the entire function (e.g. bells ringing, checking to ensure proper fans shut down, etc.). Observing a change of state in the fire alarm control panel (e.g. observing relay function) is not considered complete verification of the entire function. Verification shall include actual field checking of proper operation of ancillary devices and equipment. Complete fire alarm system verification report shall be submitted to Consultant, Owner and authorities having jurisdiction minimum of one week before City of Winnipeg Acceptance Inspections.

.9 All costs necessary for this verification shall be included in electrical trade's tender price.

.10 Upon completion of this inspection, manufacturer shall demonstrate the operation of system to Owners.

.11 Verify identification of all terminals (markers, directories and diagrams) in interconnecting wires and cables, certifying their correctness. Upon completion of verification, submit all documentation to Consultant, including mylar sepia of as-built system riser block diagram and all tub or cabinet directories. Indicate on all documentation submitted that in fact it has been verified.

.12 Any errors in verification report shall be just cause for complete reverification of all verification work performed by Contractor, at discretion of Consultant. Contractor shall be responsible for all costs associated with system reverification.

.13 Verify number of detectors on each zone and include verification report quantity of detectors on each zone.

.14 Sprinkler Flow Switches: Check and calibrate time delay of all sprinkler flow switches such that time delay is between 25 and 30 seconds. Record 'final setting' time delay of every flow switch in verification report.

.2 Fire Alarm System Equipment Data

.1 Supply complete manufacturer's data, information and instructions to aid the Owner to troubleshoot, repair, maintain and service the equipment and system. Include all of the following in each of the Maintenance/Operating Manuals:

- .1 engineering specifications data
- .2 user manual complete with explanation of equipment capabilities
- .3 specific sequence of operation and events
- .4 control schematics
- .5 schematics of electronic operation
- .6 theory of electronic modules
- .7 electrical values of all electronic components
- .8 assembly drawings and parts list, stating part number and manufacturer
- .9 as-built system wiring diagrams showing location of all panels
- .10 test procedure for systems, panels and individual modules
- .11 colour code of wire

.12 block diagram of each panel identifying all zone locations and wire numbers
.13 mylar drawings and prints of verified system "as-builts". All mylar drawings to be 'DILAR FILM', blackline (dry erasable), reverse reading (reverse print).
.14 Mylar drawings and prints of all new and altered fire alarm control panels showing the detailed point to point panel wiring, detailing all functions, wire numbers and colour coding.
.15 Floor plan drawings (as-builts)indicating:
.1 Locations of all fire alarm devices, panels, etc.
.2 Location of all magnetic holders and ancillary devices connected to fire alarm control panel.
.3 All conduit runs, junction boxes.
.4 Quantity of wires in each conduit run.
.5 Zone wiring identification at each junction box and fire alarm device.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Firestopping Requirements	Section 07270
.2	Electrical General Requirements	Section 16010
.3	Installation of Cables in Trenches and in Ducts	Section 16106
.4	Direct Buried Underground Cable Ducts	Section 16107
.5	Conduits, Conduit Fastenings, and Conduit Fittings	Section 16111
.6	Splitters, Junction, Pull Boxes and Cabinets	Section 16131
.7	Outlet Boxes, Conduit Boxes and Fittings	Section 16132

1.2 References

.1 Latest edition of the following:
.1 EIA/TIA-569; Commercial Building Standards for Telecommunications Pathways and Spaces (refer to CSA standards CAN/CSA T530-M90, CAN/CSA-C22.2 No.214-M90)
.2 EIA/TIA-607;Commercial Building Grounding and Bonding Requirements for Telecommunications (refer to CSA standard CAN/CSA T527)
.3 NBC National Building Code of Canada
.4 CAN/CSA-C22.1 Canadian Electrical Code Part One
.5 CAN/CSA-C22.1 Canadian Electrical Code Part One Section 60 "Electrical Communication Systems".
.6 CAN/CSA-C22.2 No.0-M91 General Requirements - Canadian Electrical Code, Part Two.
.7 NRC-CNRC National Building & Fire Codes of Canada
.8 IEEE STD 1100 - 1992 IEEE Recommended Practice for Powering & Grounding Sensitive Electronic Equipment "Emerald Book"

1.3 Description of System

.1 System to include:
.1 The communications horizontal cabling pathway shall consist of a cable tray system.
.2 The Voice Communications backbone cabling pathway shall consist of a cable tray system.
.3 The Data Communications backbone cabling pathway shall consist of a cable tray system.

.4 All backboards, cable support hardware, clamps, bonding clamps, and grounding to provide a complete system as specified.

1.4 Standards

.1 The equipment and installation shall comply with the following current requirements:
.1 National Building Code
.2 Manitoba Building Code
.3 Canadian Electrical Code
.4 EIA/TIA and CSA Telecommunications Building Wiring Standards
.5 Manitoba Fire Code
.6 Local and Municipal By-laws
.7 Authorities having jurisdiction

1.5 Submittals

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.2 Include:
.1 Cable Tray
.2 Grounding termination connectors.
.3 Grounding bus bars

.3 This information is to be revised to "as-built" after construction is completed. Insert as part of the Operating and Maintenance Manuals.

1.6 Operation and Maintenance Manuals

.1 Provide Operation and Maintenance data for Voice and Data Communications Pathway for incorporation into manual specified in Section 01300 - Submittals.

.2 Include:
.1 Technical data - illustrated parts lists with parts catalogue numbers.
.2 Copy of approved shop drawings with corrections completed and marks removed except for reviewed stamps.
.3 Complete Record Drawings.

PART 2 - PRODUCTS

2.1 Materials

.1 Equipment and materials to be CSA or ULC certified. Where there is no alternative to supplying equipment which is not CSA or ULC certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.

.2 Submit for Contract Administrator's approval, a duplicate list of shop drawings for this project prior to placing of orders for same.

2.2 Equipment Backboards

.1 Equipment backboards shall be 19mm3/4in plywood backing, located as shown on drawings.

2.3 Cable Tray

.1 Trough type Cable Tray:
.1 Cable Tray and fittings: to EEMAC F5-1-1977.
.2 Ladder type, Class C1 to CSA C22.2 No. 126 - M1980, 230mm9in rung spacing.
.3 Single stacked cable tray unless otherwise indicated on drawings.
.4 Aluminum ladder, solid or tubular with 9.5mm x 38mm3/8in x 1.5in sides, 6.4mm x 25mm1/4in x 1in rungs and width as indicated on drawings.
.5 Fittings: manufactured accessories for approved cable tray. Corner clamps, splice clamps, end plates, side clips, side clips with 9.5mm3/8in pins (on both sides between suspension rods) where required.
.6 Solid aluminum pan located on all horizontal cable tray including fittings.
.7 Cable tray to be suspended using 16mm5/8in threaded rods or larger as required, with double locknuts below the tray and single lock nuts above.
.8 Cable Tray shall be isolated from the building structure with insulated threaded couplings.
.9 Equipment racks shall not be used to support the cable trays.
.10 Finish: painted with gray enamel.
.11 Acceptable Manufacturers: Newton, Chatsworth.

.2 Ladder Type Cable Tray:
.1 Cable Tray and fittings: to EEMAC F5-1-1977.
.2 Ladder type, Class C1 to CSA C22.2 No. 126 - M1980, 230mm9in rung spacing.
.3 Single stacked cable tray unless otherwise indicated on drawings.

.4 Extruded aluminum tray with depth of 100mm4in and width as indicated on drawings.
.5 Horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required.
.6 Fittings: manufactured accessories for approved cable tray. Radii on fittings: 600mm24in minimum.
.7 Provide conduit to tray adaptors for the termination of all conduits terminating at the cable tray.
.8 Cable tray to be c/w 100mm4in high center barrier.
.9 Cable tray to be suspended using 13mm1/2in threaded rods or larger as required, with double locknuts below the tray and single lock nuts above.
.10 Finish: natural aluminum.
.11 Acceptable Manufacturers:. Burndy, Canadian Strut, Pilgrim, Pursley, Unistrut, Newton, Chatsworth.

2.4 EMT Conduit

.1 Refer to Section 16111.

.2 Minimum trade size shall be 19mm3/4 in.

.3 Flexible conduit shall only be utilized for connections from modular furniture to junction boxes.

.4 The use of 90 degree Condulets is not allowed.

2.5 PVC Underground Conduit

.1 Refer to Section 16111.

.2 PVC conduit shall be heavy duty rigid spec schedule 40 type with 6.4mm1/4in wall.

2.6 Outlet Boxes

.1 Spider Outlet Boxes:
.1 Flush wall mounted 1, 2, 4, or 6 gang outlet boxes c/w knock outs on top and bottom of each gang.
.2 Minimum depth: 70mm2-3/4in.
.3 Accepts standard type duplex outlets.
.4 Refer to detail sheets for faceplate configurations.
.5 Acceptable manufacturer: Spider Mfg.

.2 Electro-Galvanized Outlet Boxes:
.1 Flush wall mounted electro-galvanized steel device box 100mm4in square x 65mm2-1/2in deep.
.2 Single or two gang raised plaster rings with squared corners as required.
.3 Accepts standard type duplex outlet.

.4 Refer to detail sheets for faceplate configurations.

PART 3 - EXECUTION

3.1 Communications Pathway

.1 All communication pathways shall maintain the following distances from the equipment listed:
.1 motors or transformers 1.2m4ft
.2 wire in conduit and/or cables >300V 1.0m3ft
.3 wire in conduit and/or cables <300V 300mm12in

3.2 Equipment Backboards

.1 Equipment backboards shall be rigidly secured and painted with a ASA #61 industrial gray nonconductive fire-retardant overcoat.

3.3 Cable Trays

.1 Refer to Section 16114.

.2 Refer to Canadian Electrical Code Section 12.

.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 Support cable tray on 1.5m5ft centers and within 760mm30in from a connection fitting or end.

.6 Support cable tray at connection points and at end points

.7 Each Cable tray section (or 3m10ft interval maximum) shall be grounded with a #3/0 AWG RW90 insulated green copper conductor installed within the cable tray.

.8 For double stacked cable trays the ground conductor shall be layed in the upper tray. An additional #3/0 AWG RW90 insulated green copper conductor jumper shall be installed from the upper cable tray down to the lower cable tray at each interval.

.9 Within the Communications Cabling Wiring Closets the cable tray deck shall be located 150mm6in back from the equipment rack centreline. Clearance of cable tray above finished floor as shown on drawings.

.10 The cable tray shall be installed so that there is a minimum of 300mm12in clearance above the cable tray.

.11 Provide a barrier separation in the cable tray as shown on the detail sheets.

.12 Arrange for opening in walls and floors for width and depth of cable tray to pass through.

.13 Provide and install acceptable firestopping of floors and walls after cables have been installed.

3.4 Conduits

.1 Refer to Canadian Electrical Code Section 12.

.2 Refer to Section 16111.

.3 Conduit sleeves shall be installed with acceptable fire stop to meet local fire codes.

.4 Conduit sleeves shall extend a minimum of 100mm4in above the finished floor.

.5 Spare sleeves with no cables installed within them shall be fitted with an acceptable firestop.

.6 Raceways shall enter Communication Cabling Wiring Closets at a minimum height of 2.4m8ft AFF.

.7 Conduit runs shall not contain more than two (2) 90 degree bends between pull points or pull boxes.

.8 Conduits shall have long sweep bends.

.9 Continuous conduit runs shall not exceed 30m100ft without a pull point or pull box.

.10 Conduits shall be reamed to eliminate sharp edges.

.11 Conduit couplings and connectors shall be steel type.

.12 Steel connectors shall be terminated with an insulated bushing.

.13 Pull boxes shall be installed in such a manner that the conduits that enter the pull box shall be aligned at opposite ends from each other, the cable shall not have a bend within the pull box.

.14 Conduit runs shall remain clear of areas in which flammable material may be stored. Conduits shall not be installed adjacent to sources of heat.

.15 All conduits shall be left with a nylon pull cord with a minimum test rating of 90kg200lbs.

.16 Provide one 20mm3/4in conduit stubbed up to accessible ceiling space from a single gang communications outlet.

.17 Provide two 20mm3/4in conduits stubbed up to accessible ceiling space from a two gang communications outlet.

.18 Provide four 20mm3/4in conduits stubbed up to accessible ceiling space from a four gang communications outlet.

.19 Conduits stubbed up from communications outlet shall be routed to the nearest point of the cable tray. Conduits shall terminate onto the cable tray with conduit to tray adaptors.

.20 Conduit fill shall be as per cable manufacturers recommendations, but shall in no case exceed the maximum fill allowed by code.

3.5 PVC Underground Conduit

.1 The use of 90 degree corners is not allowed. Use two 45 degree fittings spaced apart to provide a 90 degree corner. The bending radius shall be 410mm16in minimum.

.2 Layout underground PVC conduit below the building structure with long sweeping bends around structure piles.

.3 Underground PVC conduit shall be installed with watertight sealant between each section.

3.6 Outlet Boxes

.1 Refer to Section 16132.

.2 Refer to detail sheets for faceplate configurations.

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

.4 Information outlet boxes shall not be placed back to back when servicing adjacent rooms, there shall be a minimum of 200mm8in offset between boxes.

.5 Mount communication outlet boxes at the same height as the electrical power outlets unless noted otherwise. Communication outlets shall be mounted adjacent (within 4in.) to power outlets.

END

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Electrical General Requirements	Section 16010
.2	Installation of Cables in Trenches and in Ducts	Section 16106
.3	Direct Buried Underground Cable Ducts	Section 16107
.4	Pole Lines and Hardware	Section 16108
.5	Conduits, Conduit Fastenings, and Conduit Fittings	Section 16111
.6	Splitters, Junction, Pull Boxes and Cabinets	Section 16131
.7	Voice and Data Communications Pathway	Section 16746

1.2 References

.1 Latest edition of the following:
.1 EIA/TIA-568-A; Commercial Building Telecommunications Cabling Standard (refer to CSA standard CAN/CSA T529-M91, CAN/CSA-C22.2 No. 214-M90).
.2 EIA/TIA-569; Commercial Building Standards for Telecommunications Pathways and Spaces (refer to CSA standards CAN/CSA T530-M90).
.3 EIA/TIA-570 Residential and Light Commercial Telecommunications Wiring Standard.
.4 EIA-TIA-606; The Administration Standard for the Telecommunications Infrastructure of Commercial Building (refer to CSA standard CAN/CSA T528-93).
.5 EIA/TIA-607; Commercial Building Grounding and Bonding Requirements for Telecommunications (refer to CSA standard CAN/CSA T527-94).
.6 EIA/TIA TSB 67 Transmission Performance Specifications for Field Testing of Twisted-Pair Cabling Systems.
.7 EIA/TIA TSB 72 Centralized Optical Fiber Cabling Guidelines.
.8 EIA/TIA TSB 75 Cabling practices for Open Offices.
.9 NBC National Building Code of Canada.
.10 CAN/CSA-C22.1 Canadian Electrical Code Part One.
.11 CAN/CSA-C22.1 Canadian Electrical Code Part One Section 60 "Electrical Communication Systems".
.12 CAN/CSA-C22.2 No. 0-M91 General Requirements - Canadian Electrical Code, Part Two.
.13 CSA C22.2 No. 154-1975 Data Processing Equipment.
.14 NRC-CNRC National Building & Fire Codes of Canada.

.15 IEEE STD 1100 - 1992 IEEE Recommended Practice for Powering & Grounding Sensitive Electronic Equipment "Emerald Book".
.16 ISO/IEC 11801 Generic Cabling for Customer Premises.
.17 ANSI X3T9.5 Requirements for UTP at 100Mbps.
.18 TBITS-6.9; Canadian Open Systems Application Criteria (COSAC) "Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings", Treasury Board Information Technology Standards.

1.3 Description of System

.1 System to include:

.1 A centralized network for the Voice Communications cabling system.

.2 A Category 6 centralized network for the Data Communications cabling system.

.3 Information outlets, c/w faceplates, recessed enclosures, located in the Work area for connection to communications devices.

.4 Unshielded Twisted Pair (UTP) enhanced Category 3 copper cable for the Voice Communications horizontal cabling system.

.5 Unshielded Twisted Pair (UTP) enhanced Category 3 copper cable for the Voice Communications backbone cabling system.

.6 Unshielded Twisted Pair (UTP) enhanced Category 6 copper cable for the Data Communications horizontal cabling system.

.7 All patch panels, troughs, labeling, clamps, bonding clamps, and grounding to provide a complete system as specified.

.8 All connector cables, splices, and miscellaneous material to provide a complete system as specified.

.9 Wiring connections to the Local Telephone Service Provider shall originate at the demarcation point. The cross connect and disconnect links shall be provided by Voice and Data Contractor.

1.4 System Performance

.1 The Category 6 System shall provide the following:

.1 Worst case channel performance requirements at 200 MHz shall be:

.1 NEXT power sum rated: 37.1dB
.2 Attenuation: 21.7dB
.3 power sum rated ACR: 15.4dB
.4 ELFEXT power sum rated: 20.2dB
.5 Return loss: 12dB
.6 Propogation delay: 548ns
.7 Delay skew: 50ns

1.5 Standards

.1 The equipment and installation shall comply with the following current requirements:
.1 National Building Code
.2 Manitoba Building Code
.3 Canadian Electrical Code
.4 EIA/TIA and CSA Telecommunications Building Wiring Standards
.5 Manitoba Fire Code
.6 Local and Municipal By-laws
.7 Authorities having jurisdiction
.8 Equipment to be as supplied by:
.1 AMP
.2 Systimax

1.6 Approved Voice and Data Subcontractor

.1 Voice and Data Communications Cabling System Subcontractors shall adhere to the following:
.1 Subcontractor shall install only approved product.
.2 Equipment manufacturer must be supported by at least three certified local installers.
.3 Subcontractor shall be certified by the equipment manufacturer they represent.
.4 Subcontractor shall be experienced in all aspects of this Work and shall have direct experience on recent systems of similar type and size.
.5 Subcontractor shall own and maintain tools and equipment necessary for successful installation and testing of UTP and Optical Fiber Voice and Data Communications Cabling Systems and shall have personnel who are adequately trained in the use of such tools and equipment.
.6 Subcontractor shall not contract any portion of the Work out to other Contractors.

.2 The following list of Voice and Data Subcontractors are approved for this project:
.1 Kingston Electric Ltd. att: Brian Allen 861 Cockburn St. S. Winnipeg, Manitoba R3L 2N6 Phone: (204) 477-1405 Fax: (204) 474-0853
.2 Len Andrews Enterprises Inc. att: Len Andrews 538 Templeton Ave. Winnipeg, Manitoba R2V 3S4 Phone: (204) 338-5174 Fax: (204) 338-5199
.3 McCaine Electric Ltd. att: Brian Hogg 630 Erin St. Winnipeg, Manitoba R3G 2V9 Phone: (204) 786-2435 Fax: (204) 783-2180
.4 Saltech Computer Cabling Services att: Ray Saltel 833 Dugald Road Winnipeg, Manitoba R2J 0G7 Phone: (204) 237-1127 Fax: (204) 237-4887
.5 Static Electric Ltd. att: Richard Robertson 936 Logan Ave. Winnipeg, Manitoba R3E 1P1 Phone: (204) 783-3236 Fax: (204) 786-4823

.6 Tri-Star Electric att: Peter Thiessen 203-356 Furby St. Winnipeg, Manitoba R3B 2V5 Phone: (204) 788-4006 Fax: (204) 783-3818
.7 Wescan Electric att: Charlie Deeborn, 1049 Logan Avenue, Winnipeg, Manitoba R3E 1P6 Phone: (204) 786-3384 Fax: (204) 783-2750.

1.7 Submittals

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.2 Include:
.1 Technical data sheet supplied by cable manufacturer for the cables which are to be used. The data sheets shall include:
.1 Mutual Capacitance
.2 Impedance
.3 DC Resistance
.4 Attenuation
.5 Near End Crosstalk
.6 ACR
.7 Delay Skew
.8 ELFEXT
.2 Information outlets c/w faceplates.
.3 Backboards, patch panels, troughs, equipment racks, wall mounted equipment racks, wire management panels.
.4 Fiber Optic interconnection units, connectors, couplings.
.5 Grounding termination connectors.
.6 All test equipment.
.7 Instructions for storage, handling, protection, examination, preparation, operation, and installation of products.

.3 This information is to be revised to "as-built" after construction is completed. Insert as part of the Operating and Maintenance Manuals.

1.8 Operation and Maintenance Manuals

.1 Provide Operation and Maintenance data for the Voice and Data Communications Cabling System for incorporation into manual specified in Section 01300 - Submittals.

.2 Include:
.1 Instructions for complete Voice and Data Communications Cabling System to permit effective operation and maintenance.
.2 Technical data - illustrated parts lists with parts catalogue numbers.
.3 Copy of approved shop drawings with corrections completed and marks removed except for reviewed stamps.
.4 Vendor's list of recommended spare parts for system.

.5 Provide name, address and telephone number of the Contractors service representative to be contacted during the warranty period.
.6 Provide name, address and telephone number of the Vendor's service representative to be contacted during the warranty period.
.7 Complete records of all Administration labeling data. Administrative labeling to be in electronic database format on 3-1/2" disk, and included on hardcopy of Record Drawings.
.8 A table of all test results to be included in hardcopy and 3½" diskette.
.9 Complete Record Drawings.

1.9 Manufacturers Warranty

.1 Warranty all passive equipment, materials, installation and workmanship for one(1) year. The warranty must assure the support of all premise standards applications as listed in EIA/TIA standards.

1.10 Training

.1 Contractor shall provide two 4 hour on-site training sessions, together with vendor's representative, for Voice and Data Communications Cabling System to operational personal in use and maintenance of system. Contractor shall provide all equipment and personal necessary to video tape training session and submit two copies to the City of Winnipeg. Training sessions shall be provided at a time convenient to the City of Winnipeg.

.2 The Contractor shall provide a technician to assist the City of Winnipeg in cross connecting the voice and data services throughout the facility. Contractor shall also perform cross connecting of the station assignments between the City of Winnipeg's service demarcation.

1.11 Co-ordination with Local Telephone Utility

.1 Contractor shall provide and install all cross connects and patch cords required at demarcation. Co-ordinate all cross connects with local telephone utility.

PART 2 - PRODUCTS

2.1 Materials

.1 Equipment and materials to be CSA or ULC certified. Where there is no alternative to supplying equipment which is not CSA or ULC certified, obtain special approval from local Electrical Inspection Department or authority having jurisdiction.

.2 All cabling and termination hardware shall be of one manufacturer.

.3 Submit for Contract Administrator's approval, a duplicate list of shop drawings for this project as specified prior to placing of orders for same.

2.2 Approved Manufacturers

.1 The following is a list of approved manufacturers for the voice and data cabling system. Additional approved manufacturers for miscellaneous hardware shall be as noted in specifications.
.1 AMP
.2 Systimax

2.3 Equipment Racks

.1 Equipment racks shall meet ANSI/EIA-310.

.2 Constructed of lightweight steel, charcoal gray or black in color.

.3 Complete with steel mounting hardware.

.4 Rack hardware must provide vertical wire management on both sides of the equipment rack.

.5 Rack hardware shall be provided with a top cable trough to facilitate cable management.

.6 Equipment rack frames shall meet the following specifications:
.1 dimensions: 7ft x 20.3in x 3in with 18-5/16in center mounting.
.2 footprint: 20.3in length x 15in depth.
.3 hole pattern: 5/8in - 5/8in - 1/2in spacing.
.4 screw size: 10-24 thread, 1/2in length.

.7 Each equipment rack or cabinet designated with space for active electronics shall be provided with a surge suppressor power bar. Acceptable Manufacturer: Tripp-Lite #IBR-12

.8 Additional approved manufacturer: Cabletalk, DL Custom, Hubbell.

2.4 Wall Mounted Equipment Racks

.1 Wall mounted equipment racks shall meet ANSI/EIA-310.

.2 Constructed of lightweight steel, charcoal gray or black in color.

.3 Complete with steel mounting hardware.

.4 Rack hardware must provide vertical wire management on both sides of the wall mounted equipment rack.

.5 Wall mounted equipment rack frames shall meet the following specifications:
.1 dimensions: 48in x 20.3in x 6in deep with 18-5/16in center mounting.
.2 hole pattern: 5/8in - 5/8in - 1/2in spacing.
.3 screw size: 10-24 thread, 1/2in length.

.6 Each equipment rack or cabinet designated with space for active electronics shall be provided with a surge suppressor power bar. Acceptable Manufacturer: Tripp-Lite #IBR-12

.7 Additional approved manufacturers: Cabletalk, DL Custom, Hubbell.

2.5 Wall Mounted Equipment Cabinets

.1 Wall mounted equipment cabinets shall meet ANSI/EIA-310.

.2 Constructed of lightweight steel, charcoal gray or black in color.

.3 Complete with steel mounting hardware.

.4 Cabinet hardware must provide vertical wire management on wall mounted equipment cabinet.

.5 Front lockable hinged Lexan door.

.6 Lockable hinged body for rear cabling access.

.7 Removable top and bottom covers.

.8 Wall mounted equipment cabinet frames shall meet the following specifications:
.1 Dimensions: 36.75in x 24in x 18in deep (min) with 18-5/16in centre mounting.
.2 Hole pattern: 5/8in - 5/8in - 1/2in spacing.
.3 Screw size: 10-24 thread, 1/2in length.

.9 Cabinets shall be wall mounted on 19mm equipment backboard.

.10 Each equipment rack or cabinet designated with space for active electronics shall be provided with a surge suppressor power bar. Acceptable Manufacturer: Tripp-Lite #IBR-12

.11 Additional acceptable Manufacturers: Rittal, CableTalk.

2.6 Wall Mounted Equipment Brackets

.1 Wall mounted equipment brackets shall meet ANSI/EIA-310.

.2 Constructed of lightweight steel, charcoal gray or black in color.

.3 Brackets shall be c/w bottom or side hinge.

.4 Depth: 8 in. minimum.

.5 Each bracket shall provide adequate mounting space for one patch panel and two wire management panels, one above and one below each patch panel.

.6 Provide vertical cable management troughs on each side of equipment brackets for patch cable management. Vertical cable troughs to be Panduit type G slotted wall duct 4 in. wide by 5 in. deep. Mount trough on unistrut to bring face of trough 1 in. out beyond face of patch panels mounted on wall brackets. Vertical trough to extend the height of the wall mounted brackets.

.7 Provide vertical cable management troughs in the center of each column of equipment brackets for horizontal and backbone cable management. Vertical cable troughs to be Panduit type G slotted wall duct 4 in. wide by 5 in. deep. Provide number of cable troughs to meet cable manufacturers percent fill recommendations. Vertical trough to extend from the top of the wall mounted brackets up to the ceiling space.

.8 Additional acceptable Manufacturers: Ortronics.

2.7 Wire Management

.1 Provide a horizontal wire management panel between patch panels or above and below a patch panel for patch cables.

.2 Horizontal wire management panels shall be 2 rack units high with 5 finger retaining rings minimum.

.3 Allow for an additional fifteen (15) horizontal wire management panels for active electronics patch cables. Locations to be determined on Site.

.4 Provide one cable support bar, 5" deep min., on rear of equipment rack or cabinet for each patch panel mounted on the equipment rack or cabinet.

2.8 Faceplate and Patch Panel Icons

.1 The following icon descriptions and colors shall be utilized throughout the voice and data networking systems at all workstations and patch panels.
.1 Telephone - "Phone", gray
.2 Fax - "Fax", gray
.3 Modem - "Modem", gray
.4 Data LAN - "Data", blue

.2 Provide blank icons for all unused ports.

2.9 Faceplates

.1 Faceplates shall accept dual port installation kits.

.2 Faceplates shall accept a minimum of four workstation jacks as specified.

.3 Faceplates shall be iconable.

.4 Faceplates shall be provided with integral administrative labeling strips.

2.10 Modular Furniture Faceplates

.1 Faceplate shall accept a minimum of 3 workstation jacks as specified.

.2 Faceplate shall be iconable.

.3 Faceplate provided shall suit the modular furniture supplied by the City of Winnipeg. Contractor to co-ordinate on Site.

2.11 Category 6 Workstation Jacks

.1 Jacks shall incorporate insulation displacement connections specified for 24 AWG wire.

.2 Jacks shall be 8 position, 8 conductor modular type.

.3 All unused jack locations shall be installed with blank inserts.

.4 The connecting hardware for the enhanced Category 56 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.4 System Performance. The

channel shall meet the requirements specified with the connecting hardware provided.

.5 Jacks shall be an unshielded T568A wiring configuration.

2.12 Category 3 Patch Panels

.1 Patch Panels shall be Category 3, 8-position 8-conductor modular jack on face to 110 terminations on rear of panel. Wiring configuration to terminate 2 pairs per port on telephone backbone cabling system.

.2 All patch panels shall be CSA or ULC approved and shall be of one manufacturer.

.3 Designation strips shall be provided for each jack. All cables shall be terminated in numerical sequence and labeled as per approved labelling scheme.

2.13 Category 6 Patch Panels

.1 Patch Panels shall be 8-position, 8-conductor modular jack on face to 110 terminations on rear of panel. Wiring patterns to be T568A.

.2 All patch panels shall be CSA or ULC approved and shall be of one manufacturer.

.3 Termination blocks shall have the following characteristics:
.1 Type: all plastic insulants.
.2 Termination type: insulation displacement, dry, gas tight.
.3 Wire Size supported: 24AWG
.4 Retermination rate: greater than 200.
.5 Wire insertion force (24AWG): 59-127 Newtons.
.6 Wire retention force: (24AWG): 8lbs Horizontal. 1.8 lbs Vertical.
.7 Insulation resistance: 100M ohms
.8 Dielectric strength: 2.0kV at 60 Hz.
.9 The patch panels for the enhanced Category 56 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.4 System Performance. The channel shall meet the requirements specified with the patch panels provided.

.4 Designation strips shall be provided for each jack. All cables shall be terminated in numerical sequence and labeled as per approved labelling scheme.

2.14 Category 6 Patch Cables

.1 Shall meet EIA/TIA 568A standards.

.2 24 AWG stranded tinned copper, insulated with high density plyethylene data grade cordage. The cord shall be jacketed in flame retardant PVC.

.3 Shall be four pair configuration and terminate with eight pin modular plug.

.4 Capable of high data rates to support voice, data, and video applications.

.5 DC resistance per lead: 94 ohms/100m maximum.

.6 DC resistance unbalanced: 5% maximum.

.7 Mutual capacitance: 6.6nF/100m maximum.

.8 Characteristic Impedance: 100 ohms ±15% @ 1 to 100 MHz.

.9 The patch cables for the enhanced Category 56 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.4 System Performance. The channel shall meet the requirements specified with the Category 5 patch cables provided.

2.15 Horizontal Cabling

.1 Horizontal cabling shall consist of the following:
.1 four pair 100 ohm unshielded twisted pair (UTP).
.1 CSA or ULC certified.
.2 The horizontal cable for the enhanced Category 56 cabling system channel shall meet the electrical characteristics of the cabling system as specified in Clause 1.4 System Performance. The channel shall meet the requirements specified with the horizontal cable provided.
.3 24AWG solid copper conductor.
.4 insulation shall meet FT-4 fire rating.
.5 DC resistance: 9.38 ohms/100m maximum.
.6 DC resistance unbalanced: 5% maximum.
.7 Mutual capacitance: 5.6nF/100m maximum.
.8 Capacitance Unbalance (pair to ground): 330pF/100m.
.9 Characteristic Impedance: 100 ohms ± 15% at 1 to 100MHz.

2.16 Backbone Cabling

.1 Voice backbone cabling shall consist of 25 pair 100 ohm unshielded twisted pair (UTP).

.1 meet Category 3 specifications and CSA or ULC certified.

.2 24AWG solid copper conductor

.3 insulated with suitable plastic dielectric material, FT-4 rated

.4 When mixing multiple dissimilar signals the 25 pair Category 3 cable must support distances up to 100m.

.5 DC resistance 9.4 ohms/100m maximum.

.6 Mutual capacitance: 5.6pF/100m.

.7 Characteristic Impedance: 100 ohms ± 15% at 1 to 100MHz

.8 Worst Pair Attenuation dB/100m:

MHz	dB
1.00	2.6
4.00	5.6
8.00	8.5
10.00	9.7
16.00	13.1

.9 Worst Pair Near End Crosstalk (NEXT) dB at 100m:

MHz	dB
1.00	41
4.00	32
8.00	27
10.00	26
16.00	23

.2 Data backbone cabling shall consist of:

.1 Category 6 UTP 4-pair cable as specified in Clause 2.19 Horizontal Cabling.

.2 Multimode Optical Fiber:

.1 CSA or ULC certified.

.2 Insulation shall meet FT-4 rating.

.3 Core diameter: 62.5 micron ± 3 micron.

.4 Cladding diameter: 125 micron ± 2 micron .

.5 Colored Fiber diameter: 900 micron ± 15 micron .

.6 Numerical Aperture: 0.275 ± 0.015.

.7 Buffering diameter: 890mm ± 50mm.

.8 Proof strength: 100,000 psi minimum.

.9 Fiber loss:

.1 3.5 dB/km at 850nm maximum.

.2 1.0 dB/km at 1300nm maximum.

.10 Bandwidth:

.1 200MHz at 850nm minimum.

.2 600MHz at 1300 nm minimum.

.11 Minimum bending radius of 20x cable diameter during installation and 10x cable diameter after installation minimum or as per manufacturers recommendations.

.12 Distribution sytle

2.17 Grounding

.1 Provide a #3/0 AWG RW-90 insulated green copper ground from each communications wiring closet back to the building main electrical ground.

.2 Provide grounding bus bar in each wiring closet to terminate ground conductors.

PART 3 - EXECUTION

3.1 Equipment

.1 Provide a minimum of 1m clearance between exposed live parts of equipment and cross connect fields.

.2 Racks and cabinets shall be secured and grounded to communications ground with a #2 RW90 insulated green copper ground.

.3 Racks and cabinets shall be located so as to provide 800mm clearance in front and behind each rack or cabinet as measured from the outermost point of the rack, cabinet, or equipment which is mounted within the rack or cabinet.

.4 Wall mounted equipment, racks, cabinets or brackets shall be mounted on 19mm3/4" backboard 2.1m7 ft. to the top AFF.

.5 Equipment shall be mounted on backboards, racks, or cabinets a minimum of 300mm12in AFF.

.6 Equipment shall be mounted to provide a minimum clearance of 300mm12in from end walls.

.7 Equipment connected directly to a cross connect shall be connected with cables not more than 3m/10ft in length.

.8 Install the surge suppressor power bar on the rack designated for active electronics as directed on Site.

3.2 Connectors and Faceplates

.1 Modular jacks shall be mounted with the contacts up.

.2 Four pair 100 ohms UTP cable:
.1 Terminate each four pair 100 ohms UTP cable directly to an 8 position, 8 conductor modular jack assembly at the Work area.
.2 Terminate all 8 position, 8 conductor modular jacks as per T568A pin assignment.

3.3 UTP Patch Cables

.1 Patch cables shall not exceed a combined length of 6m/20ft in a channel.

.2 Provide all patch cables required to cross connect and connect all patch panels and active electronics, and telephone cross connects throughout the communications system including the telephone demarcation field.

.3 Provide 3m patch cables for all workstations.

.4 Install patch cables in an organized manner, neatly laced within the wire managment provided.

3.4 Horizontal Cabling

.1 Horizontal cabling shall be installed in a star topology.

.2 Cables shall be "combed" within cable tray in an organized manner.

.3 Bridged taps shall not be used within the horizontal cabling system.

.4 Hard splices shall not be used within a twisted pair horizontal cabling system.

.5 Equipment shall not be connected directly to horizontal cables.

.6 Ensure minimum cable bend radius and maximum pulling tension, as recommended by the cable manufacturer, is not exceeded. Minimum bend radii for UTP cable is four (4) times the cable diameter, manufacturers recommendations may be greater.

.7 Cables shall be bundled with Velcro cable straps. No tyraps are permitted. Velcro cable straps are for bundling only, Velcro cable straps shall not support the weight of the cable.

.8 When terminating cable in connecting hardware insure that the amount of untwisted wire of UTP cable at the termination does not exceed 13mm.

.9 Ensure cable is mounted, terminated, and managed to meet manufacturers specifications.

.10 Horizontal cabling shall not exceed a distance of 90 meters from cross connect to information outlet.

.11 Provide 3m10ft coil of slack in the Telecommunications Closet in the cable tray above the equipment rack.

.12 UTP cable at the information outlet shall be provided with 300mm12in coil of slack in the cable tray prior to entering conduit stub.

.13 All horizontal cabling shall maintain the following distances from EMI producing equipment:
.1 1.2m48in: motors or transformers
.2 1.0m40in: conduit and/or cables used for electrical power distribution with voltages greater than 300V.
.3 300mm12in: conduit and/or cables used for electrical power distribution with voltages less than 300V.
.4 300mm12in: fluorescent lighting.
.5 When horizontal cabling is required to cross fluorescent lighting, conduit and/or cables used for power they shall cross perpendicular to each other.

.14 When a building lightning protection system is utilized the communications cabling shall not be installed closer than 1.8m6ft from any lightning protection system conductors.

.15 All horizontal cabling that penetrates fire rated barriers must be provided with fire stop to meet local fire codes.

3.5 UTP Backbone Cabling

.1 Backbone cabling shall be installed in a star topology.

.2 Install cables individually.

.3 Cables shall be "combed" within cable tray in an organized manner.

.4 Bridged taps shall not be used within the backbone cabling system.

.5 Ensure minimum cable bend radius and maximum pulling tension, as recommended by the cable manufacturer, is not exceeded.

.6 When a building lightning protection system is utilized the communications cabling shall not be installed closer than 1.8m6ft from any lightning protection system conductors.

3.6 Administration

.1 Labeling shall be as per EIA/TIA 606 standards.

.2 All administrative labeling shall be typewritten with electronic label maker printed on self-adhesive ribbon or on integral labeling strip provided with equipment. Clean area where label will be applied with alcohol or equivalent cleaner to remove dirt and grease.

.3 Workstation and Horizontal Patch Panel labeling:
.1 R1-1000/2000

R R - Rack, C - Cabinet
1 Rack or Cabinet #
1000 sequential cable identification number
2000 room number or workstation location

.2 Provide icons as specified on workstation devices and patch panels.

.4 Backbone Patch Panel labeling:
.1 D1000-R1/C2

D D - data backbone, T - telephone backbone
1000 sequential cable identification number
R Head end; R - rack, C - cabinet
1 Head end rack or cabinet identification
C Intermediate end; R - rack, C - cabinet
2 Intermediate end rack or cabinet identification

.2 Provide icons as specified on workstation devices and patch panels.

.5 All horizontal and backbone cabling shall be provided with cable labeling identification at both ends. Provide clear plastic cover over cable labeling.

.6 All administrative labeling shall be recorded on as-built drawings and included in the Operation and Maintenance Manuals.

.7 The use of colored backboards, connections, covers, or labels are an approved method of color coding for the cross connect fields.

3.7 Testing

.1 UTP Cabling:
.1 Testing shall be made in accordance with EIA/TIA TSB67 and EIA/TIA-568A Annex A.
.2 Test kit must have been calibrated/re-calibrated within one year prior to test results submitted. Provide a dated paper copy of the calibration/re-calibration report. Include serial number(s), firmware version and date of manufacturer. An accredited laboratory that is traceable to NIST must have completed the calibration.
.3 Only special adapters and/or special patch cables or OEM of test kit are allowed to be used to perform a Channel Link test.
.4 Test results must show a "headroom" figure for each cable.
.5 Test reports must be from software/firmware that is the latest version.
.6 Test kit must test for stray noise on the cable prior to performing test.

.7 The following tests shall be performed and recorded on all the individual Voice and Data Communications cables from both directions using a level 2 tester at 100MHz sweeps.

.1 Continuity or wiremap testing consisting of:

.1 Open/short testing.

.2 Polarity testing.

.3 Pair transposition testing.

.2 Signal Attenuation test.

.3 Near End Crosstalk (NEXT) at both Telecommunications Closet and information outlet.

.4 DC loop resistance test.

.5 length in meters

.8 Tests shall be performed on the individual links. Link test to TSB 67.

.9 Cables not complying with EIA/TIA 568A Category 5 standards for 100MHz or passing TSB 67 test guidelines shall be identified to the Contract Administrator for corrective action which may include replacement at no additional expense to the City of Winnipeg.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Electrical General Requirements	Section 16010
.2	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.3	Wires and Cables	Section 16122
.4	Outlet Boxes, Conduit Boxes and Fittings	Section 16132
.5	CCTV System	Section 16920

1.2 Care, Operation and Start-up

.1 Provide instructions in accordance with Section 16010.

1.3 Product Data

.1 Submit product data in accordance with Section 16010.

.2 Include riser diagram, talk paths of complete intercom system.

1.4 Operation and Maintenance Data

.1 Provide data for incorporation into maintenance manual specified in Section 16010.

.2 Include description of system operation.

.3 Include parts list using component identification numbers standard to electronics industry.

PART 2 - PRODUCTS

2.1 Materials

.1 Conduits: type EMT, size as indicated, to Section 16.

.2 Communication conductors: type LVT, size as indicated, to Section 16010.

2.2 Central Exchange

.1 The Central Intercommunications Exchange shall be provided with all the necessary components to connect and control slave and master stations. The exchange shall be TOA #N-8000EX or approved equal.

2.3 Master Station "Type A" (Handsets)

.1 The master station shall be TOA #N-8000MS speakerphone type master. It shall require 24vDC supplied by the central exchange and consume no more than 2.4W.

.2 Communication shall be loadspeaking voice-actuated, or voice actuated with handset.

.3 Calling shall be by pretone and call LED illumination.

.4 Mounting shall be desk or surface wall mount.

2.4 Slave Station

.1 The slave station shall be TOA #N-8031MS open-voice type master. It shall require 24vDC supplied by the central exchange and consume no more than 10MA.

.2 Communication shall be loadspeaking voice-actuated.

.3 Calling shall be by pretone and call LED illumination.

.4 Mounting shall be flush wall mount with a stainless steel front panel.

.5 Provide phone numbers in glazed frames adjacent to station to indicate department master phone numbers.

2.5 Weatherproof Slave Station

.1 The slave station shall be TOA #N8050DSWP.

.2 Communication shall be loudspeaking voice-actuated.

.3 Mounting shall be flush, weatherproof.

PART 3 - EXECUTION

3.1 Installation

.1 Install equipment and wiring as indicated and in accordance with manufacturer's instructions.

.2 Interconnect system components.

.3 Program as required.

.4 Exterior station located at parking lot, connects to CCTV camera when activated.

3.2 Tests

.1 Perform tests in accordance with Section 16010.

.2 Conduct intelligibility performance test and submit test results to Consultant.

END

PART 1 - GENERAL

1.1 General

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

1.2 Requirements Specified Elsewhere

.1	Electrical General Provisions	Section 16010
.2	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.3	Wires and Cables	Section 16122
.4	Outlet Boxes, Conduit Boxes and Fittings	Section 16132

PART 2 - PRODUCTS

2.1 Electric Heaters

.1 Provide, install, wire and connect all convection type baseboard and fan forced wall heaters c/w thermostats sized and positioned as indicated on the drawings and schedules. All heaters shall be rated for specified voltage, constructed of minimum 18 ga. steel, as manufactured by Canadian Chromalox Company Ltd., Westcan or approved equal.

.2 Remote thermostats shall be: low voltage (24 Volts) T87F3145 c/w wall plate, sub-base, covering ring and clear key, lock cover for non and tamperproof locations.

.3 Provide also heavy-duty ventilated plastic guards on remote thermostats located in public areas such as entrances, washrooms, corridors and other unsupervised areas. Plastic guards to be Honeywell clear TG500A c/w lock and two keys.

.4 All heaters with 3 phase power and all heaters in excess of 4000 watts shall be c/w built-in contactor controlled by thermostat. All units in excess of 240 volts shall be c/w built-in contactor and control transformer.

.5 All heaters mounted on wall shall be above baseboard unless otherwise noted.

.6 Provide built-in relays and control transformers in either the heater or on a separate matching blank heater section.

.7 Unless specified, provide control transformers controlling more than one relay and narrow type heaters shall be mounted in a separate matching enclosure adjacent to the heater.

PART 3 - EXECUTION

3.1 Electric Heaters and Cables

.1 Install wire and connect all convection type, baseboard and fan forced wall heaters c/w thermostats positioned as indicated on the drawings.

.2 Where remote thermostats are indicated in public areas such as entrances, washrooms, corridors, and other unsupervised areas install heavy-duty ventilated plastic guards.

.3 Make power and control connections.

.4 Install relays, transformers and thermostats.

.5 Interconnect heater relays to be controlled from one common thermostat.

PART 1 - GENERAL

1.1 Related Work Specified Elsewhere

.1	Electrical General Requirements	Section 16010
.2	Conduits, Conduit Fastenings and Conduit Fittings	Section 16111
.3	Wires and Cables	Section 16122
.4	Motor Control Centre	Section 16820

1.2 Shop Drawings and Product Data

.1 Submit shop drawings in accordance with Section 01300 - Submittals.

.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 Operation and Maintenance Data

.1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 01300 - Submittals.

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

1.4 Maintenance Materials

.1 Provide maintenance materials in accordance with Section 16010.

.2 Provide listed spare parts for each different size and type of starter:
- .1 4 contacts, stationary.
- .2 4 contacts, movable.
- .3 2 contacts, auxiliary.
- .4 2 control transformers.
- .5 2 operating coils.
- .6 2 fuses.
- .7 10 indicating lamps.
- .8 1 HOA kit.

PART 2 - PRODUCTS

2.1 Materials

.1 Starters: EEMAC E14-1.
.1 Half size starters not acceptable.
.2 Provide NEMA rated starters only; IEC rated starters are not acceptable.

2.2 Manual Motor Starters

.1 Single and Three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
.1 Switching mechanism, quick make and break.
.2 Overload heaters, manual reset, trip indicating handle.

.2 Accessories:
.1 Toggle switch labelled as indicated.
.2 Indicating light: type and colour as indicated.
.3 Locking tab to permit padlocking in "ON" or "OFF" position.
.4 Flush mounted type in public areas or as indicated.

2.3 Full Voltage Magnetic Starters

.1 Magnetic 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 Power and control terminals.
.4 Wiring and schematic diagram inside starter enclosure in visible location.
.5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
.6 Control transformer.
.7 Starters to be two speed where required; type to match requirement of motor provided by Division 15.

.2 Accessories:
.1 Pushbuttons and Selector switches: labelled as indicated.
.2 Indicating lights: type and color as indicated.
.3 2-N/O and 2-N/C spare auxiliary contacts unless otherwise indicated.
.4 HOA selector switch.
.5 Two speed single winding starters shall have individual Red run pilot lights for LOW and HIGH speed run indication.
.6 An adjustable 20 sec. - 3 min. time delay relay (set at 30 sec.) shall be installed in two speed starters. It shall function only during the transition from HIGH SPEED to LOW SPEED where the

motor will be in a de-energized state for a period of 30 seconds after initiation of this switching.
.7 Provide and install time delay relay (to sequence starting after power failure) adjustable 0 - 120 seconds for motors 15 horsepower and larger.

2.4 Control Transformer

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with secondary fuse, installed in starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.5 Finishes

.1 Apply finishes to enclosure in accordance with Section 16010 - Electrical - General Provisions.

2.6 Equipment Identification

.1 Provide equipment identification in accordance with Section 16010 - Electrical - General Provisions.

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

.3 Magnetic starter designation label, white plate, black letters, size 4 engraved as indicated.

2.7 Manufacturers

.1 Acceptable manufacturers: Allen Bradley Canada Ltd.; Cutler Hammer Canada Ltd.; "System 89" Siemens Electric Limited; Square D.

.2 All manufacturers shall provide their industrial quality product line; commercial quality starters are not acceptable.

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 All starters for two speed motors to be provided with six pole disconnect switches and wired with six conductors. Refer to motor schedule and drawings for two speed motors.

3.2 Tests

.1 Perform tests in accordance with Section 16010 - Electrical - General Requirements 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.

.5 Ensure motor rotation corresponds with the direction required by the driven equipment.

PART 1 - GENERAL

1.1 WORK INCLUDED

.1 The Work includes furnishing all labor, materials, tools, equipment, and documentation required for a complete and working Integrated Security Management System as specified in this section and as provided by Johnson Controls. This scope of Work shall cover the requirements for the access control, alarm monitoring and integrated systems as issued by:
  .1 The City of Winnipeg.

.2 It shall cover the operational specifications, software and hardware for a new Integrated Security Management System to be installed at the USERS office/facilities at:
  .1 700 Assiniboine Avenue

1.2 RELATED WORK

.1 General Terms and Conditions included in the Contract Documents.

.2 Division 16.

1.3 REFERENCES

.1 Design and operation of the system shall conform to the following referenced codes, regulations, and standards as applicable:
  .1 Canadian Electrical Code (CEC)

.2 NFPA 70

.3 UL 294 and UL 1076 as required where applicable

.4 FCC Rules and Regulations

.5 Part 15 Class A or B as applicable

.6 Applicable Local laws, regulations and other codes

.7 CE mark, as and where applicable

.8 C-Tick mark, as and where applicable

.9 Degrees of protection provided by the controller enclosure:
  .1 NEMA 250: minimum Type 2
  .2 IEC 529: minimum IP 21

1.4 GENERAL PRODUCT DESCRIPTION

.1 The Security Management System (SMS) shall be capable of integrating multiple building functions including access control, alarm management, intrusion detection, video imaging and badging, database partitioning, interfacing to closed circuit television monitors (CCTV) and digital video recording (DVR) matrix switches, and interfacing with intercom equipment. It shall also be capable of controlling elevators, as well as allowing cardholder information and queries from external system databases (MIS interface). For this project the card access is integrated with CCTV and Intercom.

.2 The system shall be listed by Underwriters Laboratories listed for UL 294 Access Control Systems, and UL 1076 Proprietary Burglar Alarm Systems. PC's and all controllers furnished on the job shall carry the UL 294 and UL 1076 labels as required. Bidders shall state their product is found on UL's certification website and shall provide the corresponding URL.

.3 The system shall be modular in nature, and will permit expansion in both capacity and functionality through the addition of controllers, card readers, workstations, or by increasing the number of cards and sensors.

.4 The system shall incorporate the necessary hardware, software, and firmware to collect, transmit, and process alarm, tamper and trouble conditions, access requests, and advisories in accordance with the security procedures of the facility. The system shall control the flow of authorized personnel traffic through the secured areas of the facility.

.5 The user interface at the host computer (server) and at the operator workstation shall be a mouse driven graphical user interface (GUI) allowing the user to open and Work on multiple windows simultaneously.

1.5 SUBMITTALS

.1 Contractor shall submit all items in accordance with the requirements of the Submittals sections and shall include, but not be limited to, the following:

- .1 Model numbers from all furnished job components.
- .2 Manufacturers catalog data sheets for all components.
- .3 Input power requirements for all SMS components.
- .4 Complete engineered drawings indicating:
  - .1 Manufacturer model numbers and specifications.
  - .2 Dimensions, layouts and installation details.
  - .3 Point-to-point wiring diagrams for all SMS devices.
  - .4 Termination details for all SMS devices.
  - .5 Single-line system architecture drawings representing the entire SMS.
  - .6 Interfaces with all sub-systems.

.2 Owner Acceptance Form with a check box associated with each card reader and input point. A check mark in the box will indicate that each point has been correctly installed and that communication between the controller and the server has been established. This form shall be completed prior to Owner acceptance of the system.

.3 Six (6) sets of the Manufacturer's User and Installation Manuals.

.4 Course outlines for each of the end user training programs. The course outlines shall include the course duration, and a brief description of the subject matter.

1.6 ABBREVIATIONS/ACRONYMS

.1 The following abbreviations and acronyms are used in this document:

AC	Alternating Current
ADA	Americans with Disabilities Act
ASCII	American Standard Code for Information Interchange
AV	Audio Visual
BPI	Bits Per Inch
BPS	Bits Per Second
CCTV	Closed Circuit Television
CE	European Conformity
CPU	Central Processing Unit
DVR	Digital Video Recorder
FASC-N	Federal Agency Smart Credential Number
FCC	Federal Communications Commission
FDA	Food and Drug Administration
ID	Identification
IEC	International Electrotechnical Commission
In-X-It	Entry/Exit
I/O	Input/Output
ISO	International Organization for Standardization
LED	Light Emitting Diode
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
ODBC	Open Database Connectivity
OPC	OLE for Process Control
PIN	Personal Identification Number
RFQ	Request for Quotation
SEIWG	Security Equipment Integration Working Group
SMS	Security Management System
SPDT	Single Pole, Double Throw
UDF	User Defined Field
UL	Underwriters Laboratories
URL	Uniform Resource Location
WAN	Wide Area Network

1.7 GLOSSARY OF TERMS

.1 The following terms are defined for the purposes of this specification:

.1 Access Group: A logical group of card readers (terminals) which may be connected to one or more controllers and that represent a collection of readers for which a particular cardholder may have access privileges.

.2 Access Mode: The mode of operation in which the SMS shall only annunciate tamper and trouble conditions at a monitored point. Alarm conditions shall not be annunciated in this mode. This is referred to as "alarm shunting."

.3 Acknowledge: The action taken by an SMS operator to indicate that he/she is aware of a specific alarm or tamper state.

.4 Advisory: A message provided by the SMS to the operator to inform him/her of a condition as reported by the SMS.

.5 Alarm: A change of state as detected by the SMS indicating that it has detected a condition that its sensors were designed to identify.

.6 Audit Trail: A sequential record of system activity used to reconstruct and review a series of system events.

.7 Badge: The physical card, carried by the cardholder used to gain access through a portal by presentation to a card reader.

.8 Boolean: An expression that results in a value of either TRUE or FALSE.

.9 Cardholder: A person who is a member of the cardholder database who may have been issued a valid badge.

.10 Card Reader: A device usually located at access points, designed to decode the information contained on or within a badge for the purposes of making an access decision or for identity verification.

.11 CK7xx: This term refers to Cardkey CK7xx series controllers CK705, CK720, and CK721.

.12 Clear: The action taken by an SMS operator to remove an alarm from the alarms queue after it has been acknowledged and, if required, responded to.

.13 Controller: - This term refers to Cardkey CK7xx series (CK705, CK720, and CK721) network panels or S321, S320, D6xx series (D620, D620-TIU, and D600 AP), and P900 serial panels. These connect to terminals and communicate with the Server. S320 and D6xx series panels are also called "legacy" panels.

.14 Disable: A system command that intentionally places a device or system out of service, typically for maintenance.

.15 Download: Refers to the transfer of system configuration information from the server to the memory of the controllers. This includes information such as badge records and access rights.

.16 Dry Contact: A voltage free electrical contact.

.17 Elevator/Cabinet Control: Elevators and cabinets are readers associated with a set of output points and an optional set of input points. The field controller interfaces with elevators and cabinets using output points to enable car-call buttons or unlock cabinet doors and input points to monitor their

status. The controller may grant access to a floor or cabinet door when a badge is presented at a reader installed in the elevator cab. The elevator/cabinet access control allows the operator to assign cardholder access to various elevators, floors, cabinets, and doors in a facility using access group definition.

.18 Events: Events are sequences of system commands or actions that may be activated at a pre-defined time or on an as-needed basis. Events can be activated and deactivated either manually or automatically.

.19 Facility Code: A coded number, in addition to the individual card number stored within each card key, which uniquely identifies the facility at which the card is valid. This feature prevents cards from one facility being used at another facility with a similar access control system.

.20 Guard Tour: A sequence of transactions that, when performed within a specified time frame, ensures that your facility is being properly monitored by security personnel. The main purpose of a tour is to confirm and record that an area has been physically visited. It provides real time monitoring of guard activities - reporting if a guard arrives early or late to designated tour stations. Guard Tour stations can either be readers or input points. Tours can be selected randomly or may be specified at regular time intervals.

.21 Input Point: Electrical contacts that open or close to inform the system of a change of state.

.22 Legacy: Refers to S320 and D6xx series (D620, D620-TIU, and D600 AP) controllers.

.23 Line Supervision: The process of monitoring an electrical circuit via electrical and software systems to verify the electrical integrity of the supervised circuit.

.24 Loop: A number of terminals connected in series in a continuous circuit that starts and ends at the controller.

.25 Monitoring: The process of maintaining a vigilant watch over a system element or point and taking appropriate action in response to system activity.

.26 Offline: A condition in which a controller is not in communication with the server. In the offline mode, the controller continues to make access decisions and process alarms according to the information stored at its local database.

.27 Output Point: Control external devices such as signals, relays, LEDs, control modules, etc.

.28 Panel: See Controller.

.29 Password: A combination of numbers and/or letters unique to each SMS operator.

.30 Polling: Terminals are interrogated at regular intervals by the controller to establish and verify communications with other equipment and exchange data if necessary.

.31 Port: A connection that provides a means of communication between devices.

.32 Priority: The relative importance of system events.

.33 Reset: A command or feedback signal that indicates that a monitored point has returned to its normal state having previously been at the alarm or trouble state.

.34 Secure Mode: The normal state of an alarm input point. A change of state in this mode shall indicate an alarm, or that it has transferred to the trouble or tamper state.
.35 Secured Area: A physical location within the facility to which access is controlled by one or more card readers.
.36 Server: The main computer in the system. The server runs the SMS software, stores database information, and communicates with the field controllers and operator workstation terminals.
.37 Service: The process that performs specific system functions and operates in the background without user intervention.
.38 Soft Alarm: Soft alarms and their addresses are created by the system during installation rather than hardwired to an actual input point.
.39 Tamper: A condition within the circuitry of a monitored point, which indicates that the electrical integrity of that sensing circuit has been compromised.
.40 Terminal: Terminals provide additional reader interfaces, input points or output points to the SMS.
.41 Time Zone: A user-defined period made up of days of the week and hours of the day during which events such as Valid Card Grants and Input/Output linking events may occur.
.42 Transaction: Indicate some form of system activity. It may include items such as access requests and general system messages.
.43 Trouble: A condition within the circuitry of a monitored point, which indicates that an equipment malfunction, single break, single fault and/or a wire-to-wire short exists.
.44 User-Definable: An attribute of an SMS function, which may be easily tailored by an operator without extensive computer programming knowledge or experience.
.45 Workstation: A personal computer connected to the main Security Management System (SMS) server computer via local area network connections for the purpose of operating the system and responding to alarms.

1.8 OPERATIONAL REQUIREMENTS

.1 System Capabilities
- .1 General
  - .1 The SMS shall operate in client-server architecture. Any SMS software and firmware required for the following system functions shall be fully tested with the existing SMS application software. Custom software including "ladder logic programming" and other custom application programming intended to provide the following features are unacceptable.
- .2 Database Management
  - .1 The system shall create and maintain a master database of all cardholder records and system activity for all connected points.
    - .1 Multiple data bases shall be able to be created, each with its own password protection.

.3 Audit Trail

.1 The SMS shall maintain an audit trail file of operator activity, and provide the ability to generate a report by operator, time and date, and type of activity. The system shall allow the operator to direct the audit trail report to screen, printer, or file. The audit trail feature shall record operator activity associated with:

- Users
- Partitions
- Badges, badge layouts, badge fields, badge IDs, badge encoding, automatic badge numbers, setup
- Cardholders
- Field devices such as panels, terminals, terminal groups, input points and groups, output points and groups
- Access groups
- Holidays, time zones, panel holidays and panel time zones
- Access templates
- Companies and Departments
- Soft alarms
- Site Parameters
- Workstations
- Maps and map icon sets
- User Defined Fields
- Events
- Panel card event
- Alarms, alarm filters, alarm history, alarm response text, alarm colors, and alarm instructions
- Message forwarding
- Permission groups
- Panel relays
- Reports
- MIS Interface
- Image recall filters
- Counters
- BACnet elements such as action interlocks and BACnet sources
- Guard Tour definition, station definition and guard tour history transactions
- Loop configuration
- Enterprise Sites and Enterprise Parameters
- Elevator parameters, including configuration, floor masks, floor groups
- Cabinet parameters, including configuration, door masks, door groups
- Area and area control layouts
- Muster zones and muster history transactions
- Connections
- CCTV elements, including server, switch, tour, alarm, macro, system auxiliary, monitor, sequence, camera, preset, pattern, and camera auxiliary
- Enable codes
- P900 elements such as flags, counters, trigger events, trigger links, system parameters, sequence files

- Air Crew PIN Number
- Remote Server
- Message filters and message filter groups
- Local Site
- Service Startup Configuration
- Application
- Panel Card Format
- Security Level Range
- Audit
- Transaction History
- Redundancy
- Intercom exchanges and stations
- Audio Visual (AV) elements such as site, camera, monitor, preset, input to camera, dry contact
- Request Approvers
- FASC-N CCC

.4 Input Point Monitoring

.1 The SMS shall collect and process status information from all monitored points.

.5 Alarm Annunciation

.1 The SMS shall audibly and visually annunciate all alarms, advisories, and tamper and trouble conditions.

.6 Input Point Supervision

.1 The SMS shall electrically supervise all 2-state and 4-state input point circuits as specified or shown on the drawings.

.7 Reports

.1 The SMS shall fully integrate with a dynamic report writer module allowing users to create custom reports. The dynamic report writer shall be Seagate Crystal Reports Writer 9.0 professional version with the following features:

.1 Mouse-driven graphical user interface with the ability to select from a list of database fields.

.2 User-definable reports that can be saved and re-run as required, without redefining the report fields and format each time the report is run.

.2 The SMS report feature shall provide access to all data in the system from entire databases to specific system transactions or configurations. Reports shall be reviewed on screen or printed.

.8 Online Help System

.1 The SMS shall provide online help, which shall be available at anytime from any active screen by pressing <F1>.

.9 Operator Access

.1 The SMS shall provide operator password controls to be assigned to individual users. The system administrator shall be able to define a number of parameters to set up strong passwords, passwords that are hard to break such as password validation, maximum consecutive invalid logins, minimum length, number of letters (uppercase and lowercase) or numerals required in a password. The SMS shall provide added security by requiring operators to enter their password when

performing certain system-critical functions. Stored passwords shall be encrypted.

.2 The system administrator shall assign the operator with menu permissions that define the system elements to which the operator can access. In addition, the SMS shall assign message filters to define which messages (alarms or transactions) the operator can see.

.10 Alarm Input Point Reporting Delay

.1 The SMS shall allow the operator to apply an input point reporting delay period from 0-60 seconds for each input point terminal. The default setting for each input point reporting delay shall be zero seconds.

.11 Alarm Input Point Suppression

.1 The SMS shall provide an alarm input point suppression facility such that the operator may define a time zone suppression period for each individual input point. Alarm conditions for suppressed input points shall not be recorded or archived by the system, however trouble conditions will be recorded.

.12 Alarm Graphics (Maps)

.1 The alarm graphics portion of the SMS shall provide dynamic color alarm graphic maps with the following functions:

.1 User-definable graphic maps to depict input/output point conditions, reader status, and sub-map attachments in the system.

.2 The SMS shall support the importing of image formats produced with any graphic drawing program in TIF, BMP, JPEG, WMF, PCX or EPS format. Vector file formats are not acceptable.

.3 The SMS map program shall support the importing of most image file format graphics to produce custom icons for all map attachments (input, output, reader, etc.).

.4 The map display window shall have Home, Previous and Up level buttons for rapid movement among map levels. It shall also provide map selection and size adjustment lists.

.5 The SMS software shall be capable of storing a number of graphic maps. The quantity shall be limited by available hard disk storage space only.

.6 The SMS shall provide a palette that includes the following categories of pre-defined alarm map icons:

.1 Input - a user-defined alarm input point located anywhere in the system. The input point icon flashes, changes color and the computer's internal sounder beeps when an alarm condition exits. Users can respond by either clicking on the icon or moving directly to the alarm queue window. Each alarm input icon has a pop-up box to indicate its current state (open, short, alarm/active, secure, suppressed, unknown).

.2 Output - a user-defined output point located anywhere in the SMS. Clicking on the icon will set

or reset the output point. In addition, it can display its current status (set, reset, unknown).
.3 Map layer - indicates that lower level maps associated with the top layer map exist in the system. Operators will navigate through the map layers by clicking on the up and down icons.
.4 Intercom Station - when a call request is received for a station, the intercom icon will flash on the map, and the user can select to connect or disconnect the call. In addition, the map can display the following intercom states Station Idle, Station Busy, Station Connected, Station Call Request, or Status Unknown.
.5 Reader Terminals - will display one of the following icons: unlocked, unknown, up and down.
.6 Panels - a system panel controlled by the SMS. Panel icons will indicate a status of either up, down, or unknown.
.7 I/O Terminals - I/O terminal icons will indicate a status of either up, down, or unknown.
.8 Events - Events can be manually activated from a map rather than by trigger conditions.
.9 Loop Tamper - loop tamper alarms icons will indicate a status of set, secure or unknown.
.10 Cameras - When cameras are associated with input points and the input point is on the map, the user can click a camera icon to open AV Player to display live or stored video.
.11 AV Dry Contact - AV dry contact alarm icons will indicate a status of secure, alarmed or unknown.

.13 Alarm Handling

.1 The alarm handling portion of the system, which consists of the point contacts and the alarm monitoring window, shall provide the following functions:
.2 Alarm monitoring window - displays the total number of alarms in the queue and the number of alarms pending, and can be sorted by column. Users can select highlighted alarm inputs to directly access map layer.
.3 User-definable alarm message/instructions description - allows the user to assign an alarm message/instruction to input points and other applications.
.4 Alarm message "pick list" - all alarm message names and associated descriptions appear in the form of a pick list from which the user may select an appropriate alarm name and message.
.5 Alarm input points - the system supports up to 17,000 alarm-input points.
.6 Alarm input point maintenance - allows the operator to 'Add', 'Edit', or 'Delete' an alarm input point. The 'Delete' option requires user confirmation. All maintenance functions are logged to the audit trail and archived to the hard disk of the server.

.7 The system shall support both 2-state and 4-state alarm input point monitoring as called for in this specification or as shown on the drawings.
.8 Alarm priority - an alarm priority queue from 0-255. Individual wave sound assignment will be based on alarm priority.
.9 Alarm pop-up - alarm inputs that are designated, as "pop-up" by the operator shall take priority over any active non-alarm window. If the operator is viewing a non-alarm window when a pop-up alarm occurs, the alarm queue window shall be automatically placed on top of all other windows to allow the operator to respond to the alarm condition.
.10 Alarm instruction display - a window containing up to ten lines of user-defined instructions, which indicate to the operator how to respond to the selected alarm.
.11 Alarm condition history display - a window displaying the alarm history, together with a time and date stamp of each condition.
.12 Alarm response entry - a window in which the operator may enter free-form text (up to 255 characters) describing how he/she responded to a given alarm.
.13 The operator shall be able to select from a list of predefined response descriptions.
.14 The alarm instruction display, alarm condition history display, and the alarm response entry box shall all be part of one summary window. Separate windows or applications to support any of these three functions are unacceptable.
.15 Alarm colors - the operator shall be able to recognize specific alarms by the color assigned to each. Color assignment is based on alarm priority and alarm state.

.14 Security Threat Level Alert
.1 The SMS shall allow the user to configure badge and terminal security levels (0 to 99) by color and range. Security levels shall be mapped to a five-color "Red-Orange-Yellow-Blue-Green" system, each of which can be set a numeric value range. In the event of a security breach, an authorized operator shall be able to quickly change access privileges, including overrides, to efficiently set/reset the status of all readers to the required security level.

.15 Event Processing
.1 Panel Card Events: The SMS shall allow the user to define panel card events, executed by the cardholder at a keypad card reader. The user can define any of the following data for each event:
.1 Alphanumeric event name (numeric identifier only is unacceptable)
.2 Access code to control the triggering of the event (card activated event)
.3 Event trigger type (card only, card + PIN, card + PIN + code, card + code, void card)
.4 Event privilege level (0-7)
.5 Duration of the event execution (0-1440 minutes)
.6 Input point group to be suppressed or not

.7 Output point group to be activated or not
.8 Door strike operation enabled/disable
.9 Reset panel alarm relay

.2 Host Events (Triggers): The SMS shall provide the operator with a scrolling list of event sequence triggers, which may be combined with the event sequence logical operators listed below to program a custom sequence of events. The SMS shall be delivered with this functionality, regardless of whether or not these features are implemented by the user upon initial installation.

.3 Host Events (Actions): The SMS shall provide a scrolling list of event sequence actions, and shall allow the user to attach one or more actions to the event sequence triggers to program a custom sequence of events.

.4 Logical Operators for Trigger Conditions: The SMS shall provide a scrolling list of the following logical operators for event trigger conditions:

.1 = (Equal to)
.2 ! (Not equal to)
.3 (Greater than)
.4 < (Less than)
.5 >= (Greater than or equal to)
.6 <= (Less than or equal to)

.5 Logical Operators for Triggers: The SMS shall the provide the following event trigger logical operators to allow the user to attach one or more of the logical operators with one or more of the event triggers and card actions listed above to program a custom sequence of events.

.6 And
.7 Or

.16 Time Zones

.1 The SMS shall provide the capability for the user to define time zones with the following identification and configuration parameters.

.1 Alphanumeric name.
.2 Alphanumeric description.
.3 Allowance for up to eight periods, four active and four inactive, during each day of the week and each of three different holiday types.
.4 Any day of the year may be designated as a holiday; each defined as one of three holiday types.

.17 Communications

.1 Pertaining to network-based communications between the server and S321/CK7xx series controllers:

.1 Communications between the server and the CK7xx series controllers can optionally support a redundant network path. Thus, the loss of communications on the primary network path automatically causes communications to be established via the other path without operator intervention.
.2 Should the controllers lose communication with the server, the controllers shall continue to control access and monitor inputs for all connected points. Local history of all transactions shall be buffered at

the controller and automatically uploaded to the server for alarm reporting and long-term historical storage once communications is re-established.

.3 The Contractor shall be responsible for the design of a system that will compensate for all signal level losses in the trunk wiring. This shall include any power supplies for the field devices and any signal level converters or repeaters for the proper amplification of electrical signals.

.2 Pertaining to serial communications between the server and Legacy (D620, D620-TIU, D600 AP, and S320) controllers:

.1 Communications between the server and the Legacy controllers can optionally support a redundant communications path via a bi-directional polling methodology. Thus, the loss of communications on the primary ("forward") polling path automatically causes communications to be established via the other ("reverse") path without operator intervention.

.2 Should the Legacy controllers lose communications with the server, the controllers shall continue to control access and monitor inputs for all connected points. Local history of all transactions shall be buffered at the controller and automatically uploaded to the server for alarm reporting and long-term historical storage once communications is re-established.

.3 The Contractor shall be responsible for the design of a system that will compensate for all signal level losses in the trunk wiring. This shall include any power supplies for the field devices and any signal level converters or repeaters for the proper amplification of electrical signals.

.3 Pertaining to communication modes, the SMS shall communicate with controllers that provide reader interfaces, input points, or output relays. Communication shall be bi-directional, some messages shall be sent from the server to the field controllers, other messages shall be sent from the controllers to the server, and then can be distributed within the system (e.g. workstations). The SMS shall provide the following three operating modes:

.1 Local - All access decisions shall be made by the controllers. This eliminates the need for panels to communicate with the server every time an access request is presented at a reader. Local mode provides the best overall system capability; however, access will be denied to those badges not stored in the controller memory.

.2 Central - This mode is useful when assigning access restrictions on a global scale (throughout the entire system). All access requests shall be forwarded to the server for an access grant or deny decision. Central mode has the most impact on system performance (the slowest), and should be used only when necessary.

.3 Shared - Access decisions shall be made either at the controller level or by the server. Controllers will first search for a badge in their memory, as in Local mode. If a badge's record is not found at the controller level, the access request is then forwarded to the server, as in Central mode. Shared mode is useful when a controller's badge capacity is exceeded.

.18 User-defined Cardholder Database Fields

.1 The SMS shall support an unlimited number of user-defined data fields, which may be used to store information for each cardholder. Each field may be alphanumeric text, numeric, date, and Boolean. The SMS shall provide standard menu items, which allow the operator to define these cardholder database fields at anytime. The SMS shall remain online while user-defined cardholder database fields are added or edited. It shall be possible, using standard SMS system menu commands to report on all user-defined cardholder fields.

.19 Event and Transaction History

.1 The SMS shall maintain a record of all alarms, card transactions, and system exceptions, and provide a means for users to access this information. This log can either be viewed in real-time or by printed report.

.20 Message Filtering/Routing

.1 The SMS shall provide the capacity to control the types of messages transmitted to local workstations and remote servers, thereby reducing the amount of network traffic by only providing filters that only allow a subset of messages to pass a specific criteria. Filtering shall be applied based on the operator logged on to the workstation. Filtering criteria shall include alarm or message type and subtype, Site name, operator name, partition, item name, query string and priority.

.21 Anti-Passback Control

.1 The SMS shall provide the capability to prevent more than one person from gaining access to a controlled area by recognizing when a cardholder with access privileges attempts to pass their card back to another person. If so programmed, an alarm may be generated if the cardholder violates the anti-passback rules. It shall be possible to define which readers are subject to anti-passback rules on an individual basis.

.22 Anti-Tailgate Control

.1 The SMS shall provide the capability to prevent more than one person accessing a controlled area because of a single card transaction.

.23 In-X-It (entry/exit) Control

.1 The SMS shall support the capability to control a card's entry into or exit from an area based on the previous transaction status of the card. An alarm may be generated if the cardholder violates the In-X-It conditions.

.24 Duress Processing

.1 The SMS shall permit cardholders to force a soft alarm to indicate that they are requesting access to an area under

force or duress. In the event of such a situation, the cardholder will be granted access and an alarm will be generated.

.25 Cardholder Definition

.1 The SMS shall allow cardholders to be defined by any of the following identification and operating parameters:

.1 Cardholder name (first, middle, last)
.2 Cardholder type (regular or visitor)
.3 Cardholder ID
.4 Cardholder address
.5 Cardholder phone number and extension number
.6 Validation period using start and void dates
.7 Department and Company fields from selection list of user-defined departments and companies
.8 Web access permissions
.9 Email address
.10 Cardholder journal (user-entered notes associated with the cardholder)
.11 Unlimited number of user-defined cardholder fields. The SMS shall use these fields in filtering reports

.2 The Cardholder application shall select automatically the name of a newly added cardholder in the list of cardholders; the application shall also allow the display of cardholder badge transaction history.

.26 Badge Definition

.1 The SMS shall allow cardholders to be defined by any of the following badge identification and operating parameters on a per badge basis:

.1 Badge number assignment
.2 Badge type (access or identification)
.3 Issue level (0-255), only (1) per badge
.4 Badge facility code
.5 Reason for issuing a badge (damaged, lost, new, not returned, reissue, returned, stolen, temporary, visitor)
.6 Badge purpose (to specify the badge's intention)
.7 Validation period using start and void date and time
.8 Executive privilege enabled or disabled
.9 Active/Disable badge toggle button
.10 Trace enabled or disabled
.11 Override enabled or disabled
.12 PIN code (4 or 5 digits)
.13 Badge event privilege level (0-7)
.14 Security level (0-99)
.15 Special access privileges (to satisfy requirements for assisted access according to ADA)
.16 Assign a minimum number of 10 badges per Cardholder
.17 Assign 32 Access Groups and Time zones per badge

.27 Image Recall

.1 The SMS shall allow the system to display a cardholder's picture whenever he/she badges at a specific

terminal or group of terminals. When a cardholder badges at a terminal under one of the following filtering conditions, the cardholder image linked to the badge number shall be displayed, along with their name, date/time, badge number, terminal, user-defined fields, and the transaction message. The SMS shall allow the display to pop-up in front of other windows whenever a badge meets one or all of the following defined filtering criteria:

- Access Grant
- Access Deny
- Invalid Card
- Invalid Issue Level
- Invalid PIN
- Anti-Passback On
- Invalid Card Timezone
- Invalid Reader

.28 Real-time System Activity Window

.1 The SMS shall provide a real time system activity monitor window, which can be displayed on any operator workstation terminal screen whenever the SMS server is online. This window shall have the capability to toggle the display on and off, as well as to selectively display the following items at the operator's discretion:

- Alarms
- Access grant
- Access denied
- Badge Trace
- Audit trail
- Panel
- Host
- Elevator
- Cabinet
- Area
- Mustering
- Guard Tour

.2 The SMS shall provide color configuration capabilities for each of the above transaction types to help operators recognize a specific type of transaction. In addition, in transactions associated with cardholders, the real time system shall display cardholder information including image and badge transaction history.

.29 System Status Display

.1 The SMS shall provide a dynamic system summary display that graphically indicates the following status information, filtered by panel or terminal. All status display information shall be summarized in a single window:

- Status Unknown
- Panel or Terminal Up
- Panel or Terminal Down
- Terminal Mixed States
- Input Secure
- Input Alarmed
- Input Open
- Input Shorted

- Input Suppressed
- Output Reset
- Output Set
- Door Unlocked
- Panel version mismatch
- Muster Operable
- Muster Degraded
- Muster Inoperable

.30 Control Points

.1 The SMS shall allow input points to be defined as control points when used in input/output linking and event processing sequences of operation. Control points shall not enter the alarm queue and shall not require that an operator acknowledge them when they change state. The control point activity will, however, be automatically logged to the history file.

.31 Workstation Control

.1 The SMS shall allow workstations to be assigned a name, and to have the following capabilities:

.1 Be identified as either workstation only, or workstation/video badging.

.2 Have a time zone to define the period to be in use.

.3 Assign message filtering to define the messages that can be transmitted to the workstation.

.4 Have an enable/disable toggle button to allow or deny operator login at the workstation.

.32 Real-time Printer

.1 The SMS shall have the ability to print either to a network-accessible printer or to an LPT port. The toggle button may be either enabled or disabled to allow real time printing, and the following print parameters may be independently defined:

- Alarms
- Access grant
- Access denied
- Badge Trace
- Audit trail
- Panel
- Host
- Elevator
- Cabinet
- Area
- Mustering
- Guard Tour

.33 Elevator Control (Not used on this project)

.1 The server shall have the ability to control compatible elevators using a CK7xx series controller. This feature shall allow up to 16 elevators per controller, and a maximum of 128 floors. History of elevator activity shall be maintained in electronic or printed form. The SMS shall provide two types of elevator interfaces:

.1 Low Level Interface: Low level interface elevators have readers associated with a set of output

points and an optional set of input points. The field panel shall work with the elevator manufacturer's control system using output points to enable car-call buttons, and input points to monitor car-call buttons. The panel shall grant access to a floor by enabling the corresponding car-call button when a badge is presented at a reader installed in the elevator cab. The SMS shall provide a D620-ECG elevator mode that if selected, causes a modification in the badging sequence and in the elevator input and output points behavior.

.2 High Level Interface: The SMS shall allow the CK7xx controllers to communicate with High Level Interface elevator control equipment via a serial protocol. The SMS shall support the KONE group controller with up to eight elevators, with each elevator supporting up to 64 floors. The KONE group controller can be connected at either 1200 or 9600 baud.

.34 Current Loop Configuration

.1 The SMS shall allow communication with legacy, P900, and S321 panels via a current loop configuration. The loop system shall support up to 32 loops with up to 16 legacy panels per loop, up to sixty-four P900 panels per loop, and up to thirty S321 panels per loop.

.35 Mustering

.1 This feature shall provide the capability of tracking personnel movement in the event of an emergency. During the emergency, all personnel that had logged into a risk area are expected to evacuate and are required to badge at a reader outside the risk area. This will allow for real-time monitoring, printed or on-screen, as to who may be still in the hazard area. This information can be used to direct search and rescue operations. One or more areas within a plant or facility can be designated as Muster Zones.

.36 Area Control

.1 This feature shall be used to control the number of personnel/cardholders that are allowed within a controlled area, thereby allowing large facilities to manage specific areas more easily. For example, a controlled substance room can be monitored, and the system will be able to report and display in real time how many and which cardholders are within the area at any given time.

.37 Air Crew PIN

.1 The SMS shall allow the definition of air crew personal identification numbers (PIN) to be used at PIN readers connected to D600 AP panels and CK7xx panels version 2.3 and higher. Once the Air Crew PIN numbers are defined, a system administrator shall enable or disable the Air Crew PIN feature. When this feature is enabled, entering the assigned Air Crew PIN number shall allow access at the door. Air Crew PIN numbers shall be assigned to a group of people or shall be assigned individually to an Air Crew member with different access needs. Presenting a badge shall not be required when using the Air Crew PIN Number feature.

.38 Cotag P900 Mark I and Mark II Controller Support

.1 The features and functionality will be based on the Mark I configuration, meaning that the limits on badges will be limited to the maximum count of the Mark I controller or 30,000 badges with the badge upgrade memory expansion. There are three types of I/O Modules that are applicable: 1) 8 Input and 4 Output; 2) 8 Input and 8 Output; 3) 16 Input.

.39 Smart Download Feature

.1 This feature shall allow the customer to set the download time for changes that have been made to access and terminal groups, as well as cardholders and badges changes. There are three choices:

.1 Start download after the system has been idle for "x" minutes after the last change.

.2 Download will occur at set time every day.

.3 Download to be performed manually.

.2 In each case, changes made to the cardholder data are downloaded from the server immediately.

.40 Temporary Access Feature

.1 This feature shall allow the customer to define "temporary access" to any valid access group for each individual badge. Temporary access shall be defined on a selected date and time, which shall grant the cardholder permission for limited access within the normal time zone. Temporary access shall be based on the following parameters:

.2 Start - specifies the date and time when permission for access shall be granted. If this is not specified then access is granted immediately.

.3 Void - specifies the stopping date and time when permission for access expires.

.41 Enhanced local global entry/exit synchronization

.1 The SMS Entry-Exit Enforcement application shall be expanded to include system wide readers. This feature shall allow synchronization of badge status across multiple panels. This feature is not recommended for medium and large systems, unless using panels CK7xx of version 2.5 or higher.

.42 Special Access

.1 The SMS shall provide special access that allows setting up a door's access time to be different, to satisfy the requirements for assisted access according to ADA (Americans with Disabilities Act). The system shall provide up to three special access flags, and then assign them to a cardholder that requires special access at a door. Additionally, the SMS shall provide the activation of an ADA relay in conjunction with the granting of assisted access.

.43 Port Configuration

.1 The SMS shall allow changing default port values that are assigned to system applications during software installation. Some of these values must match the values configured at the panel.

.44 Email Settings

.1 The SMS shall allow setting e-mail accounts that shall be used to send e-mail messages as event actions, and where automatic error return could be sent.

.45 External Event Triggers

.1 The SMS shall allow external inputs to be used as event trigger conditions. These external inputs can be in the form of an RS232 serial message or a TCP/IP message; an ASCII file or a database write. These inputs shall allow external software or hardware systems to send a message to the SMS, which will trigger a Host event that will in turn generate an alarm or other event action.

.46 Localization (Optional)

.1 The SMS shall provide an internationalized framework to assist companies and users to work effectively in their native language. All text in the SMS menus, dialogs, and prompts shall appear in the language selected.

.47 Dial-up Panels

.1 The SMS shall support communications with dial-up panels (CK720 and CK705) using WAN connections and RRAS interface service.

.48 Dual Ethernet interface

.1 The SMS shall provide an alternate panel connection to configure panels (CK720 or CK705 version 2.5 or higher) that have a second network connection through a Dual Ethernet interface. Dual Ethernet allows the alternate connection to take over the communications if the primary connection fails.

.49 Exempt from Archiving to Flash

.1 The SMS shall provide the option of not saving the following databases to Flash during a Write-Flash operation (available for panels CK7xx version 2.5 and higher):

.1 Badge

.2 Access Groups (including elevator access groups)

.3 Configuration: (including the Panel Configuration databases such as Elevator Configuration, Terminal, Input, Output, Time Zones, Holidays, Soft Alarms, and Card Events)

.50 Input Suppression Messages

.1 The SMS shall allow input points that enter suppression to be reported as being suppressed (available for panels CK7xx version 2.5 and higher). When the input is no longer suppressed, the current input point state is reported.

.51 Custom Card Formats

.1 The SMS shall support up to eight custom card formats that can be downloaded to all S321 and CK7xx panels of version 2.2 or higher. Upon selection, custom card files shall be stored in a separate database table. Once the selected card formats have been compiled, they will be available for selection.

.52 PIN Plus 1 Duress

.1 The SMS shall provide this option (available for S321 and CK7xx panels version 2.2 and higher) to enable a duress alarm to be generated when a cardholder adds 1 to the last digit of the PIN code. When this option is enabled, the 9 does not create a duress alarm. If the last digit of the PIN

code is a 9, then the user substitutes a 0 for the 9 and this will trigger the duress alarm.

.53 Star Feature

.1 The SMS shall provide the Star Feature (available for S321 and CK7xx panels version 2.2 and higher) to enable cardholders to press the star (*) key at the keypad plus a feature number, to activate some of the panel's functions that are normally invoked from keypads that contain the A, B, C or D keys. The (#) key acts as the Enter key, it wraps-up the previously entered keys and starts the processing of the key sequence. It also clears the keypad buffer for the next command to be entered. The (*) key starts the feature selection process. Once pressed, the cardholder can activate one of the following features: 0 = Local Override, followed by number of minutes 1 = Enable event, followed by event number 2 = Disable event, followed by event number * = Clear the keypad buffer (works independently of the Star Feature setting)

.54 BQT Reader with LCD

.1 When used with panels CK7xx 2.5 and higher, the SMS shall enable the LCD display of the following messages (arranged from highest to lowest initial priority). :

- Reader Offline
- Access Granted
- Access Denied
- Enter PIN Code
- Enter Shunt Time
- Shunt Time Warning
- Present Card

.55 No Green Light On Aux Access

.1 The SMS shall provide this option to disable the green light displayed on AUX access. Requires S300-DIN-RDR2S (connected to CK7xx 2.5 and higher), with firmware revision Q or above.)

.56 Deny if Door Open

.1 The SMS shall provide the option of generating access denied messages when cardholders swipe their badges at opened doors (available for panels CK7xx version 2.5 and higher).

.57 Override Reset Threat Level

.1 The SMS shall allow each reader terminal defined for a CK7xx (version 2.4 or higher) or S321 panel to be configured with an Override Reset Threat Level ranging between 0 and 99. A value of 0 disables the "Override Reset" feature; a value between 1 and 99 invokes the following behavior:

.2 Whenever a terminal's Security Level reaches or exceeds the terminal's Override Reset Threat Level, all time zone based overrides, host initiated overrides and cardholder overrides are immediately disabled. Subsequent attempts to invoke host initiated overrides or cardholder overrides will be denied.

.3 Once a terminal's Security Level drops below the terminal's Override Reset Threat Level, the time zone based override is restored immediately. Host initiated overrides

and cardholder overrides are not automatically restored, but subsequent attempts to invoke host initiated overrides or cardholder overrides will be granted, provided the configuration allows these overrides.

.58 Smart Card Management

.1 The SMS shall support the Federal Government smart card encoding protocol. All encoded badges shall include FASC-N (Federal Agency Smart Credential Number) data fields.

.59 Auto Badge Management

.1 The SMS shall allow the control and management of badge numbers within a defined pool. Once the pool of numbers is defined, the operator can automatically assign the next available number to the badge.

.60 Service Startup Configuration

.1 The SMS shall allow enabling or disabling any of the services at the start of communications, as well as set up recovery actions to take place if a service fails. If the Auto Start flag is enabled for a particular service, that service will start automatically and can be stopped or restarted using the Service Control or the Service Monitor application. If the Auto Start flag is disabled, the service will not start automatically and will not display in Service Control. By managing the SMS services, you can reduce system load by running only the required services.

.61 Manual Controls

.1 The SMS shall allow some system functions to be operated manually from a workstation. Operators with the appropriate permissions can manually control doors, output devices, and panel relays. For example, an operator can unlock all doors at once, manually trigger an event, or allow a guard to manually control access to a specific door during off business hours.

.62 N-Man Rule

.1 The SMS shall provide additional security measures for specific access-controlled readers using the N-Man rule function. The N-Man Rule is based in a team of cardholders who must present their badge as a group within a defined period of time in order to gain access at an N-Man Rule defined reader. For this option to work, the terminals are required to operate in Central mode. The SMS shall enable visitors to gain access at an N-Man rule defined reader, as long as their sponsor presents the badge after the visitor.

.63 Database Maintenance

.1 The SMS shall provide several functions to help customers maintain their database.

.64 Visitor Definition

.1 The SMS shall allow an easier and faster way to enter visitor and badge information, by allowing authorized operators to enter visitor and badge data using a single user interface. Prior to a visitor's arrival, the operator shall be able to enter the appropriate visitor data into the system, shall assign a visitor sponsor, shall enter the date and time period of the scheduled visit, and shall assign

access privileges using Access Templates, subsequently and from the same screen, the visitor badge shall be printed

.65 Badge Resync

.1 Facilities that use entry and exit terminals require cardholders to enter and exit an area in sequence. That is, when cardholders badge in at an entry terminal, they must badge out at the next badging. If, for example, they follow another cardholder out without swiping their badge, their badge will remain in the In state (out-of-sync). When they attempt to badge back into the area, they will be denied access. The SMS shall provide the capability of manually adjusting the state of a badge to return it to a correct state. The operator shall also be able to reconfigure the badge as Undefined to clear the Entry/Exit status until the next badging. The SMS shall allow badges to be resync by:

.1 Cardholders - to resync the status of badges that belong to all or specific cardholders.

.2 Last Badging Terminal - to resync the status of all badges last presented at the selected terminal.

.3 Last Badging Terminal Group - to resync the status of all badges last presented at all terminals in the selected terminal group.

.66 Request Queue View

.1 The SMS shall provide a Request Queue database table that contains requests originated from external sources, such as Web Access requests. Since external requests involve adding, deleting or modifying data in the SMS database, the Request Queue shall be designed to provide additional security measures in the request processing by checking all records before they are allowed to enter the SMS.

.2 The Request Queue shall allow operators to intercept requests for the purpose of reviewing, editing, and finally letting request data enter the SMS database system. The requests shall be packaged as XML documents and saved into the SMS Request Queue table. The Request Queue View window shall displays current requests or requests that were archived in the Request Queue database table.

.67 Web Access Option

.1 The Web Access feature shall enable users to perform various security management tasks from any web-ready PC or compatible PDA device. This feature shall support different permission levels for each user, and requests can be approved and/or validated prior to being implemented to prevent unauthorized operations or changes to the SMS. Rules shall be established to determine how requests are submitted. If requests require approval, pre-defined approvers shall approve or reject requests. If validation shall be required, a user with the proper permissions shall confirm the validity of the request before it can be fully processed. Web Access features shall include:

- Visitor Requests
- Contractor Requests
- Cardholder Management
- Customizable User Interface

- Request Approval and Validation
- Badge Activities
- Guard Services
- Emergency Access Disable

.68 MIS Interface Option

.1 This option shall provide the capability for the SMS to receive cardholder information from an external source (such as a Human Resources or MIS system). Using the MIS interface and standard ODBC protocols, cardholders and their badges shall be added, modified or deleted from the SMS database, cardholder information can be queried using "wildcards", and data imported from ASCII files. Such import/export sessions can occur in either batch or real-time mode.

.69 Intercom Interface

.1 Intercom calls shall be monitored and connected to from the Intercom Call Monitor and shall be used to automatically trigger host actions, such as CCTV activities. When incoming call requests are displayed, the operator shall be able to select a call request from the list, and connect the master intercom station to the selected station. Intercom calls shall also be monitored and responded to from the real-time map system. The SMS shall support multi-exchange station calling. A call request can be forwarded to multiple master stations.

.70 Database Partitioning Option

.1 Multi-tenant building control shall be supported via database partitioning. Each tenant may be provided with their own user partition capable of controlling and monitoring their own cards, doors, alarms, etc. Building owners still retain overall control and can override tenant commands if necessary. Building owners are free to lease workstation "seats" on the security system thereby generating additional revenue while enhancing tenant satisfaction. In a campus environment, each building can be configured as a separate partition with several operations per partition. Each partition shall appear to the user as a separate security system without incurring an additional cost.

.71 Guard Tour Option

.1 This option shall provide the ability to monitor security personnel by time frame and tour definition. Selected tours may be either randomly selected or fixed. Users shall be able to define up to 256 guard tours with a maximum of three guards per tour.

.72 FDA CFR Part 11 Compliance

.1 The SMS shall provide features designed to assist facilities that may be subject to FDA Title 21, Code of Federal Regulation (CFR) Part 11 concerning electronic records and signatures. The SMS shall allow customer to define parameters to assure FDA Part 11 compliance. The

following are general Part 11 requirements applicable to the SMS:

.1 Audit Trail - The SMS shall provide valuable time-stamped reports to monitor day-to-day operator activity, such as how the hardware is controlled, when alarms are acknowledged, when cardholder records are changed, and more.

.2 Authorized Users - The SMS software shall limit system access only to authorized individuals. Authorized users shall be identified by their unique combination of user name and password. The passwords for these individuals shall be configured to change periodically and shall have a minimum password length. Additionally, the software shall disable user access on multiple invalid login attempts and shall provide for automatic log off due to user inactivity.

.3 Record Validation - The SMS software shall provide a tampering tool to detect unauthorized record modifications. The SMS shall validate digital signatures, pointing out discrepancies and correcting discrepancies to ensure that records have a valid digital signature.

.4 Record Persistence - All original records shall be saved in the SMS database, even if records are modified. The SMS shall generate detailed, time-stamped audit trails reports, assuring that all record changes maintain the original recorded information and thereby protecting all previous data.

.5 Record Retention - Through software configuration, a system administrator shall define parameters to backup and retrieve records to ensure the availability of all records for a specified period of time.

.73 Video Imaging and Badging Integration Option (Not required on this project)

.1 This option shall provide a visual identification of every cardholder. Badge layouts shall be defined to include a number of elements, such as company logos, cardholder photographs, custom text, barcodes, fingerprints and signatures. The captured and stored images can be viewed as part of a cardholder's data record on a workstation.

.74 CCTV (not required on this project)

.1 This option shall provide controls to operate the cameras and monitors forming part of the CCTV system. Additionally, the system shall provide the controls to define and run the following:

.1 Alarms, macros, and tours.

.2 Sequences from the monitors.

.3 Pan, tilt, zoom focus, iris, wiper, washer and light controls for any given camera.

.4 Patterns, presets, and auxiliaries.

.2 The CCTV option shall provide for a single-seat integrated security solution when used with the SMS and shall support at a minimum the following CCTV protocols:

.1 General ASCII protocol

.2 American Dynamics switch: AD1024

.3 BetaTech switch: Ademco VideoBlox Switch

.4 Geutebruck - GST Interface: CPX 24/8; CPX 48/8; VX 3 (Vicros III); KS 48 (Vicros II); and KS 40 switches.

.5 Panasonic SX850 switch, other models may be supported if they are compatible with SX850 Protocol Version 1.4 01.24/00.

.6 Pelco 9760, CM 6700 and CM 6800 switches.

.7 Philips Burle (Bosch) LTC 8100; LTC 8200; LTC 8300; LTC 8500; LTC 8600; LTC 8800 and LTC 8900 series switches.

.8 Ultrak MaxPro-1000 switch.

.9 Vicon VPS1300; VPS1344; VPS1422 and VPS1466 switches.

.3 Integrate the CCTV system into the SMS c/w full PTZ controls.

.75 DVR Integration (AV) (not required on this project)

.1 This option shall provide seamless integration of the SMS with approved Digital Video Recording (DVR) systems. The integration shall allow authorized users to manage camera functions, including frame rate and resolution, from a single workstation, as well as to tie an event generated on the system to live or recorded audio visual (AV) recording. Audio and video may be accessed via a real time list, real time graphical map, or alarm monitor screen.

.2 Depending on the DVR equipment, users shall be able to search, retrieve, and download real time or archived AV recording from any surveillance camera, from any place, at any time. Query options shall include time/date, alarm events, camera ID and DVR ID. The playback interface shall have fast forward, rewind, go to first frame, go to last frame, pause and stop controls. The AV integration shall allow for Pan, tilt, zoom control, including presets.

.3 The system shall support at a minimum the following DVR protocols:

.1 Nice protocol, version 8.0 (with alarm forwarding and message filtering)

.2 Loronix protocol, versions 4.4 and 4.5

.3 Verint SmartSight

.4 Johnson Controls Digital Vision Network DVN 5000 series and DVN 3000 series.

.76 Metasys BACnet Integration Option

.1 The BACnet integration option shall allow the SMS to interface across the BACnet via TCP/IP to the Johnson Controls Metasys Building Management System OPC server supporting either M3 or M5 workstations. It shall further allow the Metasys workstations to view and acknowledge alarms, and control output functions from up to five M3 or M5 workstations in real time. This shall allow the user to

elect the Johnson Controls Metasys workstation running the M-Alarm graphics to view and interact with alarms generated from the SMS.

.2 The BACnet integration shall require no special hardware subset, but rather be a simple upgrade, via software, to allow SMS users to enhance their workstation operations by integrating BACnet communications with the Metasys server.

.77 Metasysr System Extended Architecture Option

.1 The Metasys System Extended Architecture option shall allow the SMS to interface using web-based technology to the Johnson Controls Metasys Building Management System. It shall allow the Metasys workstations to view and acknowledge certain SMS alarms, send access control commands, print reports, and to create interlock events.

.2 The option shall require no special hardware subset, but rather be a simple upgrade, via software.

.78 Enterprise Option

.1 The Enterprise option shall allow customers with multiple sites to communicate with each other to share Cardholder/Badge information. Cardholders can be granted access to doors at all assigned sites within the Enterprise system. In the Enterprise Configuration, one SMS Site becomes the SMS Central Site and all other SMS systems within the enterprise become SMS Regional Sites. Each regional Site synchronizes its data with the central Site. Database replication shall be implemented using Microsoft SQL Server database technologies.

.79 Redundancy Option

.1 The SMS shall provide redundancy options that lessen or eliminate the impact of system failure. If a failure occurs, it shall be automatically detected, and the function of the defective component shall be taken over by the redundancy component. The two redundancy systems available are:

.1 Cluster Redundancy: A high availability, redundant computer system with failover and failback capabilities using HP Proliant DL380 Packaged Cluster to provide system duplication and backup functions.

.2 Remote Redundancy: A disaster recovery system with failover and failback capabilities using NSI Double-Take software to provide database mirroring and backup functions.

1.9 SOFTWARE REQUIREMENTS

.1 The software shall have an installed capacity to accommodate the following at a minimum:

.1 A central database on the server able to support up to 200,000 badges maximum.

.2 Unlimited number of access groups.

.3 Up to 16,000 2-state alarm input points, or up to 8,000 4-state alarm input points (or any combination in between).

.4 Up to 40 operator workstation terminals connected to a server via an Ethernet TCP/IP network.
.5 Central online data storage of 500,000 historical transactions, expandable (as system resources allow), with local panel storage capability of up to 200,000 cardholders and 50,000 events.
.6 256 levels of alarm priority.
.7 A minimum of ten (10) individual badge numbers per cardholder. Each badge shall be tracked separately.
.8 255 issue levels per card, only one of which shall be active at any given time.
.9 Unlimited number of user-defined cardholder fields. The SMS shall be capable of reporting on any or all of the fields. Each field may be defined by the user as either alphanumeric text, numeric, date, or Boolean.

.2 System Software
.1 The server operating system shall be Microsoft Windows 2003 Server or Microsoft Windows 2000 Server. It shall have multi-tasking and multi-user capability, and support workstations with Windows XP Professional or Windows 2000 Professional operating systems.
.2 The system database shall be Windows SQL Server 2000 for Windows 2003 Server or for Windows 2000 Server.
.3 The SMS software features shall be fully documented in the form of a complete User's Manual including operation and installation sections, and a detailed description of the major SMS functions.

.3 The SMS shall be capable of partitioning (segmenting) the database which must include, but is not limited to, the following items:
- Cardholders
- Badges
- Time Zones
- Holidays
- Access Groups
- Panels
- Reader/Terminals
- Workstations

1.10 INTEGRATION REQUIREMENTS

.1 Video imaging system integration. The SMS shall integrate with the Johnson Controls, Inc. SMS Video Imaging and badging system without the need for custom software development.
.1 The integration shall provide for a single database on the SMS server, which shall store the cardholder data and image fields.
.2 The communications between the video capture/badging station and the SMS server shall be via Ethernet TCP/IP only. Serial connections are unacceptable.

.3 It shall be possible to operate the Video Imaging software from the same qualified workstation operating with Microsoft Windows 2000.

1.11 PRODUCT - GENERAL

.1 Manufacturers

.1 All access control hardware and software shall be of a single manufacturer including server system, controllers, and input and output terminal modules. Server system shall be purchased directly from Johnson Controls or shall meet minimum server requirements (as outlined below), and shall be approved by Johnson Controls.

.2 Base bid shall be Johnson Controls, Inc. P2000 only. All alternate manufacturers seeking approval shall submit the following documentation to the Division Access Control and Intrusion Detection System Engineer for review prior to bid. The following information shall be submitted.

.1 Detailed bill of material for each piece of equipment submitted as equal to that specified.

.2 Manufacturer's catalog cut sheet for each proposed piece of equipment. The specification section, paragraph and sub-section shall be typed on the front page of the catalog cut sheet to aid in review. The exact model number proposed shall be highlighted if more than one version of the product is contained in the cut sheet.

.3 Line-by-line typewritten compliance/non-compliance statement, comparing each requirement of the specification against verifiable performance specifications of the proposed product(s). This compliance statement shall be signed by an executive officer of the proposing company.

1.12 HARDWARE REQUIREMENTS

.1 The minimum system server/workstation requirements shall be a standard name brand personal computer with sufficient capacity for the intended purpose. The server computer shall ship factory configured with all software pre-loaded and tested. All computer hardware replacement components shall be available from multiple third party sources. Unless otherwise approved by the manufacturer, the minimum configuration for the server shall be as defined below for a system capacity of five workstations, 128 Readers and 15,000 cards. One system PC/Printer will be provided at 700 Assiniboine, 1 system PC/Printer will be provided at the "PSB".

.1 Genuine Intel Pentium III CPU with a clock speed of 1 GHz or greater

.2 1 GB RAM (additional RAM required if P2000 options are included)

.3 3.5" floppy disk drive

.4 SCSI DAT drive - 4 GB minimum

.5 24X speed CD-ROM/DVD

.6 10 GB SCSI hard disk, 7200 RPM
.7 1024 x 768 resolution 64K color, video card with 4MB RAM
.8 17", flat screen, LCD
.9 Standard 101- type keyboard and optical mouse
.10 One network interface controller (10/100BaseT Network Controller port) or equivalent.

.2 System printers shall be provided in the quantities specified or as shown on the drawings. Printers shall be dot matrix, 180 characters per second, bi-directional printers.

.3 Controllers shall be Johnson Controls, Inc. CK721 v2.4+, CK720/CK705 v2.0+, S321 v1.0 or approved substitutes with the following functionality:
.1 The controller shall be a fully stand-alone processor capable of making all access control decisions without the involvement of the server computer based on a set of parameters passed to the controller from the server.
.2 The controller shall support up to sixteen (16) card readers in addition to either 256 input points or 128 input and 128 output points. It shall further support up to 12 facility codes per reader, 40 unique holidays, 32 access group and time zone pairs.
.3 Memory Requirements:
.1 Standard number of cards: 15,000 expandable to 200,000.
.2 Minimum number of historical transactions: 5,000 expandable to 50,000 at full card capacity.
.4 The controller shall require no firmware changes and shall use flash memory modules to provide non-volatile storage of both data and operational code.
.5 The CK7205 and CK705 controllers shall support the direct connection of a standard dot matrix printer for local transaction and report printing. The printer shall connect to the controller via a built-in serial (RJ45) port.
.6 Each controller shall be provided with built-in hardware to support hard-wired communications between the controller(s) and readers of up to 4000 feet.
.7 Communications between the controller(s) and the server shall be via Ethernet TC/IP at 10Mbps. CK720 and CK705 shall provide an alternate communications path to the server via a secondary IP address such that in the unlikely even the primary IP address/network is down an alternate communications path may be established. S321 controllers communicate via Ethernet connection using a third party device.
.8 An alarm summary relay shall be built-in to the CK7xx controller motherboard. If so programmed, the alarm relay shall be activated whenever a connected alarm point transfers to the alarm state and whenever soft alarms become active.
.9 A SPDT tamper switch shall be attached to the inner surface of the controller enclosure. The tamper switch shall change state whenever the enclosure door is opened to signal the SMS of the condition. The tamper switch input shall be user programmable to be suppressed, to be recognized as an input point, to be

processed by the alarm queue at the server computer, to printout at an optional printer connected directly to the controller (CK720 and CK705), and to activate the alarm summary relay described above.
.10 The controller shall include a battery module to back-up the controller's applications programs and database for 30 days after the failure of the primary AC power service. The controller database, the time clock, the transaction history, and all operator entered parameters shall be backed-up by the battery.
.11 If required elsewhere in the drawings or Specification, the controller(s) shall be furnished with an UPS battery configuration instead of a standard AC linear power supply configuration. The battery shall power the controller upon failure of the primary AC service for a minimum of one hour.
.12 While on UPS service, the controller shall continue to process event activity, card transactions, and record history transactions.
.13 The controller shall provide built-in LED to indicate whether the controller is properly communicating with the server computer.

.4 Alarm monitoring and Output Control terminal boards. Intelligent alarm monitoring and output control terminal boards shall be Johnson Controls, Inc. plug-in modules to CK7xx series controller with at least the following functionality:
.1 Sixteen two-state alarm input points.
.2 Eight four-state supervised alarm input points.
.3 Eight two-state alarm input points and eight SPDT output relays.
.4 Eight four-state supervised alarm input points and eight SPDT output relays.

1.13 CARDS AND CARD READERS

.1 General
.1 All readers shall be configured with the reader electronics mounted separately, on the "secure" side of the door such that only the reader head and pilot lights are mounted in the reader housing on the "entry" side of the door.
.2 Provide 2000 cards, proximity, photo ID type to be H.I.D. prox card II or approved equal.

.2 Wiegand Technology
.1 The reader housings shall be made of cast aluminum or molded plastic.
.2 The reader shall contain one green and one red built-in pilot light or LED to indicate valid and invalid card badging. A single LED that changes color from red to green is also acceptable.
.3 The reader shall be available in card only and card plus PIN pad versions. Furnish and install in the style and quantities as shown on the drawings.

.4 The readers shall be manufacturer-certified for an ambient operating environment of 32 to 115°F (0 to 46°C) and 10 to 90 % RH, non-condensing. For installations in environments below 32°F, a cold weather kit shall be installed in the reader to ensure normal operation. The kit shall consist of a heating element mounted inside the reader and a moisture seal gasket set to prevent moisture from entering the reader housing.
.5 The cards shall be constructed of top quality, highly durable and resilient PVC plastic or a PVC/Polyester composite material for use with Wiegand readers.
.6 Cards shall be manufacturer-encoded using the Wiegand pulse generating effect with a highly secure encryption algorithm. Each card shall be encoded with a facility code unique to the security system, an individual card number, and one of 255 issue level numbers.
.7 The encoded information shall be highly secure from alteration by external magnetic fields.
.8 Standard cards shall be available with a hot-stamped facility code and card number. The cards shall be available from the manufacturer without hot stamping, if requested by the Owner.
.9 Cards shall be ISO standard credit card size.
.10 Cards shall have the capability to be slot-punched at the top and equipped with a strap clip to attach the card to the user's clothing. NOTE: If using video badging, badges should be printed before punching slots.

.3 Magnetic Stripe Technology (Not used on this project)
.1 The reader housings shall be made of cast aluminum or molded plastic.
.2 The reader shall contain one green, and one red built-in lamp or LED to indicate valid and invalid card badging or a single multi-color LED.
.3 The reader shall be available as card only and card + PIN versions. The readers shall be furnished and installed in the style and quantities shown on the drawings.
.4 The readers shall be manufacturer-certified for an ambient operating environment of 32 to 115°F (0 to 46°C) and 10 to 90 % RH, non-condensing. For installations in environments below 32°F, a cold weather kit shall be installed in the reader to ensure normal operation. The kit shall consist of a heating element mounted inside the reader and a moisture seal gasket set to prevent moisture from entering the reader housing.
.5 The cards shall be constructed of top quality, durable, and resilient PVC plastic or a PVC/Polyester composite laminated with a magnetic stripe of high coercivity material (at least 2750 oersteds) designed for use with magnetic stripe readers.
.6 Each card shall be encoded with a facility code unique to the security system, an individual card number, and one of 255 issue level numbers.
.7 Provide Magtek MT-75 magnetic stripe card encoder or equivalent rated for 75 bpi.
.8 Standard cards shall be available permanently marked with the card number and reference code. The cards shall be available

from the manufacturer without the markings, if requested by the Owner.

.9 Cards shall be ISO 7810 standard credit card size.

.10 Cards shall have the capability to be slot-punched at one end and equipped with a strap clip to attach the card to the user's clothing. NOTE: If using video badging, badges should be printed before punching slots.

.4 Proximity Technology

.1 Furnish and install the reader style as called for in this Specification:

.1 Standard range Proximity 4000 reader (contact to 20 in.)

.2 The reader shall be integrated and contain all reader electronics inside a single polycarbonate enclosure.

.3 The reader shall operate when mounted on a variety of surfaces, including metal. Maximum read range degradation when mounted on a metal surface shall be 50-percent.

.4 The reader shall contain an integral color LED and audio tone to indicate if the card has been successfully read.

.5 The reader shall be 8" x 8" x 2" maximum.

.6 To be H.I.D. #6005B (Wigand) or approved equal.

.7 Read range shall be dependent on model selected.

.8 The reader shall be rated for normal operation from -5 to 150°F.

.9 The proximity card shall be encased in sealed plastic with a surface suitable to receive an adhesive backed photo ID or shall be capable of direct printing.

.2 Long Range Proximity Readers (Used for exterior Gate control)

.1 The reader shall be integrated and contain all reader electronics inside a single weatherproof polycarbonate enclosure.

.2 The reader shall operate when mounted on a variety of surfaces including metal. Maximum read range degradation when mounted on a metal surface shall be 50-percent.

.3 The reader shall contain an integral color LED and audio tone to indicate if the card has been successfully read.

.4 The reader shall be 12" x 12" x 2" maximum.

.5 Read range shall be a minimum of 20".

.6 The reader shall be rated for normal operation from -5 to 150°F. To be H.I.D. Maxi-Prox or approved equal.

.3 Mullion Style Proximity Readers (Not used on this project)

.1 The reader shall be integrated and contain all reader electronics inside a single polycarbonate enclosure.

.2 The reader shall operate when mounted on a variety of surfaces including metal. Maximum read range degradation when mounted on a metal surface shall be 50-percent.

.3 The reader shall contain an integral color LED and audio tone to indicate if the card has been successfully read.

.4 The reader shall be 1.7" x 6" maximum.

.5 Read range shall be up to 5".
.6 The reader shall be rated for normal operation from -5 to 150°F.
.7 The proximity card shall be encased in high impact sealed plastic with a surface suitable to receive an adhesive backed photo ID.

.4 Proximity Family Smart Card Readers (not used on this project)
.1 All electronics shall be integrated and contained inside a single polycarbonate enclosure.
.2 Reader shall operate when mounted on a variety of surfaces including metal. Maximum read range on metal shall be degraded to a point as specified by model selected.
.3 The reader shall contain an integral color LED and audio tone to indicate a successful read.
.4 Reader size shall be no greater than 6" x 6" x 3".
.5 Technology of read shall be Johnson Controls specific, 26 or 34-bit with site code, user level and badge number output in 2 wire Wiegand (D1/D0).
.6 Readers shall be personalized according to the controller type the data is sent.
.7 Readers shall comply with ISO 14443 A or B as specified by smart card use.
.8 Smart cards shall be dual use (insert or non-contact) containing at least an 8K microprocessor.

1.14 DELIVERY, STORAGE, AND HANDLING

.1 SMS components shall be shipped to the job-site in original manufacturer's shipping containers.

1.15 INSTALLATION REQUIREMENTS

.1 All consoles, terminals, and controllers shall be factory wired before shipment to the jobsite.

.2 Cabinet doors shall open a minimum of 170 degrees to avoid blocking personnel movement. Each door shall be equipped with a cylinder lock, a tamper switch and a piano-type hinge with welded tamperproof pins.

.3 Provisions shall be made for field wiring to enter the cabinet via standard knockouts at the top, bottom and sides of controller cabinets.

.4 Each wire shall be identified at both ends with the wire designation corresponding to the wire numbers shown on the wiring diagrams.

.5 All exposed wiring within the cabinets, consoles, and terminals shall be formed neatly with wires grouped in bundles using non-metallic, flame-resistant wiring cleats or wire ties.

.6 All ferrous metal Work shall be painted, in accordance with the manufacturer's standards.

1.16 TESTING AND COMMISSIONING

.1 The Contractor shall be responsible for testing and commissioning the installation in accordance with all applicable documents in the Contract set.
.1 Testing shall be comprehensive and sufficient to demonstrate compliance with each requirement.
.2 A proposed test plan shall be submitted to the Consultant at time of shop drawings for approval before commencement of final test.
.3 Final tests shall be conducted in the presence of the Owner's representative.

1.17 TRAINING AND INSTRUCTION

.1 Operator training shall consist of a two-day course conducted on-site by a factory trained professional instructor. Training conducted by unqualified personnel is unacceptable.

.2 Training materials shall consist of the following:
.1 Formal course outline and agenda.
.2 Operator training student guide for each student.
.3 Hands-on practice with online equipment.
.4 Written examinations.

.3 The training course shall be for at least two continuous business days.

.4 Additional video imaging training sessions shall be made available to the Owner if necessary.

1.18 WARRANTY

.1 All equipment furnished under this Contract shall be warranted for a period of twelve (12) months from the date of final Owner acceptance of the system.
.1 Respond to service requests on-site, if required, within 3 hours, 365 days/year.
.2 Replace or repair defective components as required.

1.19 SERVICE CONTRACT PROPOSAL

.1 The bidder shall include an optional service Contract proposal at the time of bid. The proposal shall include:

NOTE (Johnson Controls to deal directly with Owner for this item).

.1 Response to emergency service requests on-site, if required.
.2 Replace or repair defective components, as required.
.3 Manufacturer's recommended preventive maintenance.
.4 Two-year and five-year Maintenance Contract, with price, terms, and conditions shown for each year.
.5 The Service Contract shall be optional and the Owner shall have the right to accept or reject the Contract, and accept only the warranty service as described above, at no additional cost.

END

PART 1 - GENERAL

1.1 General

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

1.2 Related Work Specified Elsewhere

.1 Electrical General Requirements Section 16010

PART 2 - PRODUCTS

2.1 General

.1 Supply and install a closed circuit TV system with all conduit, wire, outlets, and equipment as shown on the drawings and as herein specified to provide a complete closed circuit TV system in the building.

2.2 System Overview and Functions

.1 The system shall consist of a series of interior CCTV cameras, exterior pan-tilt-zoom CCTV cameras, colour monitors, digital video recorder c/w all accessories for a closed circuit TV surveillance system.

.2 The system shall consist of the following components:
.1 Colour, solid state video cameras.
.2 Protective camera housing.
.3 Digital video recorder, 16 camera.
.4 Mini UPS APC # RS1500.
.5 Single 17" video monitors, 20" video monitors (flat screen).
.6 Term. cabinets c/w individual camera transformers.
.7 Wiring installed in a dedicated conduit system.

2.3 CCTV Cameras

.1 Fixed Type/Dome Cameras
.1 Cameras shall be Panasonic #WV-CW244 or approved equal.
.1 80mm (3-1/8") diameter compact colour dome camera for indoor use application.
.2 480-line horizontal resolution.
.3 Minimum illumination of 2.4 lx (0.24 fc).
.4 50dB signal to noise ratio.
.5 Built-in 2x variable-focal lens (3.8-8.0mm).
.6 Electronic shutter from 1/60 to 1/10,000 sec.

.7 Built-in aperture level (sharp/soft)correction.
.8 Advanced digital adaptive Back-Light Compensation (BLC) capability.
.9 Internal/Line-lock/VD2 synchronization (Line-lock: 24V AC operation only).
.10 Vertical drive (VD2) sync capability with Panasonic system products.
.11 Video monitor output jack for on the spot checking of the lens angle setting.
.12 Can be installed in existing electronic junction box.
.13 24V AC/12V DC compatible power source operation to suit the wide variety of applications.
.14 The 3-dimensional hinge (Pan, Tilt and Azimuth) allows the camera to be rotated as well as moved horizontally and vertically.

2.4 WEATHERPROOF AND VANDAL RESISTANT COLOUR DOME CAMERA

.1 To be Panasonic #WV-CW864A or approved equal.

.2 Pan/tilt/zoom.

.3 64 presets

.4 Zoom ratio X22, plus 10X digital.

2.5 CCTV Monitors (17")

.1 CCTV monitors shall be Panasonic #WV-LD1500 or approved equal.
.1 15" diagonal - Refer to Plans for Locations.
.2 640 x 480 VGA.
.3 3 channel video inputs (composite A/B or S-video).
.4 Built-in Panasonic security data link connector.
.5 1.5W speaker output.
.6 Rack mount adapter, 19" rack.
.7 120V, 73W.
.8 NTSC, PAL

2.6 CCTV Monitor Mounts

.1 CCTV monitor mounts to be Pelco #MR4050 c/w all options and accessories as required, or approved equal.
.1 Steel, black powder coat finish.
.2 150 lbs capacity.
.3 19" to 31" adjustable width.
.4 Mounting adapter.

2.7 Digital Disk Recorder (DVR)

.1 DVR to be Panasonic #WJ-HD316A or approved equal.
.1 General
.1 Power Source: 120V AC, 60 Hz.
.2 Power Consumption (approx.): 85W
.3 Ambient Operating Temperature: -10°C - +45°C (14°F - 113°F)
.4 Ambient Operating Humidity: Less than 90%
.5 Standard Hard Disk Drive Unit: 1 bay (160GB)
.6 Drive Bay for additional HDD Unit: 1 bay (160GB) (Provided)
.7 Dimensions (W x H x D): 420 x 88 x 350mm (16-9/16" x 3-7/16" x 13-3/4")
.8 Weight (approx.): 9.5 kg (20.9 lbs)
.2 Input/Output
.1 Video
.1 Video Input:
.1 1Vp-p/75 ohm, NTSC composite video signal with automatic termination/looping through, multiplexed control data, 8-input (1-8ch)*1 (BNC)
.2 1Vp-p/75 ohm, NTSC composite video signal with automatic termination/looping through, 8-input (9-16ch)*2 (BNC)
.2 Cascade Input: 1Vp-p/75 ohm (BNC)
.3 Video Output:
.1 1Vp-p/75 ohm, NTSC composite video signal/ active looping through, 8-input (1-8ch)*1 (BNC)
.2 1Vp-p/75 ohm, NTSC composite video signal with automatic termination/looping through, 8-input (9-16ch)*2 (BNC)
.4 Monitor Output: 1Vp-p/75 ohm, 2 terminals (BNC)
.5 Monitor Terminal (VGA): RGB output, 1 terminal (D-sub 15-pin)
.6 S Video Output: Y=1Vp-p/75 ohm, C=0.286Vp-p, 1 terminal (S terminal)
.7 Video Output (front panel): 1Vp-p/75 ohm, 1 terminal (Pin jack)
.2 Audio
.1 Audio Input: -10dB, 10K ohm, 4 terminals (Pin jack)
.2 Audio Output: -10dB, 600 ohm, unbalanced, 2 terminals (Pin jack)
.3 Others
.1 External Storage Terminal: High speed serial interface (approx. 480 Mbps), 1 terminal
.2 Copy Terminal: High speed serial interface (approx. 480 Mbps), 2 terminals
.3 Control Terminal: Emergency recording input, Disk end status output, HDD emergency output, camera emergency output, emergency output, power off output, time adjustment input/output, sequence select input/output, power inspection input, external storage unit recording mode select (D-sub, 25-pin)

.4 Alarm Connector: 1-8ch*3 alarm input, 9-16ch*4 alarm input 1-16ch*5 alarm output, alarm recover input, alarm suspend input, (D-sub, 25-pin)
.5 RS485 Port: RS485 (4line/2line), 2 terminals (RJ-11)
.6 Data: RS485, 2 terminals (RJ-11)
.7 Serial Port: RS232C, 1 terminal (D-sub, 9-pin)
.8 Network Interface Port: 10 Base-T/100Base-TX (RJ-45)

2.8 System Controllers

.1 The system controller shall be Panasonic #WV-CU650 or approved equal.
.1 The system controller enables the following functions:
.1 Camera selection
.2 Alarm (LED/Suspend/Recall/Reset)
.3 Setup menu

2.9 Power Supply

.1 To be Altronix #AL400/600 ULX c/w MOM5 or approved equal, circuit quantity as required, plus 10% spare.

.2 Power supply to be sized 150% on each branch to accomodate future expansion.

2.10 Equipment Rack

.1 Standard 19" rack c/w wire management on both sides. Refer to Detail

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 16010.

.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 16010.

.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 device backboxes to form part of the conduit system. Conduit to be sized to accommodate the wiring being installed.

3.6 Testing

.1 The complete system shall be tested in the presence of the Contract Administrator and the City of Winnipeg's representative on completion of the Work. Tests shall demonstrate that the CCTV System will function in an acceptable manner.

3.7 Installation

.1 Install equipment in accordance with manufacturer's instructions.

3.8 Tests

.1 Perform tests in accordance with Section 16010.

END

LUMINAIRE SCHEDULE

Project: **700 ASSINIBOINE PARK DRIVE**
Project Number: **05-015-01**

SMS ENGINEERING

FIXT. TYPE	LAMPS	VOLTAGE	DESCRIPTION	NOTES	APPROVED MANUFACTURERS
AA	2 T5 HO	120V	2x4 RECESSED DIRECT / INDIRECT C/W DIMMING BALLAST		ALTER: QVL2GPFSS255120BFDIMR
AX	2 T5 HO	120V	2x4 RECESSED DIRECT / INDIRECT TO MATCH TYPE AA, EXCEPT NO DIMMING BALLAST		ALTER: QVL2GPFSS255120B
AB	40W TT5	120V	SCONCE		ALTER: QVW8SPF0S2FT120SBR
BB	2 F32 T8	120V	RECESSED 2'x4' IN T-BAR CEILING C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS		C & M: 2GRS-232-FS12 CFI: AA2W8-VB LITHONIA: 2GT8232A12125 METALUX: 2GR8-232A.125 PEERLESS: LACH-24G-232-12.125
BC	3 F32 T8	120V	RECESSED 2'x4' IN T-BAR CEILING C/W CAM ACTION HINGED FRAMED .125" K12 ACRYLIC LENS		C & M: 2GRS-332-FS12 CFI: AA348-VB LITHONIA: 2GT8332A12125 METALUX: 2GR8-332A.125 PEERLESS: LACH-24G-332-12.125
DC	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
HB	2 F32 T8	120V	4' INDUSTRIAL C/W SOLID REFLECTOR AND TURRET SOCKETS SURFACE MOUNTED OR CHAIN SUSPENDED		C & M: ATIS-232 CFI: TU248-SD LITHONIA: IT232 METALUX: DCIM-232 PEERLESS: ITS-4-232
LA	1 F32 T8		1 LAMP STRIP SURFACE MOUNTED, CHAIN SUSPENDED OR MOUNTED IN VALANCE		C & M: STRIP N132 CFI: LITHONIA: S-132 METALUX: SN-132 PEERLESS: LS-4-132
LB	1 F25 T8		1 LAMP STRIP SURFACE MOUNTED, CHAIN SUSPENDED OR MOUNTED IN VALANCE		C & M: STRIP N125 CFI: SB-136 LITHONIA: S-125 METALUX: SN-125 PEERLESS: LS-3-125
NB	2 F32 T8	120V	OPAL LENS WRAPAROUND 2L C/W SPRING LOADED END CAPS WHITE IN COLOR. CEILING OR WALL MOUNTED		C & M: CUBE-L-232-W-O CFI: CSW 248 - Z0 YORK: DTW 248 METALUX: BC 232 PEERLESS: CNW-4-232
VJ	2-26W DTT	120V	RECESSED 2 LAMP FLUORESCENT POT LIGHT C/W CLEAR ALZAK REFLECTOR		GOTHAM: AF2/26DTT6AR120GEB10TRW
WA	1-26W DTT	120V	RECESSED 1 LAMP FLUORESCENT POT LIGHT C/W BLACK MULTIGROOVE DIE-CAST BAFFLE WHITE TRIM RING - 6½" Ø OPENING C/W DIMMING BALLAST		GOTHAM: AF1/26DTT6MB120DMHLTRW
WB	1-26W DTT	120V	RECESSED 1 LAMP FLUORESCENT POT LIGHT C/W CLEAR ALZAK REFLECTOR WHITE TRIM RING - 6¼" Ø OPENING		GOTHAM: AF1/26DTT6AR120GEB10TRW

LUMINAIRE SCHEDULE

Project: **700 ASSINIBOINE PARK DRIVE**
Project Number: **05-015-01**

SMS ENGINEERING

FIXT. TYPE	LAMPS	VOLTAGE	DESCRIPTION	NOTES	APPROVED MANUFACTURERS
WC	2-13W TT	120V	RECESSED 1 LAMP FLUORESCENT SHOWER LIGHT C/W DROPPED OPAL LENS		TEKNA: TEK40-E2
FL	250W MH Coated	120	ROOF MOUNTED FLOOD LIGHT CORROSION RESISTANT FINISH MOUNTING TO SUIT		LITHONIA: TFL250MRA2120CR
A8	2 T5 HO	120V	AIRCRAFT CABLE SUSPENDED INDIRECT FIXTURE WITH PERF. WHITE FINISH, 8' LONG.		LIGHTOLIER: L5C14B54-1-T5HOPERF
E-1	LED	120V	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
E-2	LED	120V	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

PANEL: **EB** LOCATION:
FED FROM: 6MD-EA LOCATION:

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
SEWAGE PUMPS			1	A	22			SEWAGE LIFT
		3P	2	B	23	3P		
			3	C	24			
SEWAGE PUMPS			4	A	25			SEWAGE LIFT
		3P	5	B	26	3P		
			6	C	27			
			7	A	28	15A		SPARE
			8	B	29	15A		SPARE
			9	C	30	15A		SPARE
			10	A	31	15A		SPARE
			11	B	32	15A	200	F-14
			12	C	33	15A	200	ELEVATOR ROOM PIT LIGHTS
			13	A	34	15A	100	ELEVATOR PIT
			14	B	35	15A	100	ELEVATOR MACHINE ROOM
			15	C	36	15A	500 2R	MTS ROOM
			16	A	37	15A	500 2R	MTS ROOM
			17	B	38	15A	250	P-1
			18	C	39	25A 2P	1248	CU-16
			19	A	40		1248	
			20	B	41	25A 2P	1248	CU-17
			21	C	42		1248	

VOLTAGE: **347/600VV,3Ø,4W**
CAPACITY: 225A
MOUNTING: SURFACE
REMARKS:

LOADS - PH.A 1848
PH.B 1798
PH.C 3196
TOTAL **6842**

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PANEL SCHEDULE EB

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **EC** LOCATION: ROOM 122

FED FROM: 2CDP-EA LOCATION: ROOM 115

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
CALL TAKERS FURNITURE 1R	1200	15A	1	A	22	15A	1200	SPCO FURNITURE 1R
CALL TAKERS FURNITURE 1R	1200	15A	2	B	23	15A	1200	SPCO FURNITURE 1R
CALL TAKERS FURNITURE 1R	1200	15A	3	C	24	15A	1200	DISPATCH FURNITURE 1R
CALL TAKERS FURNITURE 1R	1200	15A	4	A	25	15A	1200	DISPATCH FURNITURE 1R
CALL TAKERS FURNITURE 1R	1200	15A	5	B	26	15A	1200	DISPATCH FURNITURE 1R
CALL TAKERS FURNITURE 1R	1200	15A	6	C	27	15A	1200	DISPATCH FURNITURE 1R
CALL TAKERS FURNITURE 1R	1200	15A	7	A	28	15A	1200	911 CONSOLES FURNITURE 1R
CALL TAKERS FURNITURE 1R	1200	15A	8	B	29	15A	1200	911 CONSOLES FURNITURE 1R
CALL TAKERS FURNITURE 1R	1200	15A	9	C	30	15A	1200	1R DUTY INSPECTOR
CALL TAKERS FURNITURE 1R	1200	15A	10	A	31	15A	100	1R WIRING CLOSET 125
CALL TAKERS FURNITURE 1R	1200	15A	11	B	32	15A	100	1R WIRING CLOSET 125
CALL TAKERS FURNITURE 1R	1200	15A	12	C	33	15A		SPARE
AC-5	192	15A	13	A	34	15A		SPARE
AC-6	192	15A	14	B	35	15A		SPARE
AC-7	192	15A	15	C	36	20A	373	P-2
AC-8	120	15A	16	A	37	15A	150	3 FIRE/SMOKE DAMPER
AC-9	120	15A	17	B	38	15A	100	HOUSEKEEPING RECEPTACLE 1R RM. 126
AC-10	120	15A	18	C	39	15A	860	LIGHTING RM. 124, 125, 127
F7	820	20A	19	A	40	15A		LIGHTING RM. 122
TV RECEPTACLE RM. 122	500	15A	20	B	41	15A	1440	LIGHTING RM. 122
TV RECEPTACLE RM. 122	500	15A	21	C	42	15A	960	LIGHTING RM. 122

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 9782

CAPACITY: PH.B 10852

MOUNTING: SURFACE\FLUSH PH.C 11405

REMARKS: TOTAL **32039** NOT INCLUDING PART 2

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PANEL SCHEDULE EC

PROJECT: X

FILE: XX-XXX-XX

DATE: 07-Mar-06

PANEL: **EC**
FED FROM: 2CDP-EA

LOCATION: ROOM 122
LOCATION: ROOM 115

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
BASEBOARD HEATER RM. 127, 124	1000	15A 2P	43	A	64			
	1000		44	B	65			
BASEBOARD HEATER RM. 122	3000	40A 2P	45	C	66			
2#8	3000		46	A	67			
BASEBOARD HEATER RM. 122	3000	40A 2P	47	B	68			
2#8	3000		48	C	69			
BASEBOARD HEATER RM. 122	3000	40A 2P	49	A	70			
2#8	3000		50	B	71			
BASEBOARD HEATER RM. 122	3000	40A 2P	51	C	72			
2#8	3000		52	A	73			
BASEBOARD HEATER RM. 122	1000	15A 2P	53	B	74			
2#10	1000		54	C	75			
FRIDGE ROOM 127	400	15A	55	A	76			
OFFICE 124	200	15A	56	B	77			
OFFICE 124	200	15A	57	C	78			
SPARE		15A	58	A	79			
SPARE		15A	59	B	80			
ROOF LIGHTS	750	15A	60	C	81			
			61	A	82			
			62	B	83			
			63	C	84			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY:
MOUNTING: SURFACE\FLUSH
REMARKS:

LOADSTOTAL PH.A 10400 NOT INCLUDING PART1
TOTAL PH.B 8200 NOT INCLUDING PART1
TOTAL PH.C 10950 NOT INCLUDING PART1
TOTAL **61589** INCLUDING PART 1

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PANEL SCHEDULE EC

PROJECT: X
FILE: XX-XXX-XX
DATE: 07-Mar-06

PANEL: **ED**
FED FROM: 2CDP-EA

LOCATION: RM. 110
LOCATION: RM. 115

Designation		Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)		Designation
WFPS FURNITURE	1R	500	15A	1	A	31	15A	100	1R	SERVER OFFICE 109
WFPS FURNITURE	1R	500	15A	2	B	32	15A	100		SERVER OFFICE 109
WFPS FURNITURE	1R	500	15A	3	C	33	15A			SPARE
WFPS FURNITURE	1R	500	15A	4	A	34	30A 2P	2500		BASEBOARD HEATER 2#10
WFPS FURNITURE	1R	500	15A	5	B	35		2500		RM. 110
WFPS FURNITURE	1R	500	15A	6	C	36	15A	350		F-4
WFPS FURNITURE	1R	500	15A	7	A	37	15A	192		AC-14
WFPS FURNITURE	1R	500	15A	8	B	38	15A	192		AC-15
WFPS FURNITURE	1R	500	15A	9	C	39	15A	192		AC-16
BASEBOARD HEATER		750	15A 2P	10	A	40	15A	192		AC-17
RM. 109		750		11	B	41	15A	150		3 FIRE/SMOKE DAMPERS
BASEBOARD HEATER 2#8		3000	40A 2P	12	C	42	15A	150		3 FIRE/SMOKE DAMPERS
RM. 110		3000		13	A	43	20A 2P	500		BASEBOARD HEATER ROOM 108
BASEBOARD HEATER 2#10		2500	30A 2P	14	B	44		500		
RM. 110		2500		15	C	45				
BASEBOARD HEATER 2#10		2250	30A 2P	16	A	46				
RM. 110		2250		17	B	47				
BASEBOARD HEATER 2#10		2250	30A 2P	18	C	48				
RM. 110		2250		19	A	49				
TV RECEPTACLE RM. 110		500	15A	20	B	50				
TV RECEPTACLE RM. 110		500	15A	21	C	51				
LIGHTS RM. 110		480	15A	22	A	52				
LIGHTS RM. 110		480	15A	23	B	53				
LIGHTS RM. 110		480	15A	24	C	54				
LIGHTS RM. 110			15A	25	A	55				
LIGHTS RM. 108,109		538	15A	26	B	56				
LIGHTS RM. 107,106		189	15A	27	C	57				
SPARE			15A	28	A	58				
SPARE			15A	29	B	59				
SPARE			15A	30	C	60				

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: CUSTOM
REMARKS:

LOADS - PH.A 13714
PH.B 11960
PH.C 11111
TOTAL **36785**

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PANEL SCHEDULE ED

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **EF** LOCATION: RM. 132

FED FROM: 2CDP-EA LOCATION: RM. 115

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
LIGHTING			1	A	22	15A 2P		SPARE
LIGHTING RM. 132	950	15A	2	B	23			
LIGHTING RM. 131	960	15A	3	C	24	15A 2P		SPARE
LIGHTING RM. 130, 131		15A	4	A	25			
LIGHTING RM. 129	135	15A	5	B	26	15A 2P		SPARE
LIGHTING RM. 126	390	15A	6	C	27			
LIGHTING RM. 123/128	162	15A	7	A	28			
SPARE		15A	8	B	29			
SPARE		15A	9	C	30			
SPARE		15A	10	A	31			
SPARE		15A	11	B	32			
SPARE		15A	12	C	33			
SPARE		15A	13	A	34			
SPARE		15A	14	B	35			
SPARE		15A	15	C	36			
			16	A	37			
			17	B	38			
			18	C	39			
			19	A	40			
			20	B	41			
			21	C	42	15A	350	F-6

VOLTAGE: **120/208V,3Ø,4W**

CAPACITY: 225A

MOUNTING: CUSTOM

REMARKS:

LOADS - PH.A 162

PH.B 1085

PH.C 1700

TOTAL **2947**

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PANEL SCHEDULE EF

PROJECT: 700 ASSINIBOINE PARK DR.

FILE: 05-015-01

DATE: 07-Mar-06

PANEL: **EG (PART 1)** LOCATION: RM. 131
FED FROM: 2CDP-EA LOCATION: RM. 115

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
AC-11	192	15A	1	A	22	15A	20	LIGHTING RM. 105
AC-12	192	15A	2	B	23	15A	663	LIGHTING RM. 105
AC-13	192	15A	3	C	24	15A	620	LIGHTING RM. 103, 104
PLUS RECEPTACLE - RM. 104 1R	100	15A	4	A	25	15A	281	LIGHTING VESTIBULE 100-6, 100-7
TV RECEPTACLE - RM. 105 1R	400	15A	5	B	26	15A 2P	300	1R COUNTER RECEPTACLE
PLUS RECEPTACLE - RM. 103 1R	300	15A	6	C	27		300	1R
COUNTER RECEPTACLE	300	15A 2P	7	A	28	15A 2P	300	1R COUNTER RECEPTACLE
	300		8	B	29		300	1R
MICROWAVE 1 RECEPTACLE 1R	1000	15A	9	C	30	15A		1R COUNTER PLUG RM. 131
MICROWAVE 2 RECEPTACLE 1R	1000	15A	10	A	31			
COFFEE 1 RECEPTACLE 1R	600	15A	11	B	32	15A 2P	300	1R COUNTER RECEPTACLE
COFFEE 2 RECEPTACLE 1R	600	15A	12	C	33		300	1R
WATER COOLER RECEPTACLE 1R	200	15A	13	A	34	15A 2P	300	1R COUNTER RECEPTACLE
POP MACHINE RECEPTACLE 1R	800	15A	14	B	35		300	1R
FRIDGE 1 RECEPTACLE 2#10 1R	800	20A	15	C	36	15A 2P	300	1R COUNTER RECEPTACLE
FRIDGE 2 RECEPTACLE 2#10 1R	800	20A	16	A	37		300	1R
FRIDGE 3 RECEPTACLE 2#10 1R	800	20A	17	B	38	15A 2P	300	1R COUNTER RECEPTACLE
STOVE 3#6	4000	50A 2P	18	C	39		300	1R
	4000		19	A	40	15A	100	F-11
STOVE 3#6	4000	50A 2P	20	B	41	15A	100	2 FIRE/SMOKE DAMPERS
	4000		21	C	42	15A	150	3 FIRE/SMOKE DAMPERS

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY:
MOUNTING: SURFACE\FLUSH
REMARKS:

LOADS - PH.A 7893
PH.B 9355
PH.C 12862
TOTAL **30110** NOT INCLUDING PART 2

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PANEL SCHEDULE EG (PART 1)

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **EG (PART 2)** LOCATION: RM. 131
FED FROM: 2CDP-EA LOCATION: RM. 115

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
F-5	350	15A	43	A	64			
F-12	100	15A	44	B	65			
VEST. DOORS 100-6	300	15A	45	C	66			
TAPE STORAGE ROOM 130	1200		46	A	67			
TAPE STORAGE ROOM 130	1200		47	B	68			
TAPE ROOM RECEPTACLE ROOM 130	100		48	C	69			
UPS-A SHUNT TRIP	50		49	A	70			
UPS-A SHUNT TRIP	50		50	B	71			
BASEBOARD HEATER 2#8	2500	30A 2P	51	C	72			
RM. 131	2500		52	A	73			
BASEBOARD HEATER 2#8	2500	30A 2P	53	B	74			
RM. 131	2500		54	C	75			
BASEBOARD HEATER	500	15A 2P	55	A	76			
RM. 129	500		56	B	77			
BASEBOARD HEATER 2#10	750	15A 2P	57	C	78			
RM. 106	750		58	A	79			
BASEBOARD HEATER 2#10	1250	20A 2P	59	B	80			
RM. 103	1250		60	C	81			
			61	A	82			
			62	B	83			
			63	C	84			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY:
MOUNTING: SURFACE\FLUSH
REMARKS:

LOADS TOTAL PH.A 5350 NOT INCLUDING PART1
TOTAL PH.B 5600 NOT INCLUDING PART1
TOTAL PH.C 7400 NOT INCLUDING PART1
TOTAL **48460** INCLUDING PART 1

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PANEL SCHEDULE EG (PART 2)

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **EH (PART 1)** LOCATION: RM. 115

FED FROM: 2CDP-EA LOCATION: RM. 115

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
LIGHTING RM. 112	585	15A	1	A	22	15A	10	EXIT SIGNS
LIGHTING RM. 112, 113, 117, 119	276	15A	2	B	23	15A	390	LIGHTING RM. 115
LIGHTING RM. 113, 114	237	15A	3	C	24	15A	662	LIGHTING VESTIBULE 100-1, CORR 100-3
LIGHTING RM. 121	260	15A	4	A	25	15A	300	ELECTRICAL DOOR VEST. 111
LIGHTING RM. 119, 120	117	15A	5	B	26	15A	300	ELECTRICAL DOOR VEST. 111
LIGHTING RM. 118	65	15A	6	C	27			
COORIDOR 101/BATTERY PACKS		15A	7	A	28			
STAIRWELL LIGHTS 100-2		15A	8	B	29			
STAIRWELL LIGHTS 100-4		15A	9	C	30			
ACU-1 (DOOR CONTROL)	600	15A	10	A	31			
INTERCOM	600	15A	11	B	32			
SPARE		15A	12	C	33			
SPARE		15A	13	A	34			
SPARE		15A	14	B	35			
SPARE		15A	15	C	36			
SPARE		15A	16	A	37			
SPARE		15A	17	B	38			
SPARE		15A	18	C	39	15A	100	1R ELECTRICAL RM. 115 RECEPTACLE
PARKING LOT SECURITY GATE			19	A	40	15A	100	1R ELECTRICAL RM. 115 RECEPTACLE
		15A 3P	20	B	41	20A	820	F8
			21	C	42	15A	400	AUTO DOOR 100-1

VOLTAGE: **120/208V,3Ø,4W**

CAPACITY: 225A

MOUNTING: SURFACE

REMARKS:

LOADS - PH.A 1855

PH.B 2503

PH.C 1464

TOTAL **5822** NOT INCLUDING PART 2

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PANEL SCHEDULE EH (PART 1)

PROJECT: 700 ASSINIBOINE PARK DR.

FILE: 05-015-01

DATE: 07-Mar-06

PANEL: **EH (PART 2)** LOCATION: RM. 115

FED FROM: 2CDP-EA LOCATION: RM. 115

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
CU-1 (LEE TEMP)	150	15A	43	A	64	30A 2P	1830	CU-13
CU-2 (LEE TEMP)	150	15A	44	B	65		1830	
CU-3 (LEE TEMP)	150	15A	45	C	66	30A 2P	1830	CU-14
CU-4	1675	30A 2P	46	A	67		1830	
	1675		47	B	68	30A 2P	1830	CU-15
CU-5	1830	30A 2P	48	C	69		1830	
	1830		49	A	70	25A 2P		SPARE
CU-6	1830	30A 2P	50	B	71			
	1830		51	C	72	25A 2P		SPARE
CU-7	1830	30A 2P	52	A	73			
	1830		53	B	74	15A		SPARE
CU-8	1335	30A 2P	54	C	75	15A		SPARE
	1335		55	A	76	15A		SPARE
CU-9	1335	30A 2P	56	B	77	15A		SPARE
	1335		57	C	78	15A		SPARE
CU-10	1335	30A 2P	58	A	79	15A		SPARE
	1335		59	B	80	15A		SPARE
CU-11	1830	30A 2P	60	C	81	15A		SPARE
	1830		61	A	82	15A		SPARE
CU-12	1830	30A 2P	62	B	83	15A		SPARE
	1830		63	C	84	15A		SPARE

VOLTAGE: **120/208V,3Ø,4W**

CAPACITY: 225A

MOUNTING: SURFACE

REMARKS:

LOADS: TOTAL PH.A 13645 NOT INCLUDING PART1

TOTAL PH.B 13645 NOT INCLUDING PART1

TOTAL PH.C 13800 NOT INCLUDING PART1

TOTAL **46912** INCLUDING PART 1

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PANEL SCHEDULE EH (PART 2)

PROJECT: 700 ASSINIBOINE PARK DR.

FILE: 05-015-01

DATE: 07-Mar-06

PANEL: **EJ**
FED FROM: 2CDP-EA

LOCATION: RM. 201
LOCATION: RM. 115

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
BOARDROOM LIGHTS	480	15	1	A	22	15A		COUNTER RECEPTACLE
CORR 201 LIGHTS	240	15	2	B	23	15A		SPARE
TV RECEPTACLE RM. 202	400	15	3	C	24	15A		SPARE
FRIDGE RECEPTACLE RM. 202	800	15	4	A	25	15A		SPARE
TABLE RM. 202	300	15	5	B	26	15A		SPARE
TABLE RM. 202	300	15	6	C	27	15A		SPARE
RECEPTACLE RM. 202 2R	400	15	7	A	28	15A		SPARE
COUNTER RECEPTACLE RM. 202 1R	500	15	8	B	29	15A		SPARE
COUNTER RECEPTACLE RM. 202 1R	500	15	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: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: SURFACE
REMARKS:

LOADS - PH.A 1680
PH.B 1040
PH.C 1200
TOTAL **3920**

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PANEL SCHEDULE EJ

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **NA** LOCATION: RM. 131

FED FROM: 2CDP-A LOCATION: RM. 115

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
FLOOR RECEPTACLE RM. 131 1R	200	15A	1	A	22	15A	100	EEF4
FLOOR RECEPTACLE RM. 131 1R	200	15A	2	B	23	15A	100	EEF5
FLOOR RECEPTACLE RM. 131 1R	200	15A	3	C	24	15A	100	RECEPTACLE 100-6 1R
FLOOR RECEPTACLE RM. 131 1R	200	15A	4	A	25	15A	300	TV RECEPTACLE RM. 131 1R
FLOOR RECEPTACLE RM. 131 1R	200	15A	5	B	26	15A	300	PROJECTOR RECEPTACLE RM. 131 1R
FLOOR RECEPTACLE RM. 131 1R	200	15A	6	C	27			
HOUSEKEEPING RECEPTACLES RM. 131 2R	200	15A	7	A	28			
HOUSEKEEPING RECEPTACLES RM. 131 2R	200	15A	8	B	29			
SPARE		15A	9	C	30			
SPARE		15A	10	A	31			
SPARE		15A	11	B	32			
SPARE		15A	12	C	33			
SPARE		15A	13	A	34			
SPARE		15A	14	B	35	15A	100	1R COUNTER RECEPTACLE RM. 131
SPARE		15A	15	C	36	15A 2P	1050	ERC-1
SPARE		15A	16	A	37		1050	
SPARE		15A	17	B	38	20A 2P	1600	ERC-2
RECEPTACLES RM. 106 4R	400		18	C	39		1600	2#10
HOUSEKEEPING RECEPTACLES RM. 101, 103, 105 5R	300		19	A	40		1566	ERC-3
HOUSEKEEPING RECEPTACLES RM. 104 2R	200		20	B	41	20A 3P	1566	
HOUSEKEEPING RECEPTACLES RM. 132 2R	200		21	C	42		1566	

VOLTAGE: **120/208V,3Ø,4W**

CAPACITY: 225A

MOUNTING: SURFACE

REMARKS:

LOADS - PH.A 3916

PH.B 4466

PH.C 5316

TOTAL **13698**

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PANEL SCHEDULE NA

PROJECT: 700 ASSINIBOINE PARK DR.

FILE: 05-015-01

DATE: 07-Mar-06

PANEL: **NB**
FED FROM: 2CDP-A

LOCATION: RM. 122
LOCATION: RM. 115

Designation		Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)		Designation
HOUSEKEEPING RECEPTACLES RM. 123	3R	300	15A	1	A	22	15A	1200		SPCO DISPATCH
HOUSEKEEPING RECEPTACLE RM. 126	1R	100	15A	2	B	23	15A	1200		SPCO DISPATCH
HOUSEKEEPING RECEPTACLE RM. 125	1R	100	15A	3	C	24	15A	1200		RADIO DISPATCH
HOUSEKEEPING RECEPTACLES RM. 122	3R	300	15A	4	A	25	15A	1200		RADIO DISPATCH
HOUSEKEEPING RECEPTACLES RM. 122	3R	300	15A	5	B	26	15A	1200		RADIO DISPATCH
HOUSEKEEPING RECEPTACLES RM. 122	3R	300	15A	6	C	27	15A	1200		RADIO DISPATCH
RECEPTACLE ROOM 127	1R	100	15A	7	A	28	15A	1200		911 CONSOLE
SPARE			15A	8	B	29	15A	1200		911 CONSOLE
HOUSEKEEPING RECEPTACLES RM. 130	2R	200	15A	9	C	30	15A			DUTY INSPECTOR
HOUSEKEEPING RECEPTACLES RM. 129	4R	400	15A	10	A	31	15A	100		CALL TAKER CONSOLE ROOM 122
RECEPTACLE RM. 126	1R	100	15A	11	B	32	15A	100		CALL TAKER CONSOLE ROOM 122
CALL TAKER CONSOLE ROOM 122		100	15A	12	C	33	15A	200	1R	OFFICE 124
CALL TAKER CONSOLE ROOM 122		100	15A	13	A	34	15A	200	1R	OFFICE 124
CALL TAKER CONSOLE ROOM 122		100	15A	14	B	35	15A			SPARE
CALL TAKER CONSOLE ROOM 122		100	15A	15	C	36	15A			SPARE
CALL TAKER CONSOLE ROOM 122		100	15A	16	A	37	15A			SPARE
CALL TAKER CONSOLE ROOM 122		100	15A	17	B	38	15A	1200		TAPE STORAGE ROOM 130
CALL TAKER CONSOLE ROOM 122		100	15A	18	C	39	15A	1200		TAPE STORAGE ROOM 130
CALL TAKER CONSOLE ROOM 122		100	15A	19	A	40		3333		ERC-4
CALL TAKER CONSOLE ROOM 122		100	15A	20	B	41	40A 3P	3333		3#8
CALL TAKER CONSOLE ROOM 122		100	15A	21	C	42		3333		

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: CUSTOM
REMARKS:

LOADS - PH.A 8633
PH.B 9033
PH.C 8133
TOTAL **25799**

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PANEL SCHEDULE NB

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **NC** LOCATION: RM. 110

FED FROM: 2CDP-A LOCATION: RM. 115

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
FLOOR RECEPTACLE 1R	300	15A	1	A	22	15A	300	WALL RECEPTACLES 2R RM. 110
FLOOR RECEPTACLE 1R	300	15A	2	B	23	15A	300	WALL RECEPTACLES 2R RM. 110
FLOOR RECEPTACLE 1R	300	15A	3	C	24	15A	300	WALL RECEPTACLES 2R RM. 110
FLOOR RECEPTACLE 1R	300	15A	4	A	25	15A	150	WALL RECEPTACLES 1R RM. 110
FLOOR RECEPTACLE 1R	300	15A	5	B	26			
FLOOR RECEPTACLE 1R	300	15A	6	C	27			
FLOOR RECEPTACLE 1R	300	15A	7	A	28			
FLOOR RECEPTACLE 1R	300	15A	8	B	29			
FLOOR RECEPTACLE 1R	300	15A	9	C	30			
FLOOR RECEPTACLE 1R	300	15A	10	A	31			
SPARE		15A	11	B	32			
SPARE		15A	12	C	33			
SPARE		15A	13	A	34			
SPARE		15A	14	B	35			
SPARE		15A	15	C	36			
SPARE		15A	16	A	37			
SPARE		15A	17	B	38			
SPARE		15A	18	C	39			
SPARE		15A	19	A	40		2666	ERC-5
SPARE		15A	20	B	41	30A 3P	2666	3#10
SPARE		15A	21	C	42		2666	

VOLTAGE: **120/208V,3Ø,4W**

CAPACITY: 225A

MOUNTING: CUSTOM

REMARKS:

LOADS - PH.A 4316

PH.B 3866

PH.C 3866

TOTAL **12048**

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PANEL SCHEDULE NC

PROJECT: 700 ASSINIBOINE PARK DR.

FILE: 05-015-01

DATE: 07-Mar-06

PANEL: **ND** LOCATION: RM. 115

FED FROM: 2CDP-A LOCATION: RM. 115

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)		Designation
EEF3	100	15A	1	A	22	15A	200	2R	RECEPTACLES RM. 121
EEF2	100	15A	2	B	23	15A	300	3R	HOUSEKEEPING RECEPTACLES RM. 116, 118, 121
F2	405	20A	3	C	24	15A	100	1R	WASHROOM RECEPTACLE RM. 120
F3	320	15A	4	A	25	15A	100	1R	WASHROOM RECEPTACLE RM. 120
ERC-6	1700	30A	5	B	26	15A	200	2R	RECEPTACLES RM. 112
ERC-7	1000	15A	6	C	27	15A	200	2R	HOUSEKEEPING RECEPTACLES RM. 111, 112
	1000	2P	7	A	28	15A	100	1R	WASHROOM RECEPTACLE RM.113
BASEBOARD HEATER ROOM 120	500	15A	8	B	29	15A	100	1R	WASHROOM RECEPTACLE RM. 113
	500	2P	9	C	30	15A	100	1R	ELECTRICAL RECEPTACLE RM. 115
			10	A	31	15A	100	1R	ELECTRICAL RECEPTACLE RM. 115
			11	B	32	15A	100	2R	ELECTRICAL RECEPTACLES RM. 115
			12	C	33	15A			SPARE
			13	A	34	15A			SPARE
			14	B	35	15A			SPARE
			15	C	36	15A			SPARE
			16	A	37	15A			SPARE
			17	B	38	15A			SPARE
			18	C	39	15A			SPARE
			19	A	40	15A			SPARE
			20	B	41	15A			SPARE
			21	C	42	15A	300	3R	HOUSEKEEPING RECEPTACLES RM. 101

VOLTAGE: **120/208V,3Ø,4W**

CAPACITY: 225A

MOUNTING: SURFACE

REMARKS:

LOADS - PH.A 1920

PH.B 3000

PH.C 2605

TOTAL **7525**

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PANEL SCHEDULE ND

PROJECT: 700 ASSINIBOINE PARK DR.

FILE: 05-015-01

DATE: 07-Mar-06

PANEL: **NE** LOCATION: RM. 201

FED FROM: 2CDP-A LOCATION: RM. 115

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
BOARDROOM LIGHTS	243	15A	1	A	22	15A		F-13
CORR 201 LIGHTS	600	15A	2	B	23	15A		SPARE
OFFICE LIGHTS	948	15A	3	C	24	15A		SPARE
RECEPTACLES RM. 202 3R	600	15A	4	A	25	15A		SPARE
COUNTER RECEPTACLE RM. 202	200	15A	5	B	26	15A		SPARE
RECEPTACLES OFFICE 203 3R	600	15A	6	C	27	15A		SPARE
RECEPTACLES OFFICE 204 3R	600	15A	7	A	28	15A		SPARE
RECEPTACLES OFFICE 205 3R	600	15A	8	B	29	15A		SPARE
RECEPTACLES OFFICE 206 3R	600	15A	9	C	30	15A		SPARE
RECEPTACLES OFFICE 207 3R	600	15A	10	A	31			
RECEPTACLES OFFICE 209 3R	600	15A	11	B	32			
RECEPTACLES OFFICE 208 3R	600	15A	12	C	33			
RECEPTACLES CORR 201 3R	600	15A	13	A	34			
FAX RECEPTACLE 1R	500	15A	14	B	35			
PRINTER RECEPTACLE 1R	1000	15A	15	C	36			
COPIER RECEPTACLE 1R	1000	15A	16	A	37			
COUNTER RECEPTACLES 2R	200	15A	17	B	38			
FLOOR RECEPTACLE 3R	400	15A	18	C	39			
BUZZER		15A	19	A	40			
			20	B	41			
			21	C	42			

VOLTAGE: **120/208V,3Ø,4W**

CAPACITY: 225A

MOUNTING: SURFACE

REMARKS:

LOADS - PH.A 3643

PH.B 2700

PH.C 4148

TOTAL **10491**

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PANEL SCHEDULE NE

PROJECT: 700 ASSINIBOINE PARK DR.

FILE: 05-015-01

DATE: 07-Mar-06

PANEL: **NF**
FED FROM: TR-NF/6CDP-A

LOCATION: MECHANICAL ROOM
LOCATION: MECHANICAL ROOM

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
B-1	1000	20A 2P	1	A	22	20A 2P	1000	B-2
	1000		2	B	23		1000	
F-9	270	15A 2P	3	C	24	15A	250	P-5
	270		4	A	25	15A	250	P-6 (CONFIRM ON SITE)
UH-1	100	15A	5	B	26	15A		SPARE
UH-2	100	15A	6	C	27	15A		SPARE
UH-3	100	15A	7	A	28	15A		SPARE
UH-4	100	15A	8	B	29	15A		SPARE
CENTRAL VACUUM 3#10	2000	30A 2P	9	C	30	15A		SPARE
	2000		10	A	31	15A		SPARE
			11	B	32	15A		SPARE
			12	C	33	15A		SPARE
			13	A	34	15A		SPARE
			14	B	35	15A		SPARE
			15	C	36	15A		SPARE
			16	A	37	15A		SPARE
			17	B	38	20A		SPARE
			18	C	39	20A		SPARE
			19	A	40	15A 3P		SPARE
			20	B	41			
			21	C	42			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: SURFACE
REMARKS:

LOADS - PH.A 4620
PH.B 2200
PH.C 2620
TOTAL **9440**

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PANEL SCHEDULE NF

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **UA100** LOCATION: RM. 122
FED FROM: CDP-UPS-A LOCATION: RM. 104

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
CALL TAKERS	1200	15A	1	A	31	15A	1200	SPCO DISPATCH
CALL TAKERS	1200	15A	2	B	32	15A	1200	SPCO DISPATCH
CALL TAKERS	1200	15A	3	C	33	15A	1200	RADIO DISPATCH
CALL TAKERS	1200	15A	4	A	34	15A	1200	RADIO DISPATCH
CALL TAKERS	1200	15A	5	B	35	15A	1200	RADIO DISPATCH
CALL TAKERS	1200	15A	6	C	36	15A	1200	RADIO DISPATCH
CALL TAKERS	1200	15A	7	A	37	15A	1200	911 CONSOLES
CALL TAKERS	1200	15A	8	B	38	15A	1200	911 CONSOLES
CALL TAKERS	1200	15A	9	C	39	15A	1200	DUTY INSPECTOR
CALL TAKERS	1200	15A	10	A	40			
CALL TAKERS	1200	15A	11	B	41			
CALL TAKERS	1200	15A	12	C	42			
OFFICE 124 1R	200	15A	13	A	43			
OFFICE 124 1R	200	15A	14	B	44			
SPARE		15A	15	C	45	15A	1200	2R TELEPHONE BACKBOARD RECEPTACLE
SPARE		15A	16	A	46	20A	1600	WIRING CLOSET #125 RACK #4
SPARE		15A	17	B	47	20A	1600	WIRING CLOSET #125 RACK #4
SPARE		15A	18	C	48	20A	1600	WIRING CLOSET #125 RACK #4
SPARE		15A	19	A	49	20A	1600	WIRING CLOSET #125 RACK #5
SPARE		15A	20	B	50	20A	1600	WIRING CLOSET #125 RACK #5
SPARE		15A	21	C	51	20A	1600	WIRING CLOSET #125 RACK #5
SPARE		15A	22	A	52	20A	1600	WIRING CLOSET #125 RACK #1
			23	B	53	20A	1600	WIRING CLOSET #125 RACK #1
			24	C	54	20A	1600	WIRING CLOSET #125 RACK #1
			25	A	55	20A	1600	WIRING CLOSET #125 RACK #2
			26	B	56	20A	1600	WIRING CLOSET #125 RACK #2
			27	C	57	20A	1600	WIRING CLOSET #125 RACK #2
			28	A	58	20A	1600	WIRING CLOSET #125 RACK #3
			29	B	59	20A	1600	WIRING CLOSET #125 RACK #3
			30	C	60	20A	1600	WIRING CLOSET #125 RACK #3

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: CUSTOM
REMARKS:

LOADS - PH.A 16600
PH.B 16600
PH.C 17600
TOTAL **50800**

ALL BRANCH CIRCUITS ARE #10 AWG MINIMUM, 1 NEUTRAL PER CIRCUIT UNLESS NOTED OTHERWISE.

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PANEL SCHEDULE UA100

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **UB100** LOCATION: RM. 122
FED FROM: CDP-UPS-B LOCATION: RM. 104

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)		Designation
CALL TAKERS	1200	15A	1	A	31	15A	1200		SPCO DISPATCH
CALL TAKERS	1200	15A	2	B	32	15A	1200		SPCO DISPATCH
CALL TAKERS	1200	15A	3	C	33	15A	1200		RADIO DISPATCH
CALL TAKERS	1200	15A	4	A	34	15A	1200		RADIO DISPATCH
CALL TAKERS	1200	15A	5	B	35	15A	1200		RADIO DISPATCH
CALL TAKERS	1200	15A	6	C	36	15A	1200		RADIO DISPATCH
CALL TAKERS	1200	15A	7	A	37	15A	1200		911 CONSOLES
CALL TAKERS	1200	15A	8	B	38	15A	1200		911 CONSOLES
CALL TAKERS	1200	15A	9	C	39	20A	1200		DUTY INSPECTOR
CALL TAKERS	1200	15A	10	A	40	20A			SPARE
CALL TAKERS	1200	15A	11	B	41	20A			SPARE
CALL TAKERS	1200	15A	12	C	42	20A			SPARE
OFFICE 124 1R	200	15A	13	A	43	20A			SPARE
OFFICE 124 1R	200	15A	14	B	44	20A			SPARE
SPARE		15A	15	C	45	15A		2R	TELEPHONE BACKBOARD
SPARE		15A	16	A	46	20A	1600		WIRING CLOSET #125 RACK #4
SPARE		15A	17	B	47	20A	1600		WIRING CLOSET #125 RACK #4
SPARE		15A	18	C	48	20A	1600		WIRING CLOSET #125 RACK #4
SPARE		15A	19	A	49	20A	1600		WIRING CLOSET #125 RACK #5
SPARE		15A	20	B	50	20A	1600		WIRING CLOSET #125 RACK #5
SPARE		15A	21	C	51	20A	1600		WIRING CLOSET #125 RACK #5
SPACE			22	A	52	20A	1600		WIRING CLOSET #125 RACK #1
SPACE			23	B	53	20A	1600		WIRING CLOSET #125 RACK #1
SPACE			24	C	54	20A	1600		WIRING CLOSET #125 RACK #1
SPACE			25	A	55	20A	1600		WIRING CLOSET #125 RACK #2
SPACE			26	B	56	20A	1600		WIRING CLOSET #125 RACK #2
SPACE			27	C	57	20A	1600		WIRING CLOSET #125 RACK #2
SPACE			28	A	58	20A	1600		WIRING CLOSET #125 RACK #3
SPACE			29	B	59	20A	1600		WIRING CLOSET #125 RACK #3
SPACE			30	C	60	20A	1600		WIRING CLOSET #125 RACK #3

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: CUSTOM
REMARKS:

LOADS - PH.A 16600
PH.B 16600
PH.C 16400
TOTAL **49600**

ALL BRANCH CIRCUITS ARE #10 AWG MINIMUM, 1 NEUTRAL PER CIRCUIT UNLESS NOTED OTHERWISE.

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PANEL SCHEDULE UB100

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **UB200** LOCATION: RM. 110
FED FROM: CDP-UPS-B LOCATION: RM. 104

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
WFPS	1200	15A	1	A	31	15A	1200	SUPERVISOR RM. 108
WFPS	1200	15A	2	B	32			SPACE
WFPS	1200	15A	3	C	33			SPACE
WFPS	1200	15A	4	A	34			SPACE
WFPS	1200	15A	5	B	35			SPACE
WFPS	1200	15A	6	C	36			SPACE
WFPS	1200	15A	7	A	37			SPACE
WFPS	1200	15A	8	B	38			SPACE
WFPS	1200	15A	9	C	39			SPACE
WFPS	1200	15A	10	A	40			SPACE
SPARE		15A	11	B	41			SPACE
SPARE		15A	12	C	42			SPACE
SPARE		15A	13	A	43			SPACE
SPARE		15A	14	B	44			SPACE
SPARE		15A	15	C	45			SPACE
SPARE		15A	16	A	46			SPACE
SPARE		15A	17	B	47			SPACE
SPARE		15A	18	C	48			SPACE
SPARE		15A	19	A	49			SPACE
SPARE		15A	20	B	50			SPACE
SPARE		15A	21	C	51			SPACE
SPARE		20A	22	A	52	20A	1600	SERVER RM. 109 RACK #1
SPARE		20A	23	B	53	20A	1600	SERVER RM. 109 RACK #1
SPARE		20A	24	C	54	20A	1600	SERVER RM. 109 RACK #1
SPARE		20A	25	A	55	20A	1600	SERVER RM. 109 RACK #2
SPARE		20A	26	B	56	20A	1600	SERVER RM. 109 RACK #2
SPARE		20A	27	C	57	20A	1600	SERVER RM. 109 RACK #2
SPARE		20A	28	A	58	20A	1600	SERVER RM. 109 RACK #3
SPARE		20A	29	B	59	20A	1600	SERVER RM. 109 RACK #3
SPARE		20A	30	C	60	20A	1600	SERVER RM. 109 RACK #3

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: CUSTOM
REMARKS:

LOADS - PH.A 10800
PH.B 8400
PH.C 8400
TOTAL **27600**

ALL BRANCH CIRCUITS ARE #10 AWG MINIMUM, 1 NEUTRAL PER CIRCUIT UNLESS NOTED OTHERWISE.

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PANEL SCHEDULE UB200

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **UA200** LOCATION: RM. 110
FED FROM: CDP-UPS-A LOCATION: RM. 104

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
WFPS	1200	15A	1	A	31	15A	1200	SUPERVISOR RM. 108
WFPS	1200	15A	2	B	32			SPACE
WFPS	1200	15A	3	C	33			SPACE
WFPS	1200	15A	4	A	34			SPACE
WFPS	1200	15A	5	B	35			SPACE
WFPS	1200	15A	6	C	36			SPACE
WFPS	1200	15A	7	A	37			SPACE
WFPS	1200	15A	8	B	38			SPACE
WFPS	1200	15A	9	C	39			SPACE
WFPS	1200	15A	10	A	40			SPACE
SPARE		15A	11	B	41			SPACE
SPARE		15A	12	C	42			SPACE
SPARE		15A	13	A	43			SPACE
SPARE		15A	14	B	44			SPACE
SPARE		15A	15	C	45			SPACE
SPARE		15A	16	A	46			SPACE
SPARE		15A	17	B	47			SPACE
SPARE		15A	18	C	48			SPACE
SPARE		15A	19	A	49			SPACE
SPARE		15A	20	B	50			SPACE
SPARE		15A	21	C	51			SPACE
SPARE		20A	22	A	52	20A	1600	SERVER RM. 109 RACK #1
SPARE		20A	23	B	53	20A	1600	SERVER RM. 109 RACK #1
SPARE		20A	24	C	54	20A	1600	SERVER RM. 109 RACK #1
SPARE		20A	25	A	55	20A	1600	SERVER RM. 109 RACK #2
SPARE		20A	26	B	56	20A	1600	SERVER RM. 109 RACK #2
SPARE		20A	27	C	57	20A	1600	SERVER RM. 109 RACK #2
SPARE		20A	28	A	58	20A	1600	SERVER RM. 109 RACK #3
SPARE		20A	29	B	59	20A	1600	SERVER RM. 109 RACK #3
SPARE		20A	30	C	60	20A	1600	SERVER RM. 109 RACK #3

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: CUSTOM
REMARKS:

LOADS - PH.A 10800
PH.B 8400
PH.C 8400
TOTAL **27600**

ALL BRANCH CIRCUITS ARE #10 AWG MINIMUM, 1 NEUTRAL PER CIRCUIT UNLESS NOTED OTHERWISE.

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PANEL SCHEDULE UA200

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **UA300** LOCATION: RM. 132
FED FROM: CDP-UPS-A LOCATION: RM. 104

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
TAPE LIBRARY	1000	30A 2P	1	A	31		1500	TOWER RACKS
2#10	1000		2	B	32	20A 3P	1500	4#12
NETWORK RACKS	1000		3	C	33		1500	
4#12	1000	20A 3P	4	A	34		1500	TOWER RACKS
	1000		5	B	35	20A 3P	1500	4#12
NETWORK RACKS	1000	30A 2P	6	C	36		1500	
2#10	1000		7	A	37		1500	TOWER RACKS
5-6 RACK	1500		8	B	38	20A 3P	1500	4#12
4#12	1500	20A 3P	9	C	39		1500	
	1500		10	A	40		1500	TOWER RACKS
5-6 RACK	1500		11	B	41	20A 3P	1500	4#12
4#12	1500	20A 3P	12	C	42		1500	
	1500		13	A	43	30A 2P	1650	STORAGE TOWERS
TAPE LIBRARY	350		14	B	44		1650	2#10
	350	20A 3P	15	C	45	30A 2P	1650	STORAGE TOWERS
	350		16	A	46		1650	2#10
TAPE LIBRARY	350		17	B	47	30A 2P	1650	STORAGE TOWERS
	350	20A 3P	18	C	48		1650	2#10
	350		19	A	49	30A 2P	1650	STORAGE TOWERS
6 FOOT RACK	700		20	B	50		1650	2#10
	700	20A 3P	21	C	51	30A 2P	1650	STORAGE TOWERS
	700		22	A	52		1650	2#10
SPARE			23	B	53	30A 2P	1650	STORAGE TOWERS
		20A 3P	24	C	54		1650	2#10
			25	A	55	30A 2P	1650	STORAGE TOWERS
SPARE			26	B	56		1650	2#10
		20A 3P	27	C	57	30A 2P	1650	STORAGE TOWERS
			28	A	58		1650	2#10
SPARE		30A 2P	29	B	59	30A 2P		SPARE
			30	C	60			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: CUSTOM
REMARKS:

LOADS - PH.A 23300
PH.B 20650
PH.C 20650
TOTAL **64600** NOT INCLUDING PART 2

ALL BRANCH CIRCUITS ARE #10 AWG MINIMUM, 1 NEUTRAL PER CIRCUIT UNLESS NOTED OTHERWISE.

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PANEL SCHEDULE UA300

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **UA300** LOCATION: RM. 132
FED FROM: CDP-UPS-A LOCATION: RM. 104

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
TOWER RACK 4#12	600	20A 3P	61	A	91			
	600		62	B	92			
	600		63	C	93			
TOWER RACK 4#12	600	20A 3P	64	A	94			
	600		65	B	95			
	600		66	C	96			
TOWER RACK 4#12	600	20A 3P	67	A	97			
	600		68	B	98			
	600		69	C	99			
TOWER RACK 4#12	600	20A 3P	70	A	100			
	600		71	B	101			
	600		72	C	102			
TOWER RACK 4#12	600	20A 3P	73	A	103			
	600		74	B	104			
	600		75	C	105			
TOWER RACK 4#12	600	20A 3P	76	A	106			
	600		77	B	107			
	600		78	C	108			
TOWER RACK 4#12	600	20A 3P	79	A	109			
	600		80	B	110			
	600		81	C	111			
TOWER RACK 4#12	600	20A 3P	82	A	112			
	600		83	B	113			
	600		84	C	114			
5 FOOT RACK 4#12	600	20A 3P	85	A	115			
	600		86	B	116			
	600		87	C	117			
SPARE		20A 3P	88	A	118			
			89	B	119			
			90	C	120			

VOLTAGE: **120/208V,3Ø,4W** LOADS - PH.A 5400 NOT INCLUDING PART1
CAPACITY: 225A PH.B 5400 NOT INCLUDING PART1
MOUNTING: CUSTOM PH.C 5400 NOT INCLUDING PART1
REMARKS: TOTAL **80800** INCLUDING PART 1

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PANEL SCHEDULE UA300

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **UB300** LOCATION: RM. 132
FED FROM: CDP-UPS-B LOCATION: RM. 104

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
TAPE LIBRARY	1000	30A 2P	1	A	31	20A 3P	1500	TOWER RACKS
2#10	1000		2	B	32		1500	4#12
NETWORK RACKS	1000		3	C	33		1500	
4#12	1000	20A 3P	4	A	34		1500	TOWER RACKS
	1000		5	B	35	20A 3P	1500	4#12
NETWORK RACKS	1000	30A 2P	6	C	36		1500	
2#10	1000		7	A	37		1500	TOWER RACKS
5-6 RACK	1500		8	B	38	20A 3P	1500	4#12
4#12	1500	20A 3P	9	C	39		1500	
	1500		10	A	40		1500	TOWER RACKS
5-6 RACK	1500		11	B	41	20A 3P	1500	4#12
4#12	1500	20A 3P	12	C	42		1500	
	1500		13	A	43	30A 2P	1650	STORAGE TOWERS
TAPE LIBRARY	350		14	B	44		1650	2#10
	350	20A 3P	15	C	45	30A 2P	1650	STORAGE TOWERS
	350		16	A	46		1650	2#10
TAPE LIBRARY	350		17	B	47	30A 2P	1650	STORAGE TOWERS
	350	20A 3P	18	C	48		1650	2#10
	350		19	A	49	30A 2P	1650	STORAGE TOWERS
6 FOOT RACK	700		20	B	50		1650	2#10
	700	20A 3P	21	C	51	30A 2P	1650	STORAGE TOWERS
	700		22	A	52		1650	2#10
			23	B	53	30A 2P	1650	STORAGE TOWERS
			24	C	54		1650	2#10
			25	A	55	30A 2P	1650	STORAGE TOWERS
			26	B	56		1650	2#10
			27	C	57	30A 2P	1650	STORAGE TOWERS
			28	A	58		1650	2#10
			29	B	59			
			30	C	60			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: CUSTOM
REMARKS:

LOADS - PH.A 23300
PH.B 20650
PH.C 20650
TOTAL **64600** NOT INCLUDING PART 2

ALL BRANCH CIRCUITS ARE #10 AWG MINIMUM, 1 NEUTRAL PER CIRCUIT UNLESS NOTED OTHERWISE.

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PANEL SCHEDULE UB300

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **UB300** LOCATION: RM. 132
FED FROM: CDP-UPS-B LOCATION: RM. 104

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
TOWER RACK 4#12	600		61	A	91			
	600	20A 3P	62	B	92			
	600		63	C	93			
TOWER RACK 4#12	600		64	A	94			
	600	20A 3P	65	B	95			
	600		66	C	96			
TOWER RACK 4#12	600		67	A	97			
	600	20A 3P	68	B	98			
	600		69	C	99			
TOWER RACK 4#12	600		70	A	100			
	600	20A 3P	71	B	101			
	600		72	C	102			
TOWER RACK 4#12	600		73	A	103			
	600	20A 3P	74	B	104			
	600		75	C	105			
TOWER RACK 4#12	600		76	A	106			
	600	20A 3P	77	B	107			
	600		78	C	108			
TOWER RACK 4#12	600		79	A	109			
	600	20A 3P	80	B	110			
	600		81	C	111			
TOWER RACK 4#12	600		82	A	112			
	600	20A 3P	83	B	113			
	600		84	C	114			
5 FOOT RACK 4#12	600		85	A	115			
	600	20A 3P	86	B	116			
	600		87	C	117			
SPARE			88	A	118			
		20A 3P	89	B	119			
			90	C	120			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: CUSTOM
REMARKS:

LOADS - PH.A 5400 NOT INCLUDING PART1
PH.B 5400 NOT INCLUDING PART1
PH.C 5400 NOT INCLUDING PART1
TOTAL **80800** INCLUDING PART 1

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PANEL SCHEDULE
UB300

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **UA400** LOCATION: RM. 131
FED FROM: CDP-UPS-A LOCATION: RM. 104

Designation	Load (VA)	Ckt. Trip	bkr. No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
TRAINING DESK	1200	15A	1	A	31	15A		SPARE
TRAINING DESK	1200	15A	2	B	32	15A		SPARE
TRAINING DESK	1200	15A	3	C	33	15A		SPARE
TRAINING DESK	1200	15A	4	A	34	15A		SPARE
TRAINING DESK	1200	15A	5	B	35	15A		SPARE
TRAINING DESK	1200	15A	6	C	36	15A		SPARE
TRAINING DESK	1200	15A	7	A	37	15A		SPARE
TAPE STORAGE ROOM 130		15A	8	B	38	15A		SPARE
TAPE STORAGE ROOM 130		15A	9	C	39	15A		SPARE
			10	A	40	15A		SPARE
			11	B	41	15A		SPARE
			12	C	42			
			13	A	43			
			14	B	44			
			15	C	45			
			16	A	46			
			17	B	47			
			18	C	48			
			19	A	49			
			20	B	50			
			21	C	51			
			22	A	52			
			23	B	53			
			24	C	54			
			25	A	55			
			26	B	56			
			27	C	57			
			28	A	58			
			29	B	59			
			30	C	60			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: CUSTOM
REMARKS:

LOADS - PH.A 3600
PH.B 2400
PH.C 2400
TOTAL **8400**

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PANEL SCHEDULE UA400

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

PANEL: **UB400** LOCATION: RM. 131
FED FROM: CDP-UPS-B LOCATION: RM. 104

Designation	Load (VA)	Ckt. bkr. Trip	No.	Phase	Ckt. No.	bkr. Trip	Load (VA)	Designation
TRAINING DESK	1200	15A	1	A	31	15A		SPARE
TRAINING DESK	1200	15A	2	B	32	15A		SPARE
TRAINING DESK	1200	15A	3	C	33	15A		SPARE
TRAINING DESK	1200	15A	4	A	34	15A		SPARE
TRAINING DESK	1200	15A	5	B	35	15A		SPARE
TRAINING DESK	1200	15A	6	C	36	15A		SPARE
TRAINING DESK	1200	15A	7	A	37	15A		SPARE
TAPE STORAGE ROOM 130		15A	8	B	38	15A		SPARE
TAPE STORAGE ROOM 130		15A	9	C	39	15A		SPARE
			10	A	40	15A		SPARE
			11	B	41	15A		SPARE
			12	C	42			
			13	A	43			
			14	B	44			
			15	C	45			
			16	A	46			
			17	B	47			
			18	C	48			
			19	A	49			
			20	B	50			
			21	C	51			
			22	A	52			
			23	B	53			
			24	C	54			
			25	A	55			
			26	B	56			
			27	C	57			
			28	A	58			
			29	B	59			
			30	C	60			

VOLTAGE: **120/208V,3Ø,4W**
CAPACITY: 225A
MOUNTING: CUSTOM
REMARKS:

LOADS - PH.A 3600
PH.B 2400
PH.C 2400
TOTAL **8400**

ALL BRANCH CIRCUITS ARE #10 AWG MINIMUM, 1 NEUTRAL PER CIRCUIT UNLESS NOTED OTHERWISE.

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PANEL SCHEDULE UB400

PROJECT: 700 ASSINIBOINE PARK DR.
FILE: 05-015-01
DATE: 07-Mar-06

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
AC-1	AIR CONDITIONING UNIT	RM. 132	24.6 FLA	600V 3Ø					6MD-EA		3#8	PACKAGE UNIT 40A-3P INTERLOCK WITH CONDENSING UNIT
AC-2	AIR CONDITIONING UNIT	RM. 132	24.6 FLA	600V 3Ø					6MD-EA		3#8	PACKAGE UNIT 40A-3P INTERLOCK WITH CONDENSING UNIT
AC-3	AIR CONDITIONING UNIT	RM. 132	24.6 FLA	600V 3Ø					6MD-EA		3#8	PACKAGE UNIT 40A-3P INTERLOCK WITH CONDENSING UNIT
AC-4	OPEN NUMBER											
AC-5	AIR CONDITIONING UNIT	RM. 125	(.192)	120V					EC-13		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT
AC-6	AIR CONDITIONING UNIT	RM. 125	(.192)	120V					EC-14		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT
AC-7	AIR CONDITIONING UNIT	RM. 125	(.192)	120V					EC-15		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT
AC-8	AIR CONDITIONING UNIT	RM. 122	(.12)	120V					EC-16		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT
AC-9	AIR CONDITIONING UNIT	RM. 122	(.12)	120V					EC-17		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT
AC-10	AIR CONDITIONING UNIT	RM. 122	(.12)	120V					EC-18		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT
AC-11	AIR CONDITIONING UNIT	RM. 104	(.192)	120V					EG-1		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT
AC-12	AIR CONDITIONING UNIT	RM. 104	(.192)	120V					EG-2		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
AC-13	AIR CONDITIONING UNIT	RM. 104	(.192)	120V					EG-3		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT
AC-14	AIR CONDITIONING UNIT	RM. 109	(.192)	120V					ED-37		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT
AC-15	AIR CONDITIONING UNIT	RM. 109	(.192)	120V					ED-38		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT
AC-16	AIR CONDITIONING UNIT	RM. 110	(.192)	120V					ED-39		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT
AC-17	AIR CONDITIONING UNIT	RM. 110	(.192)	120V					ED-40		2#12	PACKAGE UNIT INTERLOCK WITH CONDENSING UNIT
B-1	BOILER	MECH. ROOM		208V 1Ø					NF-1,2		3#10	20A-2P BREAKER
B-2	BOILER	MECH. ROOM		208V 1Ø					NF-22,23		3#10	20A-2P BREAKER
AHU-1	AIR HANDLING UNIT	MECH. RM. 126	7.5	600V 3Ø		✓	✓	✓	6MD-EA	MECH. RM. 126	3#12	INTERLOCK WITH F-1 Shut down upon Fire Alarm
CU-1	CONDENSING UNIT	ROOF		600V 3Ø					6MD-EA EH-43 (120V)		3#12 2#10	WIRE LEE TEMP (120V), Provide WP disconnect

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
CU-2	CONDENSING UNIT	ROOF		600V 3Ø					6MD-EA EH-44 (120V)		3#12 2#10	WIRE LEE TEMP (120V), Provide WP disconnect
CU-3	CONDENSING UNIT	ROOF		600V 3Ø					6MD-EA EH-45 (120V)		3#12 2#10	WIRE LEE TEMP (120V), Provide WP disconnect
CU-4	CONDENSING UNIT	ROOF	(3.35)	208V 1Ø		✓	✓	✓	EH-46,47		2#10	CONTROLS BY DIVISION 15. 30A-2P
CU-5	CONDENSING UNIT	ROOF	(3.66)	208V 1Ø					EH-48,49		2#10	30A-2P
CU-6	CONDENSING UNIT	ROOF	(3.66)	208V 1Ø					EH-50,51		2#10	30A-2P
CU-7	CONDENSING UNIT	ROOF	(3.66)	208V 1Ø					EH-52,53		2#10	30A-2P
CU-8	CONDENSING UNIT	ROOF	(2.67)	208V 1Ø					EH-54,55		2#10	30A-2P
CU-9	CONDENSING UNIT	ROOF	(2.67)	208V 1Ø					EH-56,57		2#10	30A-2P
CU-10	CONDENSING UNIT	ROOF	(2.67)	208V 1Ø					EH-58,59		2#10	30A-2P
CU-11	CONDENSING UNIT	ROOF	(3.66)	208V 1Ø					EH-60,61		2#10	30A-2P
CU-12	CONDENSING UNIT	ROOF	(3.66)	208V 1Ø					EH-62,63		2#10	30A-2P
CU-13	CONDENSING UNIT	ROOF	(3.66)	208V 1Ø					EH-64,65		2#10	30A-2P

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
CU-14	CONDENSING UNIT	ROOF	(3.66)	208V 1Ø					EH-66,67		2#10	30A-2P
CU-15	CONDENSING UNIT	ROOF	(3.66)	208V 1Ø					EH-68,69		2#10	30A-2P
CU-16	CONDENSING UNIT	NORTHEAST CRAWLSPCE	12 AMP	208V 1Ø					EB-39, 40		2#10	25A-2P
CU-17	CONDENSING UNIT	NORTHEAST CRAWLSPCE	12 AMP	208V 1Ø					EB-41, 42		2#10	25A-2P
EHC-1	ELECTRIC HEATING COIL	CRAWLSPACE SOUTHEAST	(50)	600V 3Ø					6CDP-A		3#6	PROVIDE DISCONNECT AT UNIT. PACKAGED CONTROLS BY DIVISION 15. 70A-3P
ERC-1	ELECTRIC REHEAT COIL	RM. 103	(2.1)	208V 1Ø					NA-36, 37 15A-2P		2#12	PROVIDE DISCONNECT AT UNIT. SCR/CONTROLLER BY DIVISION 15.
ERC-2	ELECTRIC REHEAT COIL	RM. 105	(3.2)	208V 1Ø					NA-38, 39 30A-2P		2#10	PROVIDE DISCONNECT AT UNIT. SCR/CONTROLLER BY DIVISION 15.
ERC-3	ELECTRIC REHEAT COIL	RM. 131	(4.7)	208V 3Ø					NA-40, 41, 42 20A-3P		3#12	PROVIDE DISCONNECT AT UNIT. SCR/CONTROLLER BY DIVISION 15.
ERC-4	ELECTRIC REHEAT COIL	RM. 122	(10)	208V 3Ø					40A-3P NB-40,41,42		3#8	PROVIDE DISCONNECT AT UNIT. SCR/CONTROLLER BY DIVISION 15.
ERC-5	ELECTRIC REHEAT COIL	RM. 110	(8)	208V 3Ø					NC-40,41,42 30A-3P		3#10	PROVIDE DISCONNECT AT UNIT. SCR/CONTROLLER BY DIVISION 15.

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
ERC-6	ELECTRIC REHEAT COIL	RM. 121	(1.7)	120V					20A-1P ND-5		2#12	PROVIDE DISCONNECT AT UNIT. SCR/CONTROLLER BY DIVISION 15.
ERC-7	ELECTRIC REHEAT COIL	RM. 112	(2)	208V 1Ø					15A-2P ND-6,7		2#12	PROVIDE DISCONNECT AT UNIT. SCR/CONTROLLER BY DIVISION 15.
F-1	RETURN FAN	MECHANICAL RM. 126	5	600V 3Ø		✓	✓	✓	6MD-EA	RM. 126	3#12	INTERLOCK WITH AHU-1 Shut Down upon Fire Alarm
F-2	WASHROOM	RM. 113	(0.405)	120V	✓		✓		ND-3	RM. 118	2#12	
F-3	WASHROOM	RM. 119	(0.32)	120V	✓		✓		ND-4	RM. 118	2#12	
F-4	SMOKE EXHAUST	RM. 109	(0.35)	120V		✓	✓	✓	ED-36	RM. 109	2#12	START UPON ANY FIRST STAGE F.A. SIGNAL HOA @ FACP
F-5	SMOKE EXHAUST	RM. 105	(0.35)	120V		✓	✓	✓	EG-43	RM. 104	2#12	START UPON ANY FIRST STAGE F.A. SIGNAL HOA @ FACP
F-6	SMOKE EXHAUST	RM. 132	(0.35)	120V		✓	✓	✓	EF-42	RM. 132	2#12	START UPON ANY FIRST STAGE F.A. SIGNAL HOA @ FACP
F-7	SMOKE EXHAUST	RM. 122	(0.82)	120V		✓	✓	✓	EC-19	RM. 118	2#12	START UPON ANY FIRST STAGE F.A. SIGNAL HOA @ FACP
F-8	ELEC. ROOM VENTILATION	RM. 115	(0.82)	120V		✓	✓	✓	EH-41	RM. 115	2#12	DIVISION 16 TO WIRE TO THERMOSTAT
F-9	CRAWLSPACE VENTILATION	CRAWLSPACE	(0.55)	208V 1Ø		✓	✓	✓	NF-3,4	BASEMENT	2#12	

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
F-10	BASEMENT MECH. ROOM VENT.	MECH. ROOM	1	600V 3Ø		✓	✓	✓	6CDP-A	MECH. RM.	3#12	
F-11	LUNCH ROOM EXHAUST	RM. 105	(0.46)	120V	✓		✓		EG-40	LUNCH RM.	2#12	
F-12	LUNCH ROOM EXHAUST	RM. 105	(0.46)	120V	✓		✓		EG-44	LUNCH RM.	2#12	
F-13	CLOSET VENTILATION	RM. 201	FHP	120V	✓		✓		NE-13	RM. 201	2#12	
F-14	ELEVATOR MACHINE ROOM FAN	ELEV ROOM	FHP	120V	✓		✓		EB-32	Elev Room	2#12	
HWT-1	HOT WATER TANK	BASEMENT MECHANICAL RM.	(24)	600V 3Ø					6CDP-A		3#10	
HWT-2	HOT WATER TANK	BASEMENT MECHANICAL RM.	(24)	600V 3Ø					6CDP-A		3#10	
HWT-3	HOT WATER TANK	BASEMENT MECHANICAL RM.	(24)	600V 3Ø					6CDP-A		3#10	
P-1	EXCESS PRESS PUMP	MECH. ROOM	1/3	120V		✓	✓	✓	EB-38	MECH. RM.	2#12	Wire Pressure Switch
P-2	AIR COMPRESSOR	ROOM 126	1/2	120V		✓	✓	✓	EC-36	RM. 126	2#12	
P-3	HOT WATER CIRC. PUMP	MECH. ROOM	7.5	600V 3Ø		✓	✓	✓	6CDP-A	MECH. RM.	3#12	

MOTOR SCHEDULE

SMS ENGINEERING

MOTOR No.	NAME	LOCATION	H.P. (kW)	VOLTS	STARTER & ACC.				CIRCUIT	STARTER LOCATION	FEEDER	REMARKS
					MAN	MAG	PL	HOA				
P-4	HOT WATER CIRC. PUMP	MECH. ROOM	7.5	600V 3Ø		✓	✓	✓	6CDP-A	MECH. RM.	3#12	
P-5	RECIRC. PUMP	ROOM 126	0.25	120V	✓		✓		NF-24	RM. 126	2#12	
P-6	RECIRC. PUMP	MECH. ROOM	?	120V	✓		✓		NF-25	AT MOTOR	2#12	EXISTING PUMP RELOCATED CONFIRM BREAKER SIZE ON SITE
UH-1	NORTHWEST CRAWLSPACE HEATING	CRAWLSPACE	FHP	120V	✓		✓		NF-5	AT STAT SEE MECH.	2#12	WIRE THERMOSTAT
UH-2	NORTHEAST CRAWLSPACE HEATING	CRAWLSPACE	FHP	120V	✓		✓		NF-6	AT STAT SEE MECH.	2#12	WIRE THERMOSTAT
UH-3	SOUTHEAST CRAWLSPACE HEATING	CRAWLSPACE	FHP	120V	✓		✓		NF-7	AT STAT SEE MECH.	2#12	WIRE THERMOSTAT
UH-4	CRAWLSPACE HEATING	MECH. ROOM	FHP	120V	✓		✓		NF-8	AT STAT SEE MECH.	2#12	WIRE THERMOSTAT
HU-1	HUMIDIFIER	ROOM 126	17.2 KW	600V 3Ø					6MD-A		3#10	PACKAGE CONTROLS
P-9 (EXIST)	SEWAGE PUMP	SOUTH BASEMENT										REFEED EXISTING STARTER
P-10 (EXIST)	SEWAGE PUMP	SOUTH BASEMENT										REFEED EXISTING STARTER

HEATER SCHEDULE

Project: 700 ASSINIBOINE PARK DRIVE
Job Number: 05-015-01

SMS ENGINEERING

TYPE	WATTS	VOLTAGE	DESCRIPTION	NOTES	APPROVED MANUFACTURERS
CA	500	208V/1ø	SLOPE TOP TYPE CONVECTION HEATER IVORY COLOUR 647mm LONG		CHROMALOX: AS8F205 OUELLET: OPR0508 Q-MARK: ST02250201 STELPRO: CBB605-8
CC	1000	208V/1ø	SLOPE TOP TYPE CONVECTION HEATER IVORY COLOUR 1223mm LONG		CHROMALOX: AS8F410 OUELLET: OPR1008 Q-MARK: ST04250201 STELPRO: CBB-1210-8
CE	1500	208V/1ø	SLOPE TOP TYPE CONVECTION HEATER IVORY COLOUR 1835mm LONG		CHROMALOX: AS8F615 OUELLET: OPR1508 Q-MARK: ST06250201 STELPRO: CBB-1815-8
CF	1750	208V/1ø	SLOPE TOP TYPE CONVECTION HEATER IVORY COLOUR 2140mm LONG		CHROMALOX: AS8F717 OUELLET: OPR1758 Q-MARK: ST07250201 STELPRO: CBB-2117-8
CG	2000	208V/1ø	SLOPE TOP TYPE CONVECTION HEATER IVORY COLOUR 2400 mm LONG		CHROMALOX: AS8F820 OUELLET: OPR2008 Q-MARK: ST08250201 STELPRO: CBB-2420-8
CJ	2500	208V/1ø	SLOPE TOP TYPE CONVECTION HEATER IVORY COLOUR 3054 mm LONG		CHROMALOX: AS8F025 OUELLET: OPR2508 Q-MARK: ST10250201 STELPRO: CBB-2725-8
TA		240V/1ø	BUILT-IN THERMOSTAT 2-POLE BI-METAL SWITCH RATED @ 17A		CHROMALOX: BLTD OUELLET: F-TB2 Q-MARK: TA2ANWRC STELPRO: N2T1
TC			CONNECT TO ADJACENT CONTROLLED HEATER		
TD		240V/1ø	WALL MOUNTED LINE VOLTAGE THERMOSTAT 2-POLE RATED @ 16A		CHROMALOX: TD902 OUELLET: T-498B Q-MARK: T498B STELPRO: RJ32B2
TE			WALL MOUNTED LOW VOLTAGE THERMOSTAT TO CONTROL HEATER C/W L.V. RELAY & TRANSFORMER		CHROMALOX: T86A/BL-LVC OUELLET: T86A/R841C Q-MARK: T86A/LTR-1 STELPRO: T86A/R-841C
TF			LOW VOLTAGE RELAY BUILT INTO HEATER C/W AUXILIARY CONTROL BY DIV. 15		CHROMALOX: BL-LVD OUELLET: R841D Q-MARK: QMKRSA STELPRO: R-841D

C.C.T.V. SECURITY SCHEDULE

SMS ENGINEERING

I.D. NO.	LOCATION	FIXED	PAN/TILT/ ZOOM	HOUSING TYPE	LENS DESCRIPTION	DOOR INTERCOM	DOOR MONITOR	REMARKS
1	EXTERIOR SW CORNER		✓	EXTERIOR WP DOME				
2	EXTERIOR SE CORNER		✓	EXTERIOR WP DOME				
3	EXTERIOR WEST FACE		✓	EXTERIOR WP DOME				
4	EXTERIOR EAST FACE		✓	EXTERIOR WP DOME				
5	EXTERIOR NE CORNER		✓	EXTERIOR WP DOME		✓		INTERCOM AT GATE SELECTS CAMERA
6	EXTERIOR NW CORNER		✓	EXTERIOR WP DOME				
7	INTERIOR VEST. 100-6	✓		DOME				
8	INTERIOR CORR. 100-5	✓		DOME				
9	INTERIOR VEST 100-3	✓		Dome				

:urity Schedule

:SINIBOINE PARK DRIVE

ɹmber: 05-015-01

SMS ENGINEERING

Door	Intercom	Access Control\Monitoring	Card Reader	Local Key Switch	Mag Lock	Elect. Strike	Elect Retract	Request for Exit			Elect Release Hold Open	Auto Door Equipment				Interlock Pushbutton	Notes
								Exit Device	Exit Button(REX)	Exit Detector		Auto Operator	Push Button	Motion Detector	Door Position Monitor		
100-1-B			••		••					•					••		
100-1-A												•		•	••		
100-3-A			•		••					•					••		
100-5-A			••			•				•					•		
100-6-A												•		•	•		
100-6-B			•			•				•		•		•	•		CONNECT/ INTERLOCK AUTO DOOR DOOR TO CARD ACCESS SYSTEM
102-A			•			•				•					•		
104-A			•			•				•					•		
105-A			•			•				•					•		
107-A			•			•				•					•		
109-A			•			•				•					•		
110-A			•			•				•					•		

:urity Schedule

:SINIBOINE PARK DRIVE

ɹmber: 05-015-01

SMS ENGINEERING

Door	Intercom	Access Control\Monitoring	Card Reader	Local Key Switch	Mag Lock	Elect. Strike	Elect Retract	Request for Exit			Elect Release Hold Open	Auto Door Equipment			Door Position Monitor	Interlock Pushbutton	Notes
								Exit Device	Exit Button(REX)	Exit Detector		Auto Operator	Push Button	Motion Detector			
115-A			•			•				•					•		
122-A			•			•				•					•		
125-A			•			•				•					•		
126-A			•			•				•					•		
128-A			•			•				•					•		
130-A			•			•				•					•		
132-A			•			•				•					•		
201-A			•			•				•					•		
201-B			•			•				•					•		

Door Security Schedule Notes

Project:
Job Number:

SMS ENGINEERING

1. Auto Door Push Button also serves as "request-to-exit" function for Access Control/Monitor System.
2. Auto Door Motion Detector serves as timing device to hold doors open until doorway is clear.
3. Card Reader also serves to initiate Auto Door opening sequence.
4. LBM in electric strike serves as "request-to-exit" function for Access Control/Monitor System.
5. Anteroom doors are interlocked c/w pushbutton to disconnect interlock function, timable up to 5 minutes.
6. Remote door release button(s) by Access Control/Monitor System supplier.
7. Key switch to control mag lock.
8. Auto Door Push Button mounted on Patient Service Column.
9. Auto Door Push Button and/or Card Reader mounted on HSS post – refer to Details DA103 and DA104.
10. Auto Doors/Sliders are interlocked so that motion detector on outside and push button or motion detector on inside open both sets of doors/sliders in sequence in respective directions. Push buttons inside vestibule open respective doors/sliders only.
11. Auto Door motion detector also serves as "request-to-exit" function for Access Control/Monitor System.
12. Remote door release button by Intercom Supplier.
13. Remote door release button deactivates lock on first door and after timed delay activates Auto Door operators on second door.
14. Remote control by Access Control/Monitoring System disables exterior motion detector, locks exterior pair of sliders to access from exterior, keeps interior push buttons and sequencing of operation of sliders active.
15. Two push buttons on corridor side to operate auto operator.
16. On secure mode, push button is deactivated.
17. Door normally locked, but releases on fire alarm.
18. Key switch shunts alarm.
19. Power for door wired from card access system DGP at 24 volt D.C.
20. Magnetic door hold opens to be released by Access Control System to allow pre-programmed locking of doors

Project:
Project No.

This Guide to be read in conjunction with Door Security Schedule

Door	Security Operation Type	Intercom	Access Control\Monitoring	Card Reader	Local Key Switch	Mag. Lock	Elect. Strike	Elect. Retract	Request for Exit (Also Refer to Intercom Column)			Auto Door Equipment				
									Exit Device	Exit Button. REX	Exit Detector	Elect. Release Hold Open	Auto Operator	Push Button	Motion Detector	Door Position Monitor	Interlock Push Button
Identifies related door number as noted on arch. floor plans and door hardware schedule																	
	Security Operation Types as defined by Architect. There is no specific reference to door types in the electrical specifications. The specific operation of each door is to be determined by the architectal specifications ELECTRONIC DOOR HARDWARE SCHEDULE c																
		Div. 16	Denotes Ring Security Door Intercom by Division 16. Some intercom stations are specified with programmed buttons for unlocking doors. Related doors are to be unlocked and the Access Control Monitoring System shall see this as legitimate request to exitle													
				Div. 16	Denotes Access Control of door and monitoring by Honeywell System. Note that on certain doors the door is monitored only and locking and unlocking is done manually at door												
					Div. 16	Denotes Card Readers by Honeywell											
						Section 08710	Key switches by hardware supplier. In most cases used to unlock, release magnetic door locking. At some doors key switches are used as a request to exit. Key switches would be with set of contacts for Honeywell monitoring										
							Section 08710	Magnetic door locks by hardware supplier.									
								Section 08710	Electric door strikes by hardware supplier								
									Section 08710	These are electrically operated latches into header and floor at doors by door hardware supplier. Require 120 volt and must have power taken away on fire alarm. Electric latch retraction is used in few cases to lock door (e.g. JL-100A..rational..both pair							
										Section 08710	Exit device In most cases refers to door panic hardware. The request to exit function to let security know that a legitimate exit is taking place from the secure side of the door. Request to exit function is done through a set of contacts supplied with pa						
											Div. 16	This is the request to exit button by Honeywell. See spec. section 16727. The request to exit button is wired to let security know that a legitimate exit is taking place from the secure side of the door.					
												Div. 16	Exit detector is infra red motion sensor supplied and installed by Honeywell in lieu of a request to exit (REX) button. Use Kantech model no. T-REX-XL. The exit detector is wired to let security know that a legitimate exit is taking place from the secure					
													Section 08710	Magnetic door hold open by hardware supplier. Must release on fire alarm			
														Section 08710	Auto door operator by hardware supplier		
															Section 08710	Door push button by hardware supplier	
																Section 08710	Motion detector by hardware supplier
																	Div. 16	In most cases this will be magnetic door sensing contacts in header of door by Honeywell
																		Section 08710	In most cases this is the interlock on say, ante room doors to have first door close prior to second one opening

FIRE ALARM ZONE SCHEDULE

Project: 700 ASSINIBOINE PARK DRIVE
Job Number: 05-015-01

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ZONE No.	AUTOMATIC ZONES	LOCATION	NOTES
TS-1	TAMPER SWITCH - BASEMENT	BOILER ROOM	
TS-2	TAMPER SWITCH - BASEMENT	BASEMENT	
TS-3	TAMPER SWITCH - MAIN FLOOR	MAIN FLOOR	
TS-4	TAMPER SWITCH - MAIN FLOOR	RM. 126	
TS-5	TAMPER SWITCH - MAIN FLOOR	MAIN FLOOR	
TS-6	TAMPER SWITCH - SECOND FLOOR	2ND FLOOR	
TS-7	TAMPER SWITCH - THIRD FLOOR	3RD FLOOR	
FS-1	FLOW SWITCH - BASEMENT	BOILER ROOM	
FS-2	FLOW SWITCH - BASEMENT	BASEMENT	
FS-3	FLOW SWITCH - MAIN FLOOR	RM. 126	
FS-4	FLOW SWITCH - MAIN FLOOR SOUTH WING	MAIN FLOOR	
FS-5	FLOW SWITCH - SECOND FLOOR	2ND FLOOR	
FS-6	FLOW SWITCH - THIRD FLOOR SOUTH WING	3RD FLOOR	
SV-1	SOLENOID VALVE	RM. 126	
PS-1	PRESSURE SWITCH	RM. 126	

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CONSTRUCTION OF AN ALTERNATE EMERGENCY COMMUNICATION CENTRE

700 ASSINIBOINE PARK DRIVE, WINNIPEG

Drawn By	Approved By	Reference
AA	CB	0
File No.	Setup Date	Detail Sheet
05-015-01	JAN 2006	ED-1

Inspection Certificate

THIS CERTIFIES THAT THE FIRE ALARM SYSTEM INSTALLED AT:

Parks and Recreation Offices, 700 Assiniboine Park Drive, Winnipeg, Manitoba

WAS INSPECTED AND TESTED ON November 22, 2004 BY A QUALIFIED TECHNICIAN IN ACCORDANCE WITH ULC-S536-M97.

Issued November 26, 2004

Expires October 31, 2005

FIRE PROTECTION PLUS

MEMBER

Authorized Signature

Please see report for details of inspection

FIRE ALARM SYSTEM ANNUAL TEST AND INSPECTION REPORT

Building Name	Building Address		Person Contacted	Date
Parks & Recreation	700 Assiniboine Park Dr., Winnipeg, Mb.		Mr. Jack Halstead	November 22, 2004
System Manufacturer	Model number	Single Stage	Two Stage	
Edwards	6616	Yes		

TEST RESULTS: (Every line must have the appropriate marking in the space provided.)

1. *The Fire Alarm System functioned correctly under General Alarm condition.* — YES X — NO

2. *Location of the electrically furthest manual stations with main AC power off.*
   1. 2nd Floor by Room 207
   2. 3rd Floor by Centre Stair
   3. 3rd Floor by South Stair
   4. 2nd Floor by Centre Stair
   5. 2nd Floor by South Stair
   6. 2nd Floor by North Stair

   The Fire Alarm functioned correctly during the above test. — YES X — NO

3. *Each manual alarm-initiating device has been individually tested.* — YES X — NO
   Number of devices 16

4. *Each automatic alarm-initiating device has been tested.* — YES X — NO
   Number of devices 103

5. *Each audible and visual signalling device has been tested.* — YES X — NO
   Number of devices 19

6. *Correct annunciation has been confirmed for each device tested.* — YES X — NO

SUMMARY

1. *The Fire Alarm System is now fully functional.* — YES X — NO

2. *The Fire Alarm System has minor deficiencies noted on report.* — YES _ — NO X

3. *The Fire Alarm System has major deficiencies noted on report.* — YES _ — NO X

4. *A copy of this report has been given to the owner or owner's representative.* — YES X — NO
   Owners Representative Mr. Jack Halstead

THIS IS TO CERTIFY THAT THE FIRE ALARM SYSTEM HAS BEEN TESTED IN ACCORDANCE WITH SECTION 5, PERIODIC INSPECTIONS AND TESTS, OF CAN/ULC-S536-M97 AND THESE RECORDS DOCUMENT THE RESULTS OF TESTING PERFORMED.

SIGNATURE OF TECHNICIAN: ***FIRE PROTECTION PLUS PH. 204-888-1922***

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CONSTRUCTION OF AN ALTERNATE EMERGENCY COMMUNICATION CENTRE

700 ASSINIBOINE PARK DRIVE, WINNIPEG

Drawn By	Approved By	Reference
AA	CB	0
File No.	Setup Date	Detail Sheet
05-015-01	JAN 2006	ED-2

TECHNICIANS PRE-TEST CHECKLIST

1. *Has building management been alerted that the fire alarm system is being tested and that alternate measures under the Fire Safety Plan should be implemented?* YES X NO

2. *Has an alternative plan been established to alert occupants and the local fire department should an actual fire condition occur during testing?* YES X NO

3. *Has the remote central station been contacted regarding fire alarm testing?* YES X NO

NAME OF PERSON CONTACTED AT THE CENTRAL STATION: City of Winnipeg (986-2382)
TITLE: Dispatcher

TIME IN: 8:30 am *DATE:* November 22, 2004
TIME OUT: 2:00 pm

*TIME IN:*_____ *DATE:*
TIME OUT:

*TIME IN:*_____ *DATE:*
TIME OUT:

*TIME IN:*_____ *DATE:*
TIME OUT:

4. *Are there any ancillary functions that can impair building functions such as elevator capture, fan shutdown, door holders, etc.?* YES X NO
Can these be disabled and tested by groups? YES X NO

5. *Have the building occupants been made aware of fire alarm testing?* YES X NO

6. *Has a pre-determined time been made for testing of signalling devices?* YES X NO

7. *Have provisions been made for acquiring access to the secured areas?* YES X NO

8. *Are spare reset and panel keys available?* YES X NO

DEVICE LEGEND

DEVICE	DESCRIPTION	MODEL NO.	DEVICE	DESCRIPTION	MODEL NO.
M	manual pull station	270-SPO	F.S.	flow switch	
HT	fixed temp. heat detector	CF200, CF135	T.S.	tamper switch	
RHT	rate of rise heat detector	CR135	B	Bell	6100D, 439D
S	smoke detector	6249C	H	Horn	
I.S.A.	interconnected smoke alarm		M.H.	mini horn	
bat. S.A.	battery smoke alarm		C	Chime	
D.S.	duct smoke detector	6250C-100	V	visual alarm appliance	
ET	emergency telephone		SP	Speaker	
AD	ancillary devices		HSP	horn speaker	

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CONSTRUCTION OF AN ALTERNATE EMERGENCY COMMUNICATION CENTRE

700 ASSINIBOINE PARK DRIVE, WINNIPEG

Drawn By	Approved By	Reference
AA	CB	0
File No.	Setup Date	Detail Sheet
05-015-01	JAN 2006	ED-3

CONTROL EQUIPMENT TEST RECORD

Every line must have the appropriate marking in the space provided:

Y YES	N NO	n/a Not Applicable
tested correctly	did not test correctly	not provided on this fire alarm system

CONTROL PANEL TESTS

Power-on indicator	Y
Common Visual Trouble Signal	Y
Common Audible Trouble Signal	Y
Trouble Signal Silence Switch	Y
Main Power Supply Failure Trouble Signal	Y
Ground Detection Trouble (+ve & -ve)	Y
Alert Signal Operation	N/A
Alarm Signal Operation	Y
Automatic Transfer From Alert Signal to Alarm Signal	N/A
Acknowledge Switch Operation	N/A
Alarm Signal Silence Inhibit	Y
Alarm Signal Silence Operation	Y
Alarm Signal Silence Visual Indication	Y
Alarm Signal Silence Subsequent Alarm	Y
Alarm Signal Silence Automatic cut-out Timer	N/A
Input Circuit, Alarm & Supervisory Operation	Y
Input Circuit Trouble Operation	Y
Output Circuit Alarm Operation	Y
Output Circuit Trouble Operation	Y
Coded Signal Sequences Confirmed	N/A
Coded Signal Sequences are not Interrupted by Subsequent Alarm	N/A
Input to Output Circuit Operation Confirmed (including Ancillary Devices)	Y
Lamp Test	Y
Reset Operation	Y
Main Power Supply Transfer to Emergency Power	Y
Data Communication Link Supervision and Operation	N/A
Control Unit Interconnection to Monitoring Station	Y
Are Glass and Door Clean	Y
Control Panel Lock	Y
Cleanliness	Y

BATTERY TESTS

Battery Type & Rating	12.0 AH sealed lead acid	Battery Inspected for physical Damage	Good (2004)	
Battery Voltage (AC power on)	26.8 VDC	Battery Terminals cleaned and lubricated	N/A	
Battery Charge Current	1.60 A	Battery Terminals Clamped Tightly	Yes	
Battery Voltage (AC power off, supervisory condition)	26.4 VDC	Electrolyte Level Checked	N/A	
Battery Voltage (AC power off, General Alarm Condition, full load)	25.5 VDC	Specific Gravity of Electrolyte as per Manufacturer's Specifications	N/A	
Disconnection Causes Trouble Signal	Yes	Alarm Load During Test (Supv. & Full)	300 mA, 1.59A	
Duration of Test	5.5 hours supv., 5 min. full load	Comments	none	

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CONSTRUCTION OF AN ALTERNATE EMERGENCY COMMUNICATION CENTRE

700 ASSINIBOINE PARK DRIVE, WINNIPEG

Drawn By	Approved By	Reference
AA	CB	0
File No.	Setup Date	Detail Sheet
05-015-01	JAN 2006	ED-4

VOICE COMMUNICATIONS TEST

N/A

Power-on Indicator	
Communication System Trouble Lamp	
Communication System Trouble Indicator	
Communication System Trouble Silence Switch	
Paging All-Call Switch	
Paging All-Call Lamp	
Individual Paging Zone Select Switches (Individually Tested)	
Individual Paging Zone Select Indicators	
Trouble Lamps Voice Paging	
Microphone Press to Talk Switch	
One minute inhibit of Voice Communication during the first minute of alarm signalling	
Emergency Voice Paging Loudness Level	
Emergency Voice Paging Operates on All-Call (AC Power on)	
Emergency Voice Paging Operates on All-Call (on Emergency Power)	
Emergency Telephone Call-in Lamp	
Emergency Telephone Call-in Audible Signal	
Individual Telephone Zone Select Switches Individually Tested	
Individual Telephone Zone Select Indicators	
Emergency Telephone Verbal Communication	
Module Alignment	
Plug-in Components Securely in Place	
Are Exposed Electrical Contacts Clean	
Designation Indications for Common Control Indicators	
Are Glass and Door Clean	
Control Panel Lock	
Cleanliness	
The above tests have been completed in accordance with the manufacturer's literature	

REMOTE TROUBLE UNIT

N/A

Trouble Lamp	
Trouble Signal	

ANNUNCIATOR TESTS

Annunciator Alarm Lamp Operation Individually Tested	*Y*
Annunciator Alarm Lamp Designation Checked	*Y*
Trouble Lamp	*Y*
Trouble Signal	*Y*
Power-on Lamp	*Y*
Lamp Test	*Y*
Lamp Supervision	*Y*
Signal Silence Lamp	*N/A*
Annunciator Auxiliary Functions	*N/A*
Cleanliness	*Y*

ANCILLARY DEVICES TESTS

Ancillary Device and Location	Operation	Ancillary device and Location	Operation
Fan Shut Down	OK		

SYSTEM REMARKS

Note 1: Confirmation of wiring supervision to each individual device is only required during installation, verification or a complete building audit of the system and is not required at this time.

Note 2: Replaced detectors as noted in the report body.

Note 3: Building revisions have resulted in new storage areas. Recommend new heat detectors be added to these areas.

TECHNICIAN'S AFTER-TEST CHECKLIST

Reconnect Ancillary Functions (off site connections)	N/A
Reconnect Ancillary Functions	N/A
Reconnect Time Limit Cut-outs	Y
Reconnect Signal Power	Y
Advise Building Management Work Completed	Y
Advise Fire Department Work Completed	N/A
Ensure that the alarm system is functional	Y

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CONSTRUCTION OF AN ALTERNATE EMERGENCY COMMUNICATION CENTRE

700 ASSINIBOINE PARK DRIVE, WINNIPEG

Drawn By	Approved By	Reference
AA	CB	0
File No.	Setup Date	Detail Sheet
05-015-01	JAN 2006	ED-6

ANNUAL TEST AND INSPECTION REPORT

Building Name: Parks and Recreation

Building Address: 700 Assiniboine Park Drive, Winnipeg, Manitoba

LOCATION	DEVICE	ALARM OPERATION CONFIRMED	ZONE NUMBER	ANNUNCIATION INDICATION CONFIRMED	SMOKE DETECTOR SENSITIVITY	SUPERVISION CIRCUIT CONFIRMED		REMARKS
Basement			Zone 1					
South Hall	M	YES	1	YES				
South Hall	S	YES	1	YES	1.13			
Electrical Room	RHT	YES	1	YES				
Electrical Room	RHT	YES	1	YES				
By Storage	S	YES	1	YES	1.19			
Storage Room	RHT	YES	1	YES				
Storage Room	RHT	YES	1	YES				
Maintenance Office	RHT	YES	1	YES				
Telephone Room	HT	YES	1	YES				
Locker Room	RHT	YES	1	YES				
Locker Room	RHT	YES	1	YES				
Boiler Room	HT	YES	1	YES				
Boiler Room	HT	YES	1	YES				
Boiler Room	HT	YES	1	YES				
By Centre Stair	M	YES	1	YES				
By Centre Stair	S	YES	1	YES	1.52			
Storage	RHT	YES	1	YES				
Hallway	S	YES	1	YES	1.12			
Hallway	S	YES	1	YES	.83			
Hallway	S	YES	1	YES	1.37			
Hallway	S	YES	1	YES	1.69			
By North Stair	M	YES	1	YES				
By Engineering Office	S	YES	1	YES	1.57			

Technician: C. Kyle

Date: November 22, 2004

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CONSTRUCTION OF AN ALTERNATE EMERGENCY COMMUNICATION CENTRE

700 ASSINIBOINE PARK DRIVE, WINNIPEG

Drawn By	Approved By	Reference
AA	CB	0
File No.	Setup Date	Detail Sheet
05-015-01	JAN 2006	ED-7

ANNUAL TEST AND INSPECTION REPORT

Building Name: Parks and Recreation

Building Address: 700 Assiniboine Park Drive, Winnipeg, Manitoba

LOCATION	DEVICE	ALARM OPERATION CONFIRMED	ZONE NUMBER	ANNUNCIATION INDICATION CONFIRMED	SMOKE DETECTOR SENSITIVITY	SUPERVISION CIRCUIT CONFIRMED	REMARKS
S.E. Crawlspace			Zone 2				South hall Access
Crawlspace	RHT	YES	2	YES			
Crawlspace	RHT	YES	2	YES			
N.E. Crawlspace			Zone 3				Boiler Room Access
Crawlspace	RHT	YES	3	YES			
Crawlspace	RHT	YES	3	YES			
Crawlspace	RHT	YES	3	YES			
Crawlspace	RHT	YES	3	YES			
N.W. Crawlspace			Zone 4				By Centre Stair Access
Crawlspace	RHT	YES	4	YES			
Crawlspace	RHT	YES	4	YES			
Crawlspace	RHT	YES	4	YES			
AHU 3	DS	YES	Zone 5	YES			NE Crawlspace
AHU 14	DS	YES	Zone 6	YES			Basement Hallway

Technician: C. Kyle

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CONSTRUCTION OF AN ALTERNATE EMERGENCY COMMUNICATION CENTRE

700 ASSINIBOINE PARK DRIVE, WINNIPEG

Drawn By	Approved By	Reference
AA	CB	0
File No.	Setup Date	Detail Sheet
05-015-01	JAN 2006	ED-8

ANNUAL TEST AND INSPECTION REPORT

Building Name: Parks and Recreation

Building Address: 700 Assiniboine Park Drive, Winnipeg, Manitoba

LOCATION	DEVICE	ALARM OPERATION CONFIRMED	ZONE NUMBER	ANNUNCIATION INDICATION CONFIRMED	SMOKE DETECTOR SENSITIVITY	SUPERVISION CIRCUIT CONFIRMED		REMARKS
Ground Floor South			Zone 7					
By South Stair	M	YES	7	YES			Replaced	
By Janitor Room	M	YES	7	YES				
Janitor Room	RHT	YES	7	YES			Replaced	
Police Entrance	RHT	YES	7	YES				
Park Police Closet	RHT	YES	7	YES				
By Cafeteria	S	YES	7	YES	1.56			
Lunch Room	RHT	YES	7	YES				
Lunch Room	RHT	YES	7	YES				
Cafeteria Storage	RHT	YES	7	YES				
Servery	HT	YES	7	YES				
Servery	HT	YES	7	YES				
By Cafeteria	S	YES	7	YES	2.44		Replaced	
Small Lunch Room	RHT	YES	7	YES				
Room 111	RHT	YES	7	YES				
Wiring Room	S	YES	7	YES	1.14			
Hallway by 109	M	YES	7	YES				
Insect Control 118	RHT	YES	7	YES				
Staff Storage	RHT	YES	7	YES				
Staff Room	M	YES	7	YES				
Staff Foyer	RHT	YES	7	YES			Replaced	
Office 109	RHT	YES	7	YES				
Room 109	RHT	YES	7	YES				

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CONSTRUCTION OF AN ALTERNATE EMERGENCY COMMUNICATION CENTRE

700 ASSINIBOINE PARK DRIVE, WINNIPEG

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File No.	Setup Date	Detail Sheet
05-015-01	JAN 2006	ED-9

ANNUAL TEST AND INSPECTION REPORT

Building Name: Parks and Recreation

Building Address: 700 Assiniboine Park Drive, Winnipeg, Manitoba

LOCATION	DEVICE	ALARM OPERATION CONFIRMED	ZONE NUMBER	ANNUNCIATION INDICATION CONFIRMED	SMOKE DETECTOR SENSITIVITY	SUPERVISION CIRCUIT CONFIRMED		REMARKS
Ground Floor North			Zone 8					
By North Stair	M	YES	8	YES				
By North Stair	S	YES	8	YES	1.21			
Janitor Room	HT	YES	8	YES				
Room 101	RHT	YES	8	YES				
Room 103 Storage	RHT	YES	8	YES				
Room 103	RHT	YES	8	YES				
By Room 103	S	YES	8	YES	1.32			
Room 102	S	YES	8	YES	2.07			
Room 102	S	YES	8	YES	1.04			
Room 102 Photocopy	RHT	YES	8	YES				
Room 104	RHT	YES	8	YES				
Store Room	RHT	YES	8	YES				
Room 105 Storage	RHT	YES	8	YES				
Room 105	RHT	YES	8	YES				
Room 105	RHT	YES	8	YES				
Room 112	RHT	YES	8	YES				
By Room 112	S	YES	8	YES	1.12			
Room 107	S	YES	8	YES	1.09			
Room 107 Storage	RHT	YES	8	YES				
By Room 107	S	YES	8	YES	1.00			
By Room 107	M	YES	8	YES				
By Men's Washroom	S	YES	8	YES	1.39			

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700 ASSINIBOINE PARK DRIVE, WINNIPEG

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05-015-01	JAN 2006	ED-10

ANNUAL TEST AND INSPECTION REPORT

Building Name: Parks and Recreation

Building Address: 700 Assiniboine Park Drive, Winnipeg, Manitoba

LOCATION	DEVICE	ALARM OPERATION CONFIRMED	ZONE NUMBER	ANNUNCIATION INDICATION CONFIRMED	SMOKE DETECTOR SENSITIVITY	SUPERVISION CIRCUIT CONFIRMED		REMARKS
Main Floor South			Zone 9					
By Room 207	M	YES	9 ✓	YES				
Room 207	S	YES	9 ✓	YES	1.39%			
Room 207 Storage	RHT	YES	9 ✓	YES				
Front Office	S	YES	9 ✓	YES	1.94%			
Reception	S	YES	9 ✓	YES	1.51%			
Main Entrance	M	YES	9 ✓	YES				
Hall	S	YES	9 ✓	YES	1.28%			
Room 213 Photocopy	RHT	YES	9 ✓	YES				
By Room 213	S	YES	9 ✓	YES	1.40%			
Lunch Room	RHT	YES	9 ✓	YES				
By Room 222	S	YES	9 ✓	YES	1.46%			
By Stair	M	YES	9 ✓	YES				

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700 ASSINIBOINE PARK DRIVE, WINNIPEG

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File No.	Setup Date	Detail Sheet
05-015-01	JAN 2006	ED-11

ANNUAL TEST AND INSPECTION REPORT

Building Name: Parks and Recreation

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LOCATION	DEVICE	ALARM OPERATION CONFIRMED	ZONE NUMBER	ANNUNCIATION INDICATION CONFIRMED	SMOKE DETECTOR SENSITIVITY	SUPERVISION CIRCUIT CONFIRMED		REMARKS
Main Floor North			None 10					
By Centre Stair	M ✓	YES	10	YES				
By Room 203	S ✓	YES	10	YES	1.40			
Room 204	S ✓	YES	10	YES	1.74			
Room 204	S ✓	YES	10	YES	1.59			
By Room 204	S ✓	YES	10	YES	1.51			
Room 205	S ✓	YES	10	YES	1.05			
Room 205	S ✓	YES	10	YES	1.40			
Room 203	RET ✓	YES	10	YES				
By Room 203	S ✓	YES	10	YES	1.39			
By Room 201	S ✓	YES	10	YES	1.37			
Room 201	S ✓	YES	10	YES	1.49			
Room 201	S ✓	YES	10	YES	1.35			
Room 202	S ✓	YES	10	YES	1.59			
Room 202	S ✓	YES	10	YES	1.39			
By Room 202	S ✓	YES	10	YES	1.70			
Janitor Room	RET ✓	YES	10	YES				
By Stair	M ✓	YES	10	YES				
Room 201	RET ✓	YES	10	YES				
Rm 201 Storage	RET ✓	YES	10	YES				
Room 205.10	RET ✓	YES	10	YES				
Room 204	DS	YES	10	YES				Above Ceiling RL OK
ROOm 203	DS	YES	10	YES				Above Ceiling RL OK

Te **Technician: C. Kyle**

Date: November 22, 2004

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CONSTRUCTION OF AN ALTERNATE EMERGENCY COMMUNICATION CENTRE

700 ASSINIBOINE PARK DRIVE, WINNIPEG

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File No.	Setup Date	Detail Sheet
05-015-01	JAN 2006	ED-12

ANNUAL TEST AND INSPECTION REPORT

Building Name: Parks and Recreation

Building Address: 700 Assiniboine Park Drive, Winnipeg, Manitoba

LOCATION	DEVICE	ALARM OPERATION CONFIRMED	ZONE NUMBER	ANNUNCIATION INDICATION CONFIRMED	SMOKE DETECTOR SENSITIVITY	SUPERVISION CIRCUIT CONFIRMED		REMARKS
Signals								
By Room 313	B10	YES ✓						
By Room 308	B10	YES ✓						
By Room 201	B10	YES ✓						
Room 202	B10	YES ✓						
Room 203	B10	YES ✓						
Room 204	B10	YES ✓						
Room 205	B10	YES ✓						
By Room 205	B10	YES ✓						
By Room 207	B10	YES ✓						
By Room 220	B10	YES ✓						
By Cafeteria	B10	YES						
By Save The Elms Office	B10	YES						
By Room 105	B10	YES						
Room 102	B10	YES						
By Room 101	B10	YES						
North Basement	B10	YES						
By Boiler Room	B10	YES						
South Basement	B10	YES						
Boiler Room	B10	YES						

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ANNUAL TEST AND INSPECTION REPORT

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LOCATION	DEVICE	ALARM OPERATION CONFIRMED	ZONE NUMBER	ANNUNCIATION INDICATION CONFIRMED	SMOKE DETECTOR SENSITIVITY	SUPERVISION CIRCUIT CONFIRMED		REMARKS
North Stair	S	YES	Zone 11	YES	1:398			
Level 3			Zone 12					
By Centre Stair	M	YES	12	YES				
By Room 300	S	YES	12	YES	1.368			
Room 303	RET	YES	12	YES				
By Room 308	S	YES	12	YES	1.238			
Kitchenette	RET	YES	12	YES				
Janitor Room	RET	YES	12	YES				
By Janitor Room	S	YES	12	YES	1.378			
Room 310	RET	YES	12	YES				
By Room 314	S	YES	12	YES	1.458			
Stair	M	YES	12	YES				
Room 301 file room							No Device	
South Stair	S	YES	Zone 13	YES	1.458			
Centre Stair	S	YES	Zone 14	YES	1.478			

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File No.	Setup Date	Detail Sheet
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