1 ELECTRICAL GENERAL PROVISIONS

1.1 GENERAL REQUIREMENTS

.1 Comply with the requirements set out for the Contractor.

1.2 APPLICATION

.1 This Section applies to and is part of all Sections of divisions 26, 27 and 28.

1.3 DEFINITIONS

.1 ELECTRICAL CODE means Local Code in force at Project location.

.2 INDICATED means as shown on Contract drawings or noted in Contract Documents.

.3 Notwithstanding any definition elsewhere in the Contract documents, wherever the term "Provide" is used in relationship to equipment, piping etc., in this Division, it means "Supply, Install and Connect, test, commission and put into work order".

.4 Whenever "Drawings and Specifications" are referred to in these documents, it means "the Contract Drawings and Specifications" (including all addenda and post Contract revisions) of all Disciplines (Architectural, Structural, Mechanical and Electrical).

1.4 TRADE DEFINITIONS

.1 All work called for in the Contract Documents shall be considered to be within the scope of the Contract, and shall be the responsibility of the Contractor.

.2 The arrangement of the Drawings and Specifications into Divisions, Sections, and Trades is purely arbitrary, with the sole intention of clarifying the scope and content of the work required to complete the project. The actual division of the work amongst the sub-Contractors shall be the responsibility of the Contractor, and the actual division of the work between the sub-sub-contractors shall be the responsibility of the sub-contractors.

.3 The Contractor, at his option and as per his contracts with the Sub-Contractors, may delegate responsibility to the Sub-contractors for the division of the work.

.4 The Sub-contractors, at their option and as per their contracts with the sub-sub-contractors, may delegate responsibility to the sub-sub-contractors for the division of the work.

.5 Sections of the Electrical specifications, and specific but arbitrary responsibility divisions noted in the Electrical Specifications, are not intended to delegate functions nor to delegate work to any specific trade, but may be useful to the Contractor or Sub-contractor when dividing the work amongst the Trades and Sub-trades.

.6 In the event of a dispute regarding the responsibilities of the various trades and sub-trades, the Contractor and Sub-contractors may request information or a recommendation from the Contract Administrators. However, the Contractor and Sub-contractor shall be responsible for determining the final division of work.

1.5 GENERAL SCOPE OF WORK

.1 The Electrical work shall include all labour, materials, equipment, and tools required to install, test and place into operation a complete and fully operational Electrical System consisting of the various sub-systems as described in, but not necessarily limited to, the items in the following Specification Sections and Drawings:

.1	Section 26 00 05	Electrical General Provisions
.2	Section 26 05 01	Basic Electrical Materials and Methods
.3	Section 26 05 04	Miscellaneous Apparatus and Appliances
.4	Section 26 05 21	Wire and Cables
.5	Section 26 05 22	Connectors and Terminations
.6	Section 26 05 28	Grounding
.7	Section 26 05 29	Fastenings and Supports
.8	Section 26 05 31	Cabinets, Splitters, Junction and Pull Boxes
.9	Section 26 05 32	Outlet Boxes and Fittings
.10	Section 26 05 34	Conduit
.11	Section 26 05 43	Underground Conduits & Cables
.12	Section 26 05 80	Mechanical Equipment Connections
.13	Section 26 05 94	Electric Heating and Cooling Controls
.14	Section 26 08 00	Electrical Commissioning
.15	Section 26 24 13	Main Distribution Switchboard
.16	Section 26 24 17	Panelboards
.17	Section 26 27 26	Wiring Devices
.18	Section 26 28 21	Circuit Breakers
.19	Section 26 43 13	Surge Protective Devices
.20	Section 26 50 00	Lighting
.21	Section 26 52 01	Unit Equipment for Emergency Lighting
.22	Section 26 52 01.10	Emergency Lighting Verification
.23	Section 26 60 00	Utilities Underground Service Entrance
.24	Section 26 60 10	Incoming Telephone Service
.25	Section 26 60 20	Incoming Cable TV Service
.26	Section 27 05 14	Communications System Raceways
.27	Section 27 05 15	Voice-Data-CATV Pathways
.28	Section 27 05 16	Cable TV Raceway System
.29	Section 28 13 01	Electronic Security Installation Requirements
.30	Section 28 31 01	Fire Alarm System
.31	Section 28 31 01.10	Fire Alarm Verification
.32	Section 28 31 49	CO Detection System
.33	Drawing List:	See drawing A0.0 for complete Electrical drawing list.

1.6 DETAILED SCOPE OF WORK

.1 The detailed Scope of Work includes, but is not limited to:

.1 Provision of all labour, new materials, tools, transportation, services and facilities for a complete electrical installation to the satisfaction of the Electrical Contract Administrator or The City.

.2 All other work as described herein or as shown on the drawings.

.3 Arranging for and coordination the utilities work for underground power, data, telephone, cable service and City of Winnipeg specific communication services for the new building. Provide underground conduits, trenching, back filling as

required by Utilities and as shown or indicated on drawings.

.4 Connection of permanent main Electrical Service and metering.

.5 Provision of complete power distribution system including service entrance, metering compartments, metering equipment as required, sub-distributions, feeders and panelboards.

.6 Provision of a complete operational lighting systems including conduits, fixtures, lamps, wire, switches, boxes, termination, associated relays and contactors and interface with time clock and photocell control system.

.7 Provision of all Emergency and Exit lighting system including conduit, wire remote heads, batteries and battery charging system. Systems shall be complete in every respect.

.8 Provision of a complete Fire Alarm System including coordination and allowance of all associated equipment connections.

.9 Provision of a complete CO Detection System including coordination and allowance of all associated equipment connections with central monitoring Central and interconnection with the building fire alarm system.

.10 Provision of power supply to all mechanical equipment and controls. Provide motor control as indicated.

.11 Provision of a complete receptacle system including conduits, wire, receptacle, boxes and termination.

.12 Provision of a complete, effective grounding and bonding system.

.13 Provision of a complete operating system including wire, conduit, boxes, and pull string for nurse call, access control and security and intercom systems.

.14 Provision complete voice data system including conduit and cables.

.15 Provision of complete City of Winnipeg specific security system provisions, including but not limited to Specific City of Winnipeg required CCTV rough in, door access rough in, intrusion system rough in, and intercom systems rough in.

.16 Contract Administrator shall be responsible to coordinate, submit and facilitate all items related to Manitoba Power Smart program incentives. All rebates to be forwarded to The City.

1.7 CASH ALLOWANCES

.1 For information regarding Cash Allowances, refer to the Architectural Specifications.

.2 For information regarding Cash Allowances, refer to the Specifications set out for the Contractor.

.3 Cash Allowances are to be carried by the Contractor, not by the Electrical Contractor unless specifically noted otherwise.

1.8 SUPPLEMENTARY BID SUBMISSION FORM

.1 At bid close, submit a copy of the Electrical Supplementary Bid Form showing all requested information.

.2 There will be no substitution of named Subtrades / Manufactures after bid close except as approved by the Contract Administrator.

1.9 SITE EXAMINATION

.1 Visit and inspect the site of the work to verify the location and elevation of existing items and services (such as piping, ductwork, lighting, conduit, ceilings, walls, columns, beams, etc.) which may affect the Bid and work of this Division, before submission of Bid and proceeding with the work.

.2 Make allowance to relocate all existing items/services as required, or to provide alternate locations/routings of new items/services as required. Confirm alternate locations/routings with The City/Contract Administrator prior to submitting Bid Pricing.

.3 Claims for extra payments resulting from conditions which could have reasonably been foreseen during a pre-Bid site examination will not be considered.

1.10 ELECTRICAL DRAWINGS

.1 The Drawings for the Electrical work are performance drawings, diagrammatic and approximately to scale, intended to convey the scope of work and indicate the general arrangement and approximate location of devices, fixtures, panelboards and conduit / cable runs. These Drawings do not intend to show Architectural and Structural details.

.2 Do not scale the Drawings. Obtain information involving accurate dimensions from dimensions shown on the Architectural and Structural drawings, and by site measurement.

.3 Even though some conduit, cables and systems is not completely shown or is shown schematically, and all details are not shown or specified, it is expected that the Contractors be familiar enough with their fields of work to complete the project to the standards generally adhered to by the local industry, including good workmanship and common sense. The Contract Administrator reserves the right to furnish any additional detail drawings, which, in the judgement of the Contract Administrator, may be necessary to clarify the work, and such drawings shall form a part of this Contract. The work for such Clarifications shall be at no cost to The City.

.4 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions, pipes, ducts, beams, columns etc, and to provide complete and adequate service clearance.

.5 The exact location of the Electrical components may be changed by the Contractors to suit site conditions, provided the changes are reviewed with the Contract Administrator, the changes are duly noted on the 'Record' drawings, and the changes do not affect the operation or code-compliance of the system(s). Any such changes shall be at no cost to The City.

1.11 CHANGES TO THE SCOPE OF WORK

.1 From time to time during construction, changes to the scope of work may be proposed by The City. These Proposed Changes are to be priced by the Contractors in a timely manner. Only after The City has reviewed and accepted the pricing, will these Proposed Changes be added to the Contract.

.2 Pricing for the Electrical portions of these Proposed Changes shall be submitted by the Sub-contractor to the Contractor complete with price breakdowns as follows:

.1 Sub-sub-contractors' prices c/w labor, material and overhead prices broken out.

.2 Sub-contractor's price c/w labor, material and overhead prices broken out.

.3 Pricing shall be submitted on an item-by-item basis. Each Proposed Change may contain more than one item.

1.12 WORK SCHEDULE

.1 Unless otherwise noted, the work shall be scheduled for normal hours. The Contractors shall be aware that off-hour work may be necessary for certain locations or types of work, and shall include the extra costs in the Bid price.

.2 Where the work requires the Contractors to be in occupied areas, or where building services may be disrupted, the Contractors shall closely coordinate the hours and areas of work with the The City and occupants.

.3 It shall be the responsibility of the Contractor to schedule the work to meet The City's completion date. The Contractor shall coordinate the sub-trades and adjust the workforce as required to meet the schedule.

1.13 SUPERVISION

.1 Maintain at this job site qualified personnel and supporting staff with proven experience in supervising, installing and commissioning projects of comparable nature and complexity.

.2 Supervision personnel and their qualifications are subject to the approval of the Contract Administrator.

1.14 ENGINEERING SITE REVIEW

.1 The Sub-contractor's work will be reviewed periodically by The City, the Contract Administrator, or their representatives, solely for the purpose of determining the general quality of the work. Guidance will be offered to the Contractors in regard to interpretation of plans and specifications, to assist them in carrying out the work. Inspections, and directives given to the Contractors, do not relieve the Contractor, and his agents, servants and employees, of his responsibility to provide the work in all of its parts, in a safe and workmanlike manner, and in accordance with the plans and specifications, nor impose upon The City, and/or Contract Administrator or their representatives, any responsibility to supervise or oversee the erection or installation of any work.

.2 The Contract Administrator will issue inspection reports and deficiency lists from time to time. All deficiencies shall be cleared up to the satisfaction of the Contract Administrator within a reasonably short time.

1.15 PATENTS

.1 Pay all royalties and license fees, and defend all suits or claims, for infringement of any patent rights, and save The City and Contract Administrator harmless of loss or annoyance on account of suit, or claims of any kind for violation or infringement of any letters patent or patent rights, by this Contractor or anyone directly or indirectly employed by him, or by reason of the use by him or them of any part, machine, manufacture or composition of matter on the work, in violation or infringement on such letters patent or rights.

1.16 CONSTRUCTION DRAWINGS

.1 Where requested, prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structures, and all inserts, equipment bases, sumps and pits, supports, etc.

1.17 UTILITY SERVICES

.1 Coordinate, arrange, and pay for all utility relocations, terminations and connections as required and shown on the drawings, complete with all required metering.

.2 Install all metering equipment in accordance with utility requirements.

.3 Test all services and provide report(s) as required by the Authorities Having Jurisdiction.

1.18 CODES, PERMITS, FEES AND INSPECTIONS

.1 Comply with the most stringent requirements of the latest editions of the applicable C.S.A. standards; NFPA70 and the requirements of the Authorities Having Jurisdiction; Federal, Provincial and Municipal Codes; and the applicable standards of the Underwriters' Association. These codes and regulations constitute an integral part of these specifications.

.2 In case of conflict, the codes take precedence over the Contract Documents. In no instance reduce the standard or scope of work or intent established by the drawings and specifications by applying any of the codes referred to herein.

.3 Before starting any work, submit the required number of copies of Drawings and Specifications to the Authorities for their approval and comments. Comply with any changes requested as part of the Contract, but notify the Contract Administrator immediately of such changes, for proper processing of these requirements. Prepare and furnish any additional drawings, details or information as may be required. Information such as load calculations and other data that may be required can be obtained from the Contract Administrator. Should the authorities require the information on specific forms, fill in these forms by transcribing the information provided by the Contract Administrator.

.4 Apply for, obtain, and pay for all required permits, licenses, inspections, examinations, and fees.

.5 Arrange for the inspection of all the work by the Authorities Having Jurisdiction over the work. On completion of the work, present to the Contract Administrator the final unconditional certificate of approval of the inspecting authorities. When the Authorities Having Jurisdiction do not normally issue certificates, provide a declaration confirming that the Authorities have inspected and accepted the work.

1.19 SHOP DRAWINGS

.1 Present a schedule of shop drawings within two (2) weeks after the award of the Contract, indicating the shop drawing submission and equipment delivery dates.

.2 Shop Drawings submitted by the Contractor shall contain:

.1 Project Information such as Name and Address

.2 Contractor Information such as Name, Address, Phone Numbers

.3 Supplier Information such as Name, Address, Phone Numbers

.4 Equipment Identification using the same System Name and Identification Number as the Contract Documents.

.5 All Equipment Information required for the Contract Administrator to assess the suitability such as:

- .1 Make, Model, Size
  - .1 including schedules where numerous similar items are provided
- .2 Physical Data such as:
  - .1 Dimensions
  - .2 Materials
  - .3 Weights
  - .4 Installation Requirements
  - .5 Installation Clearances
- .3 Performance Data such as:
  - .1 Volume
  - .2 Pressure
  - .3 Capacity
  - .4 Performance Curves (with specified performance clearly marked)
- .4 Motor Data such as:
  - .1 Horse Power
  - .2 Voltage/Phases
  - .3 Efficiency
- .5 Wiring and Control Diagrams

.3 Equipment Information may contain standard manufacturer's brochures, catalogue sheets, schematics, diagrams performance charts, illustrations, etc., but must have:

.1 Information which is not applicable crossed off
.2 Available listed options which are being provided clearly marked

.4 Shop Drawing Review:

.1 In addition to project identification, date, etc., the form of stamp used in shop drawing review shall contain the following format:

- .1 Drawing:
  - .1 Reviewed
  - .2 Reviewed As Noted
  - .3 Revise and Re-Submit
  - .4 Not Reviewed

.2 This review by the Contract Administrator is for the sole purpose of ascertaining conformance with the general design concept.

.3 This review shall not mean that the Contract Administrator approved the detail design inherent in the shop drawings, the responsibility for which shall remain with the Sub-contractor submitting same, and such review shall not relieve the Sub-contractor of his responsibility for errors or omissions in the shop drawings, or of his responsibility for meeting all the requirements of the Contract documents. The Contractors are responsible for confirming and correlating dimensions at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades, as well as compliance with codes and inspection authorities such as C.S.A., etc.

.5 Bind one complete set of final shop drawings in each operating and maintenance instruction manual.

.6 Refer to the Architectural General Specifications for additional information.

1.20 COORDINATION

.1 The Contractor shall be responsible for the complete coordination amongst all trades, including timing, completion, deliveries, interference of building components and sequencing of the trades.

.2 The Contractor shall coordinate the Mechanical and Electrical sub-contractors to ensure compatibility of the system components.

.3 The Contractor shall coordinate the Mechanical and Electrical sub-contractors to ensure access to control panels on mechanical equipment for the purpose of completing fire alarm panel connections.

.4 The Contractor shall coordinate all trades to ensure that access doors and panels are of the same manufacturer and of a style appropriate for the intended use.

1.21 EXPEDITING

.1 Continuously check and expedite delivery of equipment and materials. If necessary, inspect at the source of manufacture.

.2 Continuously check and expedite the flow of necessary information to and from all parties involved.

.3 Immediately inform the Contractor if information is required from him.

1.22 RECORD DRAWINGS

.1 Obtain two sets of white prints and, as the job progresses; mark these prints to accurately indicate the installed work. Have the white prints available for inspection at the site at all times, and present for scrutiny at each job meeting.

.2 At the completion of the work, submit these sets of "Record" drawings to the Contract Administrator for review. Make changes as requested by the Contract Administrator and

resubmit. This process will continue until the "Record" drawings are deemed complete by the Contract Administrator.

.3 Arrange and pay for three copies of the final 'Record' Drawings to be produced and labeled 'As Constructed'.

.4 Submit the "Record" and "As-constructed" drawings to The City.

.5 For Additional Information, refer to the Architectural General Specifications.

.6 For Additional Information, refer to the Specifications set out for the Contractor.

1.23 CUTTING AND PATCHING

.1 The cutting of openings not requiring lintels or other structural support will be the responsibility of the trade requiring the opening. The opening size shall be the minimum required. Patching will be the responsibility of the trades normally engaged in working with the finishing materials required to restore the opening to the original or specified conditions.

.2 Where openings require lintels or other structural support, or roofing work, such openings will be specified under other divisions of this specification.

.3 Cutting, patching, and repairs to existing surfaces required as a result of the removal and/or relocation of existing equipment, piping and/or installation of new equipment in existing buildings is to be included in the Bid price.

1.24 TEMPORARY SERVICES

.1 Do not use any of the permanent Electrical systems during construction unless specific written approval is obtained from the Contract Administrator.

.2 The use of permanent facilities for temporary construction service shall not affect, in any way, the commencement date of the warranty period.

.3 If the permanent Electrical systems are used during construction, the equipment and systems shall be cleaned and refurbished as required to bring them back to a new/unused condition.

1.25 TEMPORARY AND TRIAL USAGE

.1 The City has the privilege of trial usage of Electrical systems, or parts thereof, for the purpose of testing and learning the operational procedures.

.2 Assist in the trial usage over a length of time, as deemed reasonable by the Contract Administrator, at no extra cost, and do not waive any responsibility because of trial usage.

.3 Trial usage shall not be construed as acceptance by The City.

.4 Provide and pay for all testing required on the system components where, in the opinion of the Contract Administrator, Manufacturer's ratings or specified performance is not being achieved.

1.26 CLEANING

.1 General Clean-up:

.1 The worksite shall be maintained in a condition of general cleanliness and tidiness.

.2 Provide, erect, maintain and remove temporary protective barriers and shelters. Use drop sheets, temporary walls or other means necessary to limit the spread of construction dirt and debris. Barriers shall be used to minimize the spread of dust, smoke, fumes and noise to other portions of the building.

.3 For renovation work, and for phased work where part of the building is occupied, coordinate and cooperate with the occupants throughout the duration of the project to maintain the site in a usable condition.

.4 For renovation work, and for phased work where part of the building is occupied, clean the site to the satisfaction of the occupants at the end of each work day, so as to neither inconvenience the occupants nor hinder the use of the facility.

.5 For renovation work, at the end of the project, provide cleaning services to leave the site in as clean a condition as existed before the commencement of the work.

.2 Electrical Systems Clean-up:

.1 At the completion of the project, leave all systems in full operation, the exterior of all new and renovated systems clean, and the work areas cleaned to the satisfaction of the Contract Administrator, The City and Occupants.

.2 Clean exposed surfaces of new and renovated electrical equipment, light fixtures, panelboards, control panels, etc.

.3 The level of cleaning shall be consistent with the intended use of the building and the electrical systems.

.4 The City reserves the right to inspect the Electrical Systems to determine the effectiveness of the cleaning. Where cleaning is deemed to be unacceptable, the cleaning shall be re-done at no extra charge to The City.

1.27 INSTRUCTIONS TO THE CITYS

.1 Prepare a Suitable List/Sign-off Sheet to indicate the Instructions and Materials provided.

.1 List shall include all Systems.

.2 List shall include all Materials.

.3 List shall include spaces for Sign-off Names and Dates for The City's Representative.

.2 Instruct The City's representatives in all aspects of the operation of the systems and equipment.

.3 Arrange and pay for the services of Manufacturers' representatives required for the instruction on specialized portions of the installation.

.4 Assemble three Operation and Maintenance Manuals in three ring binders with index tabs, each containing:

.1 this Sub-contractor's and suppliers names and telephone numbers,
.2 a complete set of reviewed shop drawings,
.3 brochures,
.4 data sheets,
.5 operating, maintenance, and lubricating instructions,
.6 wiring diagrams,
.7 controls ‘As-Built’ shop drawings,
.8 commissioning information,
.9 warrantee certificates.

.5 Present all copies of the Operation and Maintenance Manuals to the Contract Administrator for review. The Contract Administrator will review the manuals and return them with comments. The Sub-contractor shall make all requested changes. This process shall continue until the Manuals are deemed complete by the Contract Administrator. The Sub-contractor shall turn over the completed manuals to The City.

.6 Present all copies of the Final Record Drawings to The City.

1.28 SPECIAL TOOLS AND SPARE PARTS

.1 Prepare a Suitable List/Sign-off Sheet to indicate the Materials provided.

.1 List shall include all Materials.

.2 List shall include spaces for Sign-off Names and Dates for The City’s Representative.

.2 Provide spare parts as follows:

.1 Circuit breakers and fuse as indicated in panelboard schedules and single line drawings.
.2 Motor starters as indicated
.3 10 % spare lamps of each type and rating or a minimum of two
.4 Other systems as indicated

.3 Identify spare parts containers as to contents and replacement parts number.

.4 Provide one set of all specialized tools required to service equipment as recommended by the Manufacturers.

1.29 WARRANTIES

.1 No certificate issued, payment made, or partial or entire use of the system(s) by The City, shall be construed as acceptance of defective work or material.

.2 Include copies of all warranty and guaranty certificates and declarations in the Operating and Maintenance Manuals, in the appropriate sections.

.3 Provide a certificate or declaration indicating the warranty and conditions.

.4 Warranty satisfactory operation of all work and equipment installed under this Contract. Repair or replace at no charge to The City, all items which fail or prove to be defective within the Warranty period, provided that the failure is not due to improper usage by The City. Make good all damages incurred as a result of the failure and of the repair of the system(s).

.5 The warranty shall be for all parts and labour. Do not expect any participation from The City's personnel in the correction of warranty related work.

.6 For systems, equipment and components which are used continuously throughout the year, the normal warranty period shall be one calendar year from the date of Substantial Completion. For seasonal equipment, components and systems which are not normally used continuously throughout the year, the warranty period shall include at least one full season of satisfactory operation.

.7 When equipment or systems are put into use subsequent to the acceptance of the building, or a portion of the building, the warranty period for seasonally used equipment and systems shall be deemed to commence from the date of satisfactory operation, not from the date of final acceptance by The City.

.8 The City retains the right to demand, and to receive, an extension of the original construction warranty for any equipment, component or system which consistently fails to perform, or which requires repeated repair or adjustment.

.9 Wherever manufacturer's warranties in excess of the Contractor's warranty are provided, furnish The City with copies of the Certificates, dated and acknowledged, and inserted in the O and M Manuals. The Contractors Warranty shall include a list of the Manufacturer's extended warranties.

.10 Warranty work shall be carried out within a reasonable time period following the reporting of the problem. Should the repair time for any failed component be unreasonably long, as determined by The City, make alternate arrangements to have a temporary replacement component made available until such time that the original component is repaired and re-installed. There shall be no additional cost to The City for any temporary replacement component or for any labour required to implement the work.

1.30 DOCUMENTATION AND SYSTEM(S) ACCEPTANCE

.1 The Contractor shall prepare a suitable document to be signed by The City or their representative, confirming:

.1 The City has received satisfactory instruction in the operation and maintenance of all equipment and systems.

.2 The Operation and maintenance manuals have been received and reviewed by The City.

.3 The "Record" and "As-constructed" drawings have been received and reviewed by The City.

.4 Specified spare parts, components, keys, removable handles, tools and the like, have been accepted by The City.

1.31 COMPLETION

.1 The Contractor shall be aware that it is the Contract Administrator's intention to withhold recommendations for payment of progress claims totalling more than 92.5% of the electrical Contract until the project is declared Substantially Complete.

.2 The close-out procedure may entail a take-over and occupancy of the building in more than one stage, depending on the specified phasing and The City's timetable.

.3 SUBSTANTIAL COMPLETION

.1 The project will be ready for a Substantial Completion inspection only when it is ready for The City to occupy and utilize the building for its intended purpose.

.2 At Substantial Completion, The City will realise that some deficiencies may still exist.

.3 In preparation for the inspection to determine Substantial Completion for all or a portion of the project, the Contractor shall ensure and declare in writing that:

.1 Except for seasonal deficiencies, the Start-up and Verification of the Commissioning Process has been completed, and all systems are fully functional.

.2 All systems and equipment have been cleaned.

.3 All systems and equipment have been identified and labelled.

.4 The preliminary Record drawings have been submitted for review.

.5 One set of preliminary O and M Manuals have been submitted for review.

.6 Instructions to The City's Representative have been given.

.7 Maintenance Materials and Spare Parts have been provided.

.4 When the Contractor is satisfied that the entire project is completed, and after making his own inspection, he shall apply, in writing, to The City and/or Contract Administrator, for an inspection to determine if the project can be deemed to be Substantially Complete.

.5 In the letter of request, a date shall be specified upon which the project can be delivered and be Substantially Complete.

.6 During the inspection, a deficiency list will be compiled and a report will be issued. These deficiencies shall be corrected or completed in a satisfactory and timely manner.

.7 Based on the inspection report, The City will retain a sum of money, sufficient in his estimation to cover the cost of completing the deficiencies.

.4 TOTAL COMPLETION

.1 When the Contractor has determined that the deficiencies noted during the Substantial Completion inspection have been completed or corrected, he shall apply, in writing, to The City and/or Contract Administrator, for a final inspection to determine if the project can be deemed to Totally Complete.

.2 In the letter of request, a date shall be specified upon which the project can be delivered and be Totally Complete.

.3 In preparation for the inspection to determine Total Completion for all or a portion of the project, the Contractor shall ensure and declare in writing that:

.1 All aspects of the Commissioning Process have been completed.

.2 The final Record and As-Constructed drawings have been submitted, reviewed and accepted.

.3 The final O and M Manuals have been submitted, reviewed and accepted.

.4 The deficiencies noted during the Substantial Completion inspection have been corrected or completed.

.4 During the inspection, a deficiency list will be compiled and a report will be issued. These deficiencies shall be corrected or completed in a satisfactory and timely manner.

.5 Based on the inspection report, The City will retain a sum of money, sufficient in his estimation to cover the cost of completing the deficiencies.

.6 Final Payment will only be made after the project has been determined to be Totally Complete, with all deficiencies satisfactorily corrected.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Bidding & Contract Requirements — Division 0

.2 General Requirements — Division 1

.3 All Electrical Drawings and Division 26, 27 and 28 specification sections.

.4 All Mechanical Drawings and Mechanical specification sections.

1.2 QUALITY ASSURANCE

.1 Do complete installations in accordance with local standard.

.2 While not identified and specified by number in this Division, comply with CSA Electrical Bulletins in force at time of Bid submission. Comply with the requirements of all Provincial and local laws, rules, ordinances and codes.

.3 Electrical installation shall be in accordance with the current edition of the Electrical Code, Provincial and other codes, rules and regulations. Supply material and labour required to meet the requirements of these codes, rules and regulations even though the work is not shown on the drawings or mentioned in the specifications. Where the electrical installation calls for better quality materials or construction than the minimum requirements of these codes, rules and regulations, the electrical installation shall be as shown on the drawings and as specified.

1.3 PERMITS, FEES

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work. Additional drawings for approval will be provided by the Contract Administrator.

.2 Obtain all necessary permits required for the electrical installation.

.3 Pay all fees for permits and inspections as required for the electrical installation.

1.4 SUBMITTALS

.1 Submit shop drawings and product data for review by the Contract Administrator. All drawings must be in English with Imperial dimensions or in metric where indicated. Manufacture of equipment must not commence until shop drawings have been reviewed.

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

.3 Where applicable, include wiring, single line and schematic diagrams.

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

.5 Submit samples in accordance with General Conditions. Samples shall be forwarded to the Contract Administrator's office. Pay all transportation costs to ship samples to

Contract Administrator's office and return. Approved samples will be retained until after Bid closing, then all samples will be returned except for the sample submitted by the manufacturer who has been listed by the successful Contractor in the Bid Documents. This sample will be used for comparison with the actual production run of successful manufacturer.

.6 Required shop drawing section:

.1	26 05 04	Miscellaneous Apparatus and Appliances
.2	26 05 31	Cabinets, Splitters, J.B.'s
.3	26 05 94	Electric Heating Equipment
.4	26 09 25	Lighting Contactor Panel
.5	26 22 17	Dry Type Distribution Transformers
.6	26 24 13	Main Distribution
.7	26 24 17	Panelboards
.8	26 27 26	Wiring Devices
.9	26 28 21	Breaker
.10	26 28 23	Disconnect Switches
.11	26 50 00	Lighting
.12	26 52 01	Unit Equipment for Emergency Lighting
.13	28 13 00	Card Access Security System
.14	28 13 28	Intercom system
.15	28 16 00	Security system
.16	28 31 01	Fire Alarm System
.17	28 31 49	CO Detection System

1.5 OPERATIONS AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into Maintenance Manuals.

.2 Include details of design elements, construction features, component function and maintenance requirements and schedules to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

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

.4 Include wiring and schematic diagrams and performance curves.

.5 Include names and addresses of local suppliers for items included in Maintenance Manuals.

.6 Submit Maintenance Manuals to the Contract Administrator for review. Manuals that are incomplete shall be returned to the Electrical Subcontractor for completion. Completed manuals must be submitted, to the satisfaction of the Contract Administrator, before final payment may be considered to be due.

1.6 MAINTENANCE MANUALS

.1 Provide maintenance materials and information as specified.

.2 Turn materials over to The City in an orderly fashion upon completion of installation.

.3 Maintenance manuals shall contain a copy of the final verification report and certificate, as well as a copy of the electrical inspection certificate.

1.7 EXAMINATION OF SITE AND CONSTRUCTION DOCUMENTS

.1 Attend pre-bid site meeting as scheduled and request further information or clarifications at that time.

.2 Prior to submitting a bid, examine the site and local conditions which will affect the work. Claims for extra payments, resulting from conditions which could reasonably be foreseen during an examination of the documents and site, will not be recognized.

1.8 PRICING OF CHANGES AFTER BID

.1 The Contract Administrator reserves the right to review costing using accepted Contractor's Pricing Standards.

1.9 OTHER TRADES

.1 Include in cost all work by subtrades, such as painting, coring, plastering, access doors etc. to restore all finished areas to original finish.

.2 Schedule execution of electrical work with associated work specified in other Divisions.

.3 Coordinate electrical work to avoid conflicts with pipes, air ducts or other equipment.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Deliver all materials to site in an orderly fashion and in accordance with schedule.

.2 Provide additional protection such as tarps, padding, wood skids, etc., where such is required to ensure protection of equipment and as directed by the Contract Administrator.

1.11 PROJECT RECORD DOCUMENTS

.1 The Electrical Subcontractor shall maintain one set of white prints on site to record all changes to the Contract Drawings, which affect electrical layouts of equipment. Record drawings shall indicate all circuit wiring and all conduit runs, circuit numbers and devices. All relocations of equipment shall be shown. At project completion, the Contractor shall transfer the record information to a clean set of white prints, using recognized drafting standards, and stamp drawings As-Built, including the company name, date and signature of site Supervisor.

2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

.1 Provide labour, materials, transportation, equipment and facilities, etc., required for the

complete electrical installation as indicated or implied on the drawings and specifications.

.2 Electrical equipment shall be new and of type and quality specified.

.3 Equipment and material to be CSA certified, and manufactured to standards described. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the appropriate Inspection Departments.

.4 All motors (including motors used for mechanical equipment) shall comply with the relevant appliance or equipment efficiency act or CAN/CSA-C390, article 4-10.

2.2 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.

3 EXECUTION

3.1 INSPECTION

.1 Furnish a Certificate of Acceptance from the Inspection Authorities on completion of work. Copies of Certificate to be included in Maintenance Manuals.

.2 Certificate of Inspection and Approval must be submitted before final payment may be considered to be due.

.3 During the course of the project construction, the Contract Administrator will carry out periodic inspections and prepare a deficiency list for remedial action by the Electrical Subcontractor. When requested, the Electrical Subcontractor shall respond in writing to the Contract Administrator, stating corrective action and completion date for each item listed as deficient. This response shall be in the hands of the Contract Administrator within three working days of receipt of the Site Observation Report.

3.2 CARE, OPERATION AND START-UP

.1 Instruct the Building Manager's personnel in the operation, care and maintenance of equipment. Arrangement of such instructional sessions to be done at a time convenient to The City.

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

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

3.3 FINISHES

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

.2 Clean, prime and paint exposed hangers, racks, fastenings to prevent rusting.

3.4 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with lamacoid nameplates.

.2 Provide lamacoid nameplates, 3 mm (1/8") thick plastic engraving sheet, red face, white core, mechanically attached (screwed or rivetted) unless specified otherwise. Sizes as follows:

Size 0	10 x 38 mm	(3/8" x 1 1/2")	1 line 3 mm (1/8") high letters
Size 1	10 x 100 mm	(3/8" x 4")	1 line 3 mm (1/8") high letters
Size 2	13 x 75 mm	(1/2" x 3")	1 line 5 mm (3/16") high letters
Size 3	13 x 75 mm	(1/2" x 3")	2 lines 3 mm (1/8") high letters
Size 4	19 x 75 mm	(3/4" x 3")	1 line 10 mm (3/8") high letters
Size 5	19 x 100 mm	(3/4" x 4")	2 lines 5 mm (3/16") high letters
Size 6	25 x 100 mm	(1" x 4")	1 line 13 mm (½") high letters
Size 7	25 x 100 mm	(1" x 4")	2 lines 6 mm (1/4") high letters

.3 Wording on nameplates to be approved prior to manufacture. Submit schedule of nameplates and wording to The City (where existing systems are modified or added to) and to the Contract Administrator for new construction.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Identification to be in English.

.6 Nameplates for terminal cabinets and junction boxes to indicate system, circuit, loop numbers.

.7 Use red nameplates with white lettering for fire alarm equipment and emergency power circuits. Use blue nameplates with white lettering for UPS power circuits.

.8 Use heat shrink type markers or CAB-3 cable marking system (Pass & Seymour) for all conductors and cables. Mark cables at both ends. Mark fire alarm, card access and LAN cables. Confirm labels with the Contract Administrator.

3.5 LOCATION OF OUTLETS

.1 Change location of outlets at no extra cost or credit, providing distance does not exceed 3m (10'-0") and information is provided before installation.

3.6 MOUNTING

.1 Mounting height of equipment is from finished floor to centerline of equipment unless specified or indicated otherwise.

.2 Refer to Architectural elevations and details for mounting heights.

.3 Installation of all devices shall conform to City of Winnipeg Accessibility Standards.

.4 If mounting height of equipment is not indicated, verify with Contract Administrator or The City before proceeding with installation.

.5 Install electrical equipment at the following heights unless indicated or directed otherwise (measured from the centre of the device box).

.1 Outlets above counters: 150 mm (6"); splashbacks: 100 mm (4") (100 mm).

.2 General receptacles, telephone, and television outlets: 450 mm (17 ¾).

.3 Receptacles in mechanical and shop areas: 40" (1 m).

.4 Switches, thermostats, dimmers, push buttons, Luxo bracket: 900 mm (35”) above the finished floor level.

.5 Fire alarm pullstations, end of line resistors, intercoms: 1200 mm (47”) above the finished floor level.

.6 Fire alarm bells, horns, speakers: 2200 mm (88").

.7 Panelboards, annunciators, etc.: 2000 mm (78") to top.

.8 Power door operator for person using wheel chair to be located as per architectural elevations.

.9 As per Architectural elevations.

.10 Heights as above or at bottom of nearest block or brick course.

.11 Wall mounted telephone: 1200 mm (47”).

.6 All motor control centres and floor-mounted distribution panels shall be mounted on 100 mm (4”) concrete housekeeping pads. The Electrical Subcontractor shall be responsible for provision of these pads. Where ceiling heights will not allow housekeeping pads to be installed below distributions, and where pre-approved by the Contract Administrator, 38 mm (1 ½") galvanized cantruss shall be provided in place of the pad.

3.7 CONDUIT SLEEVES AND HOLES

.1 Make necessary arrangements for cutting of chases, coring of holes and other structural work required to install electrical conduits, cables, pullboxes and outlet boxes.

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

.3 The contractor shall satisfy himself by X-Ray or other acceptable means that coring through the floor slab will not disturb existing conduit or cables. The contractor will be responsible for resulting disruptions and required refurbishments.

3.8 FIREFPROOFING

.1 Where cables or conduits pass through floors, block or concrete walls and fire rated

walls, provide fire stop to maintain rating.

.2 Refer to Architectural drawings and specifications, and conform with all requirements therein.

.3 Acceptable manufacturers (where Architects specifications do not provide details) are Dow Corning Firestop, A/D Fire Barrier Silicone Sealant, Ener Stop - Ancron Corporation. Install fire stop with strict attention to manufacturer's directions. Include directions in maintenance manuals.

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

3.9 TESTS

.1 Conduct and pay for tests including, but not limited to, the following systems:

.1 Systems: new electrical distribution system, fire alarm system(s), card access system, low voltage lighting control, parking lot demand controls, mechanical system controls, voice/data infrastructure, emergency lighting system.

.2 Furnish Manufacturer's Certificate or letter confirming that entire installation, as it pertains to each system, has been installed to manufacturer's instructions. Include letters in maintenance manuals.

.3 Carry out tests in presence of The Contract Administrator where directed.

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

.5 Submit test results in Maintenance Manuals.

3.10 CLEANING

.1 Do final cleaning in accordance with Section 01 74 00.

3.11 CUTTING AND PATCHING

.1 Include the costs of all cutting and patching required for the installation of electrical work.

.2 Obtain the approval of the Contract Administrator, Building Manager and The City before arranging for any cutting. Patching shall restore the affected area to the original condition; materials and methods used for patching shall match existing.

3.12 WORKMANSHIP

.1 Install equipment, conduit and cables in a workmanlike manner to present a neat appearance to the satisfaction of the Contract Administrator. Install conduit and cable runs parallel and perpendicular to building lines in chases, behind furring or above ceilings, where such concealment is possible. In areas where systems are to be exposed, install neatly and group in a tidy appearance.

.2 Install equipment and apparatus requiring maintenance, adjustment or eventual

replacement, with adequate clearances and accessibility for same.

.3 Include, in the work, all requirements shown on the shop drawings or manufacturer's installation instructions.

.4 Replace work unsatisfactory to the Contract Administrator without extra cost.

3.13 ACCESS DOORS

.1 Access doors to be a minimum #12 gauge prime coat painted bonderized steel. Each to be complete with a heavy flush frame and anchor, concealed hinges, positive locking screwdriver lock, and mounting and finishing provisions to suit the finish material for which they are supplied. Access doors in fire rated ceilings, walls, partitions, structures, etc. shall be U.L.C. listed and labelled and of a rating to maintain the fire separation integrity.

.2 Refer to Architectural drawings and specifications for requirements and conform there to.

.3 Where access doors are located in surfaces where special finishes are required, they shall be of a recessed door type capable of accepting the finish in which they are to be installed so as to maintain the final building surface appearance throughout.

.4 Supply access doors in inaccessible construction to give access to all concealed junction boxes, pullboxes, conductor joints and other similar electrical work which may need maintenance or repair.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Wire and Cables	Section 26 05 21
.3	Outlet Boxes and Fittings	Section 26 05 32
.4	Conduit	Section 26 05 34
.5	Wiring Devices	Section 26 27 26

1.2 SYSTEM DESCRIPTION

.1 Make all required electrical connections to devices, equipment, appliances, etc., furnished by other trades or The City, 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.

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 HEAT TRACING CABLES (WHERE APPLICABLE)

.1 Heating tracing cable for pipes to be self-limiting type rated at 10 watts/foot.

.2 Voltage and length as indicated.

.3 Provide cold lead connection kit and locate as indicated.

.4 Supply and install Ground Fault circuit Interrupters for all power and branch circuits of the heat tracing cables.

.5 Electrical Contractor shall supply and install cables to manufacturer's recommendations.

.6 Acceptable manufacturer: Raychem.

3 EXECUTION

3.1 SPECIAL EQUIPMENT (HOSE REEL)

.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 The City or the Contractor.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Conduit Fastenings	Section 26 05 29
.2	Conduits	Section 26 05 34
.3	Connectors and Terminations	Section 26 05 22
.4	Communication Systems	Section 27 05 14
.5	Data Cable Raceway System	Section 27 05 16

2 PRODUCTS

2.1 BUILDING WIRES

.1 Copper conductors: size as indicated, with 300V or 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.2 All wiring in conduit.

.3 Minimum wire size #12 AWG, copper.

.4 Use #10 for runs longer than 45m (15A branch circuits).

2.2 COPPER SHEATHED CABLE

.1 Conductors: copper, size as indicated.

.2 Insulation: type RA90 rated 600V.

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

.4 Outer jacket of pvc applied over sheath. Jacket to have LFS/LGE rating FT-4 in accordance with CSA 22.2 No. 0.3-M1985, FT-6 rating if cable installed in plenums .

.5 Fastenings for aluminum sheathed cable:

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

.2 Channel type supports for two or more cables at 1.5 mm centers.

.3 Nine mm diam threaded rods to support suspended channels.

3 EXECUTION

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

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

.2 Only cables/wires in totally enclosed noncombustible raceways are permitted to penetrate a fire-rated/fire-resistant assembly.

3.2 INSTALLATION OF ALUMINUM SHEATHED CABLE

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Section 26 05 22 - Connectors & Terminations.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Wires and Cables — Section 26 05 21

.2 Grounding — Section 26 05 28

1.2 SHOP DRAWING AND DATA

.1 Submit product data in accordance with section 26 05 01.

1.3 INSPECTION CERTIFICATE

.1 Obtain Inspection Certificate of Compliance covering high voltage connections from inspection authority and include in maintenance manuals.

2 PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

.1 Copper long barrel compression connectors as required, sized for conductors.

.2 Heat shrink termination kits for connectors.

3 EXECUTION

3.1 INSTALLATION

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

.2 Bond and ground as required

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Wire and Cable	Section 26 05 21
.3	Conduit	Section 26 05 34
.4	Main Distribution	Section 26 24 13
.5	Panelboards	Section 26 24 17

1.2 REFERENCES

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

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

2 PRODUCTS

2.1 EQUIPMENT

.1 Grounding conductors system, circuit and equipment, grounding to be bare standard copper, sized in accordance with the Canadian Electrical Code.

.2 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to;
- .1 grounding and bonding bushings
- .2 protective type clamps
- .3 bolted type conductor connectors
- .4 thermit welded type conductor connectors
- .5 boding jumpers, straps
- .6 pressure wire connectors.

3 EXECUTION

3.1 INSTALLATION GENERAL

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

.2 Install connectors to manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections using copper welding by thermit process.

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

Soldered joints not permitted.

.6 An artificial groundling electrode shall be provided to suit the requirements of the local inspection authorities.

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

.8 Install separate ground conductor, to exterior pole mounted luminaries.

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

.10 Bond single conductor, metallic armored cables to cabinet at supply end, and provide non-metallic entry plate at load end and run separate ground conductor.

.11 Provide separate ground conductors in PVC conduit, plastic or fibreglass raceways, metal conduit and EMT.

3.2 SYSTEM AND CIRCUIT GROUNDING

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

.2 Connect isolated ground buses as indicated to “Y” point of transformer immediately upstream of panel. Connection shall be via insulated green ground wire in conduit. Minimum Size #2/0.

3.3 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to: service equipment, transformers, frame of motors, motor control centers, starters, control panels, building steel work, generators, elevators distribution panels, outdoor lighting.

3.4 COMMUNICATION SYSTEM

.1 Install grounding connections for telephone, sound, fire alarm, intercommunication systems as follows:
- .1 provide telephone grounding system in accordance with the utilities’ requirements.
- .2 sound, fire alarm, intercommunication systems, as indicated.

3.5 TESTS

.1 Perform tests in accordance with Section 26 05 01.

.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.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Wires & Cables	Section 26 05 21
.2	Conduits	Section 26 05 34

2 PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended as indicated.

3 EXECUTION

3.1 INSTALLATION

.1 Secure equipment to masonry with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

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

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

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

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

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

.5 Support 2 or more cables or conduits on channels supported by 9 mm dia. threaded rod hangers at 1.5m OC where direct fastening to building construction is impractical.

.6 Group conduits on support channels in all corridor ceilings.

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

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

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

.10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Contact Administartor.

.11 Install fastenings and supports as required for each type of equipment cables and

conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Conduits	Section 26 05 34
.3	Fastenings and Supports	Section 26 05 29

2 PRODUCTS

2.1 LOCATION

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

2.2 SPLITTERS

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

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

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

2.3 JUNCTION AND PULLBOXES

.1 Sheet steel construction with screw-on flat covers for surface or recessed mounting.

.2 Covers with 1" (25 mm) minimum extension all around, for flush-mounted pull and junction boxes.

.3 Cast-type with gasketted covers where exposed to weather.

2.4 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 (3/4") GIS fir plywood backboard. Cabinets to be flush or surface-mounted as indicated.

.3 Provide other systems' cabinets as specified in Divisions 26, 27 and 28 and located on the electrical drawings.

3 EXECUTION

3.1 SPLITTER INSTALLATION

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

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

.3 Use splitters only where indicated on the drawings.

3.2 JUNCTION PULLBOXES AND CABINETS

.1 Install pullboxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 1.9 m (74") above finish floor.

.3 Install terminal blocks, as indicated.

.4 Provide pullboxes in conduit runs as described in Section 26 05 34.

.5 Boxes and cabinets to be installed plumb and square with building lines.

.6 Install junction and pullboxes clear of all mechanical ductwork and piping.

3.3 IDENTIFICATION

.1 Identify splitters with Size 5 nameplates.

.2 Identify junction and pullboxes with Size 1 nameplates.

.3 Identify cabinet with Size 5 nameplates.

END OF SECTION

1 **GENERAL**

1.1 **RELATED WORK**

.1 Basic Electrical Materials and Methods — Section 26 05 01

.2 Wiring Devices — Section 26 27 26

1.2 **REFERENCE STANDARDS**

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

2 **PRODUCTS**

2.1 **OUTLET AND CONDUIT BOXES GENERAL**

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

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

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

2.2 **CONDUIT BOXES**

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

2.3 **FITTINGS GENERAL**

.1 Bushing and connectors with nylon insulated throats.

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

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

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

3 **EXECUTION**

3.1 **INSTALLATION**

.1 Support boxes independently of connecting conduits.

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

.3 Provide correct size of openings in boxes for conduit and aluminum sheathed cable connections. Reducing washers are not allowed.

END OF SECTION

1 **GENERAL**

1.1 **RELATED WORK**

.1 Basic Electrical Materials and Methods — Section 26 05 01

.2 Fastenings and Supports — Section 26 05 29

1.2 **LOCATION OF CONDUIT**

.1 Drawings do not show all conduits. Those shown are in diagrammatic form only.

.2 Electrical Subcontractor to 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.

2 **PRODUCTS**

2.1 **CONDUITS**

.1 Electrical metallic tubing (EMT), with couplings: size as indicated. Minimum size 19 mm (3/4").

.2 Liquid-tight flexible metal conduit: size as indicated, for equipment with vibrational aspects only.

2.2 **CONDUIT FASTENINGS**

.1 One hole steel straps to secure surface conduits 32 mm (1 1/4") and smaller. Two hole steel straps for conduits larger than 32 mm (1 1/4").

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

.3 U-channel type supports for two or more conduits at 1.52 m (60") intervals (surface-mounted or suspended). 115 mm (4 1/4") diameter threaded rods to support suspended channels. One rod shall be non-ferrous.

2.3 **CONDUIT FITTINGS**

.1 Fittings manufactured for use with conduit specified.

.2 Manufacturer elbows where 90° bends are required for 64 mm (2 1/2") and larger conduits.

.3 Die cast set screw connectors and couplings. Insulated throat liners on connectors.

.4 Raintight connector fittings, complete with O-rings, for use on weatherproof or sprinklerproof enclosures. Raintight couplings to be used for surface conduit installations exposed to moisture or sprinkler heads. Raintight connectors shall be used for all top entries to panels, contactors and motor control centres.

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 electrical metallic tubing (EMT) except where noted otherwise.

.4 Wiring home runs to panels and main branch wiring runs in ceiling spaces to be run in conduit. Wiring drops from conduit systems into boxes for wiring devices in steel stud partitions may be wired with AC-90.

.5 AC-90 drops to light fixtures shall not run horizontally more than 400 m (16”) from conduit system junction boxes in ceiling space.

.6 AC-90 drops from conduit system in the ceiling space to feed outlets in steel stud partitions shall not run more than 1.5 m (5') horizontally from the ceiling outlet box to the point where the AC-90 drops vertically into the partition.

.7 Where the total length of AC-90 is greater than 3m in the ceiling, provide conduit to a junction box closer to drop location.

.8 Use liquid-tight flexible metal conduit for connection to motors, transformers and equipment subject to movement or vibration. Provide a separate insulated grounding conductor within flexible conduit.

.9 Motor connections (use liquid-tight flexible metal conduit only) shall not exceed 1.83m (6’) except where expressly allowed by the Contract Administrator.

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

.11 Install polypropylene fish cord in empty conduits.

.12 Where conduits become blocked, remove and replace blocked section.

.13 The length of any conduit run shall not exceed 45 m (150') and no conduit run shall have more than four 90^{o} bends (or equivalent) before a pullbox is installed. Pullboxes shall be installed in accessible ceiling spaces. Conduits shall be supported within 300 mm (12") of entering any junction box, pullbox, cabinet, or panelboard.

.14 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 at no extra cost.

.15 Provide and install separate ground wire in all conduits.

3.2 **SURFACE CONDUITS**

.1 Run parallel or perpendicular to building lines.

.2 Do not locate conduits within 2 m (78") of infrared or gas-fired heaters.

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

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

.5 Do not locate conduits less than 150 mm (6") to steam or hot water lines.

3.3 **CONCEALED CONDUITS**

.1 Do not install conduit home runs horizontally in masonry walls.

.2 Do not install conduits in terrazzo or concrete toppings, unless otherwise indicated.

3.4 **CONDUIT IDENTIFICATION**

.1 Color code coverplates of junction boxes in conduit systems shall match The City/facility standard or if none exists as per the color code list below.

.2 Color code by spray painting the coverplate on each junction box in the conduit run.

.3 In addition to color coding coverplates on junction boxes with power wiring, the circuits being run in the box shall be identified on the inside coverplate with permanent felt marker.

.4

120/250V Normal Power	yellow
120/250V Emergency Power	fluorescent red
347/600V Normal Power	orange
347/600V Emergency Power	fluorescent orange
Fire Alarm	red
Data/Voice	blue
Security	white
Controls	brown

Provide 50mm wide colour coded tape on all conduits at 3.5m centres.

END OF SECTION

1 **GENERAL**

1.1 **RELATED WORK**

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Wire and Cable	Section 26 05 21
.3	Conduits	Section 26 05 34

1.2 **SUBMITTALS**

.1 Submit shop drawings in accordance with Section 26 05 01.

2 PRODUCTS

2.1 CONDUIT

.1 Heavy wall rigid PVC conduits, size as indicated.

.2 FRE duct, size, as indicated.

.3 Provide pull boxes as required. Install underground pull box minimum every 200 feet unless otherwise approved. Coordinate location of pull boxes before rough-in.

2.2 FITTINGS

.1 Rigid PVC opaque solvent welded type watertight couplings, bell end fittings, plugs, caps adaptors, as required to make complete installation.

.2 Expansion joints as required.

.3 FRE duct couplings, bends, adapters, caps, etc., as required.

2.3 GROUNDING

.1 Provide a separate insulated ground wire in each PVC or FRE conduit run.

2.4 DIRECT BURIED SINGLE AND MULTI-CONDUCTOR CABLES

.1 Single conductor and multi-conductor direct buried cables to Section 26 05 21.

2.5 WIRE

.1 Wire in conduit to Section 26 05 21.

3 EXECUTION

3.1 INSTALLATION OF DIRECT BURIED CABLES AND CONDUITS

.1 Conduits and multi-conductor cables to be laid out and spaced appropriately.

.2 Single conductor cables to be spaced 150 mm (6") apart.

.3 Install sand 150 mm (6") below and 150 mm (6") above cables and conduits.

.4 Install conduit with watertight couplings. Make transitions, offsets and changes in direction using 5° bend sections. Do not exceed a total of 20° with conduit offset. Clean conduits before laying. Cap ends of conduits during construction and after installation to prevent entrance of foreign materials. Install pull cords in empty conduits.

.5 Install continuous overlapping cuprinol-treated planking 150 mm (6") above cables and conduits before backfilling. Install continuous yellow marker tapes 150 mm (6") above treated planking.

3.2 INSPECTIONS

.1 Advise the Contract Administrator that he may inspect cable and conduit installation prior to backfilling.

3.3 AS-CONSTRUCTED DRAWINGS

.1 Include on As-constructed Drawings, exact dimensioned position and routing of all underground cable feeders, pullboxes, etc.

3.4 COORDINATION

.1 Coordinate underground installations with Utilities (including underground work of other trades) before commencing any work.

.2 Coordinate underground installations with other trades before commencing any work.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Mechanical Specifications

.2	Basic Electrical Materials and Methods	Section 26 05 01
.3	Wire and Cable	Section 26 05 21
.4	Outlet Boxes and Fittings	Section 26 05 32
.5	Conduits	Section 26 05 34

1.2 SYSTEM DESCRIPTION

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

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, line voltage temperature/humidity control systems.

.3 Unless otherwise noted, motors and control devices shall be supplied by Mechanical Division/Contractor. Motor horsepower ratings shall be as shown in the Mechanical Division specifications. Motor voltage and phase ratings shall be as shown on the Electrical Division drawings.

.4 Provide the Mechanical Contractor with a copy of the Motor Schedule and ensure conformance with voltage shown. Additional prints of Motor Schedule will be made available by the Contractor.

3 EXECUTION

3.1 POWER WIRING

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

.2 Install branch circuit wiring for mechanical system control panels, time clocks, and control transformers.

.3 Install main power feeders to starter/control panels furnished by mechanical Divisions. Install branch wiring from starter/control panels to controlled equipment such as motors, electric coils, etc.

.4 Flexible connections to motors shall not exceed 1.83 m (6'), unless approved by The Contract Administrator.

3.2 **CONTROLS**

.1 Install all electrical controls in accordance with Motor Schedule Equipment list.

.2 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.

.3 Wire and connect line voltage remote thermostats and P/E switches for furnaces, condensing units, force flows, gas-fired unit heaters, electric heaters and rooftop units.

.4 In general conduit, wire, devices and fittings required to wire and connect low voltage controls which are an integral part of the trade supplying the packaged unit, unless otherwise indicated. Control wiring shall be installed in conduit.

.5 In general: conduit, wire, devices and fittings required to wire and connect low voltage temperature control systems, shall be supplied and installed by the trade supplying the temperature control system. Control wiring shall be installed in conduit.

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. Refer to Fire Protection and Mechanical 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 and locate adjacent to monitored device.

3.4 **COORDINATION**

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

.2 Obtain full information from Mechanical Divisions, regarding wiring controls, overload heaters, equipment ratings and over-current protection. Notify the Mechanical Subcontractor, at once, if any information provided is incorrect or unsatisfactory.

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

.4 Refer to Mechanical Division specifications for any further electrical requirements.

.5 Review both electrical and mechanical drawings and specifications and coordinate all controls with Mechanical Subtrades through Contractor. Report all discrepancies to both

Mechanical and Electrical Contract Administrators before close of Bid. No additional money will be justified for assumptions made on any duplication of information.

.6 Submit to Contractor, as part of the Bid Submission, a list of controls and wiring to be provided in the Electrical Contract.

END OF SECTION

1 **GENERAL**

1.1 **SCOPE OF WORK**

.1 All equipment specified in Section 26 05 94 to be provided, wired and installed by Electrical Subcontractor, unless otherwise noted.

1.2 **PRODUCT DATA**

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

.2 Product data to include:

.1 Element replacement data.

.2 Mounting methods.

.3 Auxiliary controls.

.4 Finish.

.5 kW rating, voltage, phase.

.6 Cabinet material thicknesses.

.7 Controls.

2 **PRODUCTS**

2.1 **MINIMUM REQUIREMENTS FOR SPACE HEATERS (UNIT AND FORCE FLOW HEATERS)**

.1 Built-in overheat protection.

.2 18 gauge steel construction. (16 gauge front cover).

.3 Heater assembly to be easily removable.

.4 Finish in beige.

.5 Wall mounted. (Approx. 2.1m above finished floor).

.6 Front inlet and outlet. (Sloped outlet for Dura convector).

.7 Architectural style, rounded corners.

.8 Elements: stainless steel, free floating.

.9 Size as indicated on drawings.

2.2 **BASEBOARD HEATERS**

.1 Standard watt density.

.2 120V, 240V, single phase, as noted on drawings.

.3 Built in thermostats. Tamperproof in public areas.

.4 Refer to drawings for quantity and wattage of each unit.

.5 Equal to Chromalox BN series.

2.3 **ACCEPTABLE MANUFACTURERS**

.1 Chromalox

.2 Westcan.

.3 Stelpro.

.4 Ouellet.

.5 Qmark

2.4 **WARRANTY**

.1 Replace any heater, relay or thermostat which malfunctions within one year from project acceptance by The City.

3 **EXECUTION**

3.1 **INSTALLATION**

.1 Mount electric heaters on wall as indicated. Provide additional supports or braces as required to suit application.

.2 Provide power connection.

.3 Commission, test and demonstrate operation.

END OF SECTION

1 GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 General requirements for commissioning of electrical equipment systems.

.2 Related Sections:

.1 Section 01 91 13 General Commissioning
.2 Section 22 05 05 Commissioning of Plumbing
.3 Section 23 08 05 Commissioning of HVAC
.4 Section 25 05 05 Commissioning of Integrated Automation

1.2 INTENT

.1 Provide commissioning of electrical equipment and systems in accordance with this, Section 01 91 13 and related sections.

1.3 MANUFACTURER'S SERVICE ON SITE

.1 Arrange and pay for qualified Manufacturer's representatives to supervise starting and testing of following electrical equipment and systems:

.1 Telephone Equipment System
.2 Fire Alarm System
.3 CCTV System
.4 Card Access System
.5 Security System

.2 Use manufacturers factory trained personnel where required to maintain manufacturer's warranty.

.3 Maintain documentation of all equipment start-up and commissioning and provide to Commissioning Agent.

1.4 REFERENCE DOCUMENTS

.1 Perform tests in accordance with:

.1 These Contract Documents.
.2 Requirements of authorities having jurisdiction.
.3 Manufacturer's published instructions.
.4 Applicable CSA, IEEE, IPCEA, EEMAC, NEMA and ASTM standards.

1.5 CONTRACTOR AND MANUFACTURER REPORTS

.1 Arrange for Manufacturer to submit copies of all production test records for production tests required by EEMAC and CSA standards for manufactured electrical equipment to the Contract Administrator prior to shipping.

1.6 **TESTING QUALIFICATIONS**

.1 Arrange and pay for services of testing agent(s) to perform tests and verifications specified in this Section that are not within the capabilities of the Contractor.

.2 Required Testing Qualifications:

.1 Minimum of five years experience in the maintenance and testing of electrical equipment and systems at all voltage levels up to and including 25 kV class.

.2 The Contractor will be responsible for appointing a verification agent to direct verification of fire alarm system in accordance with:

.1 CAN/ULC-S537, "Standard for Verification of Fire Alarm System Installations"

.2 Requirements of authority having jurisdiction in the province of Saskatchewan.

2 PRODUCTS

.1 None

3 EXECUTION

3.1 **GENERAL**

.1 Commission all equipment and systems installed as part of this Contract. Typical required information or actions are listed below for each equipment or system.

.2 Provide check sheets for equipment not listed in this section.

.3 Document the commissioning process by completing the Component Verification Forms, System Tests and Integrated System Tests.

3.2 **MAIN DISTRIBUTION SWITCHGEAR**

.1 Enclosure:

.1 Visually inspect.

.2 Torque all bus connections to Manufacturers requirements and seal with red lacquer.

.3 Megger test main bus at 1000 V.

.4 Check phasing and continuity of horizontal and vertical bus. This includes phasing and phase rotation of two incoming services or supplies.

.2 Wiring Checks:

.1 Check all control, relaying and instrumentation wiring against vendor wiring schematics, three line diagrams, and project specifications.

.2 Test each circuit for continuity using a buzzer or similar device.

.3 All current circuits shall be injected, all voltage circuits shall be powered at 120 Volts, all devices functioned and checked against control schematic diagram.

.4 Check polarity and verify phase relationships on all three phase metering circuits.

.5 Where errors are discovered and changes are required, mark up and note required corrective action on vendor prints.

.3 Instrumentation:

.1 Test and calibrate all meters in accordance with Manufacturers bulletins.
.2 Check calibration on all ammeters using 5 Amp secondary injection test.
.3 Perform wiring checks as listed above.

.4 Breakers - Industrial Air Circuit Breakers:

.1 Visually inspect.
.2 Clean and lubricate.
.3 Contact resistance (ductor) test and adjust contacts.
.4 Insulation resistance (Megger) test.
.5 Mechanical function test.
.6 Electrical function test.
.7 Test and calibrate, to settings provided, all elements of solid state trip unit as follows:

.1 Inspect and test in accordance with Manufacturer's most recent installation and maintenance brochure.
.2 Perform tests using Manufacturer's relay test unit as applicable, with corresponding test instruction.
.3 If the Manufacturer's tester is not available, use an approved relay tester unit with proper test data and test accessories.
.4 Proof test each relay in its control circuit by simulated trip tests to ensure total and proper operation of breaker and relay trip circuit by injection of relay circuit to test trip operation.
.5 Check C/T and P/T ratios.

.5 Fused Disconnect Switches:

.1 Visually inspect and clean.
.2 Ductor test across switch blade contact surfaces.
.3 Megger test.
.4 Mechanical function test.

3.3 **DISTRIBUTION PANELS**

.1 Enclosure:

.1 Visually inspect.
.2 Torque all bus connections.

.2 Breakers:

.1 Visually inspect.
.2 Ductor test.
.3 Megger test.
.4 Mechanical function test.
.5 Set all units with adjustable magnetic trip units.
.6 Where solid state protection is provided with large breakers, test units as follows:

.1 Inspect and test in accordance with Manufacturer's most recent installation and maintenance brochure.

.2 Perform tests using Manufacturer's relay test unit as applicable, with corresponding test instruction.

.3 If Manufacturer's tester is not available, use an approved relay tester unit with the proper test data and test accessories.

.4 Proof test each relay in its control circuit by simulated trip tests to ensure total and proper operation of breaker and relay trip circuit by injection of relay circuit to test trip operation.

.5 Check C/T and P/T ratios.

3.4 **PROTECTIVE RELAYING**

.1 Set and test protective relays according to Manufacturer's instructions.

.2 Perform tests using Manufacturer's relay test unit as applicable, with corresponding test instructions.

.3 If Manufacturer's tester is not available, use an approved relay tester unit with proper test data and test accessories.

.4 Test all possible combinations of distribution failure and confirm that protective relaying logic is functioning properly.

.5 Ensure logic diagrams are provided for the Commissioning Binder.

3.5 **ELECTRICAL START-UP AND TESTING**

.1 Energizing Main Electrical System:

.1 Prior to energizing main electrical system:

.1 Verify supply authority voltage and phase rotation.

.2 Ensure all testing as specified in Section 16972 (to be determined) has been completed and deficiencies have been corrected.

.3 Megger test all feeders and record results on approved test report forms.

.2 Testing of Wiring and Wiring Devices:

.1 Test conductors at distribution centres and panelboards for insulation resistance to ground (megger test).

.2 Test service grounding conductors for ground resistance.

.3 Test all wiring devices for correct operation and circuitry.

.3 Ground Resistance Testing:

.1 Measure ground resistance of ground grids with earth test megger to verify compliance with CSA C22.2 No. 0.4-1982 and Canadian Electrical Code.

.4 Load Balance Testing:

.1 Perform load tests with as many building loads on as possible prior to Interim Acceptance.

.2 Test load balance on all feeders at distribution centres, motor control centres and lighting panelboards.

.3 If load unbalance exceeds 15%, reconnect circuits to balance loads. Revise panelboard directories and wiring identification accordingly.

.5 Power Factor Testing:

.1 Record power factor readings at 15 minute intervals for full 72 hour period during a normal work week, once during summer with chiller operating and once during winter.

.2 Take readings at the following locations on power distribution system:

.1 Main Breaker.

.2 All motor control centres.

.3 Feeder breakers which control large motor loads (e.g. chillers).

.4 Emergency generator.

.6 Voltage Testing and Adjusting:

.1 Test voltage at service entry point, motor control centres and secondary of transformers above 45 kVA. Record voltages at Interim Acceptance for a period of ten hours (07:00 to 17:00) during a normal work day.

.2 Adjust transformer tap settings to compensate for under-voltage or over-voltage conditions, if directed to do so by the The City.

.7 Starting Motors:

.1 Prior to starting motors:

.1 Confirm motor nameplate data with motor starter heater overloads, setting of MCPs and sizing of fuses.

.2 Verify rotation.

.3 Ensure disconnects are installed.

.4 Confirm labelling of motors, disconnects and starters.

.2 Measure and record operating load amp readings for all three phase motors.

3.6 **LIGHTING**

.1 Function test all light switches, luminaries, dimmers and lighting control equipment.

.2 Record all photocell and time-clock settings.

.3 Check operation of all emergency lighting units, exit lights and connection of exit lights to emergency power as specified.

.4 Verify that correct lamps and ballasts have been used.

.5 Record lighting levels for typical rooms and specialized areas.

.6 Confirm operation of battery operated emergency lighting units including battery size and operating time.

.7 Confirm operation of exit lights and connections of exit lights to emergency lighting panels.

.8 Check all terminations and label all lighting circuits.

3.7 **WIRING AND WIRING DEVICES**

.1 Test all receptacles for proper polarity.

.2 Verify panelboard directories and branch circuit designations as indicated on record drawings, directories and lamicoid labelling.

3.8 **ISOLATED GROUND SYSTEMS**

.1 Measure isolation transformer leakage

.2 Measure circuit conductor leakage.

.3 Measure ground circuit impedance.

.4 Verify equalized ground circuit impedance.

.5 Measure internal leakage of monitoring equipment including test equipment.

.6 Record results.

3.9 **SURGE SUPPRESSION**

.1 Test and verify operation in accordance with Manufacturers recommendations.

.1 Terminated prior to testing.

3.10 **VOICE AND DATA CABLE TESTING**

.1 Test all runs upon completion of permanent terminations, using instrumentation acceptable to The City. Before commencing testing, submit sample test data sheet(s) and information with respect to test instrumentation to be used.

.2 Copper Media:

.1 Test for the following:

.1 Continuity.

.2 Pair placement and polarity.

.3 DC resistance.

.4 Characteristics at highest contemplated frequency Hz:

.1 Attenuation - data cable.

.2 Mutual Capacitance - data cable.

.3 Near-end crosstalk (NEXT) - data cable.

.4 Run length.

.2 Before recording results, compare readings to predicted values based on cable specification and run length, using connector and patch cord losses as part of the predicted value. Retest runs with:

.1 Resistance and capacitance readings more than [10% above [or below] predicted values.

.2 NEXT values [5 dB] higher than predicted values.

.3 Attenuation values [2 dB] higher than predicted values.

.3 Reconnect or re-install and retest as necessary to correct excessive variations.

.4 Check installation of all equipment.

.5 Ensure all cables are properly identified at each end and correctly terminated prior to testing.

3.11 **FIRE SAFETY SYSTEMS**

.1 Prior to requesting verification of Fire Alarm system by Contractor, Verification Agent, and Fire Safety system Manufacturer's technical staff shall:

.1 Inspect system in conjunction with the Manufacturer to ensure that Fire Alarm system is correctly installed, connected and fully operational in accordance with requirements of the Contract Documents and Manufacturers recommendations. This includes all auxiliary equipment connected to fire alarm system such as elevators, central station tie-in, fan shut-down, sprinklers, door hold-open devices, etc.

.2 Ensure that any subsequent work remaining to be performed on the above noted items will not invalidate examinations and test performed during verification procedure.

.3 Ensure that operation and maintenance data has been submitted.

.4 Ensure that spare parts and maintenance materials have been delivered.

.2 Certify to The City in writing that above prerequisites have been fulfilled and specifying known exceptions in the form of a list of items to be completed or corrected, prior to proceeding with verification.

.3 The City will proceed with verification, or advise Contractor that prerequisites are not adequately fulfilled.

.4 Fire Alarm Verification:

.1 Assist and co-operate with The City in verification procedure.

.1 Provide following equipment:

.1 Velometer.

.2 Artificial Smoke.

.3 Rate of Rise Heat Detector Tester.

.2 Do not proceed with verification unless the following parties are present at all times during verification procedure:

.1 Electrical Subcontractor.
.2 Fire Alarm System Manufacturer's Representative.
.3 The City's verification representative.

.3 Disassemble and reassemble system components.

.4 Disconnect and reconnect wiring.

.5 Perform required field adjustments.

.6 Repair defective work and replace defective components.

.7 Perform all other work on system required by verification procedure.

3.12 **SECURITY SYSTEM**

.1 Prior to function testing of system, perform following in conjunction with Manufacturer/city of Winnipeg representative:

.1 Ensure all equipment is properly installed and all terminations completed.

.2 Verify wiring of all magnetic locks, door contacts and card readers.

.3 Ensure all programming is complete and software is performing correctly.

.4 Confirm operation of each door. Check door contacts, proper latching of magnetic locks, card operation and exit pushbuttons.

.5 Confirm correct labelling of doors on annunciators, CRT monitor and in programming.

.6 Confirm system programming and printer operation.

.7 Check remote alarming via automatic diallers.

.2 Manufacturer shall function test system in presence of The City as follows:

.1 Door Supervision System:

.1 Check installation and operation of all door contacts and control panels, including automatic dialler, if specified.

.2 Confirm proper door labelling on all annunciators and main control.

.3 Confirm operation of each door. Check door contacts, proper latching of magnetic locks, card operation and exit pushbuttons.

.2 Card Access System:

.1 Check installation of all equipment.

.2 Confirm operation of each card reader.

.3 Check all interconnections with other systems.

.3 Confirm correct labelling of all door security and access control equipment on annunciators, CRT monitor and in programming.

.4 Confirm system programming and printer operation.

.5 Check remote alarming via automatic diallers.

.6 Record results on approved test report forms.

3.13 **ELECTRICAL EQUIPMENT AND SYSTEMS DEMONSTRATION AND INSTRUCTION**

.1 Provide operation and maintenance instruction and demonstrations in accordance with Section 01 91 13.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Contactors — Section 26 05 80

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

2 PRODUCTS

2.1 EQUIPMENT

.1 Enclosure constructed with minimum 14 gauge cold rolled steel, pad-lockable, flush mounted, finished with ASA 61 Grey baked enamel inside and outside.

.2 Inner panel, 12 gauge, baked enamel, white.

.3 Terminal blocks:

.1 Design base: Wiedmueller, SAK series.

.2 Acceptable materials: Wiedmueller, Allen Bradley, Schneider Canada.

.4 Lighting Contactor:

.1 20 Amp, 4 pole, 120/240 volt rated (multiple 4 pole as required).

.2 Control transformer coil: 120 volt and fuse.

.3 Mount on inner panel.

.4 Design base: Cutler Hammer CN35 Series.

.5 Acceptable materials: Cutler Hammer, Allen Bradley, or Schneider Canada.

.5 Selector switch mounted inside: HAND-OFF-AUTO:

.1 Heavy duty Cam type.

.2 Acceptable materials: Klockner Moeller, Allen Bradley, or Schneider Canada.

3 EXECUTION

3.1 INSTALLATION

.1 Terminate all conductors to terminal blocks.

.2 Mount as indicated near breaker panelboard for control of outdoor building lights.

.3 Provision for additional supports as required.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Wire and Cable	Section 26 05 21
.3	Grounding	Section 26 05 28
.4	Conduit	Section 26 05 34
.5	Circuit Breakers	Section 26 28 21

1.2 DESCRIPTION OF EQUIPMENT

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

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 05 01.
.2 Submit Short Circuit Coordination and Arc Flash Analysis study prior or at the same time with shop drawing submission.

.3 Indicate:

.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.

.4 Switchboard manufacturer to provide a coordination and short circuit study and submit to Contract Administrator with switchboard shop drawings:

.1 Manufacturer to obtain available fault current (at the customer connection point) from Electric Utility.

.2 Manufacturer to make all calculations, provide a complete report with separate statement confirming the following:

.1 Upstream Utility fusing and Utility fault level;
.2 Interrupting capacity of breakers being supplied;
.3 Summarize the study with a statement confirming device ratings are compatible with available short circuit and distribution equipment being provided. Confirm equipment is protected by respective breakers and

comment on overall coordination.

1.4 MAINTENANCE DATA

.1 Provide data for incorporation into Maintenance Manual specified in Section 26 05 01.

1.5 MAINTENANCE MATERIALS

.1 One set spare parts as recommended by manufacturer.

1.5 SOURCE QUALITY CONTROL

.1 Refer to Section 26 05 01.

2 PRODUCTS

2.1 MATERIALS

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

.2 Molded 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.

2.2 POWER SUPPLY

.1 Power supply: 120/240V, 1 phase, 3 wire, grounded neutral, 60 Hz, short circuit current rated at 35 KA RMS symmetrical, voltage as indicated on the drawings.

2.3 SERVICE ENTRANCE SWITCHBOARD

.1 Ampere rating: as indicated on the drawings.

.2 Enclosure:

.1 Wall-mount, totally enclosed sheet steel, 'sprinklerproof' enclosure with steel frame.

.2 Provision for installation of supply authority metering transformers.

.3 Customer metering instruments, transformers and selector switches.

.4 Distribution section or sections - see single line include spaces and spares as indicted.

.5 Hinged access panels with captive knurled thumb screws.

.6 High conductivity aluminium bus.

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

2.4 MAIN BREAKER SECTION

.1 The main circuit breaker shall be a manually operable, fixed mounted molded case circuit breaker. Frame size ampere rating to be as indicated on the drawings.

2.5 GROUNDING

.1 Copper ground bus extending full width of cubicles and located at bottom.

.2 Lugs at each end sized for grounding cable.

.3 Bond non-current carrying metal parts to ground bus.

.4 Connect to station ground and building ground bus.

2.6 HYDRO UTILITY METERING SECTION

.1 Separate compartment for exclusive use of utility company metering transformers.

.2 Provide mounting and wiring for the following:

.1 potential transformers

.2 current transformers.

.3 Hydro utility metering transformers to be supplied by the Hydro utility and factory installed by the switchboard manufacturer.

2.7 CUSTOMER METERING SECTION

.1 Digital metering

.1 Standards: ANSI-C6241, IEEE-587.

.2 Phase selectable current and voltage (L-L and L-N).

.3 Capable of displaying kW, kVA, MWHR, kilowatt demand, current demand, kVA demand, frequency, power factor.

.4 LCD or LED display.

.5 Resettable minimum and maximum for current, voltage and p.f.

.2 Potential transformers: if required.

.3 Potential transformers fused with separate fuse block, equipped with fuse holder and fuses. Fuses to Section 26 28 14 (to be determined).

.4 Current transformers: as indicated dry type for indoor use with the following characteristics:

.1 nominal voltage class as indicated

.2 rated frequency: 60 Hz

.3 primary circuit rated to match ampere rating of main breaker trip. Secondary current rated at 5 amp.

2.8 SECONDARY DISTRIBUTION

.1 The distribution section shall contain thermal/magnetic molded case circuit breakers. Each breaker shall be manually operated, field adjustable trip for breakers 150A and larger. Fixed trip to 125A ratings as shown on the drawings.

.2 Breakers shall have a minimum interrupting capacity of 35kA symmetrical.

.3 The distribution section to be provided with sufficient spaces for breakers and spare spaces as indicated on drawings.

2.9 FINISHES

.1 Apply finishes in accordance with Section 26 05 01:

.1 service entrance switchboard finish to be exterior gray

.2 supply 2 spray cans of touch-up enamel

.3 treated to inhibit rusting.

2.10 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01.

.2 Nameplates:

.1 black plate, white letters, size 7, to indicate voltage, amp rating and designation

.2 complete switchboard: labelled as above main disconnect: labelled "Main Breaker"

.3 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 Acceptable manufacturers: Cutler-Hammer, Square D or Siemens.

2.13 FUTURE ENERGY MANAGEMENT

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

3 EXECUTION

3.1 INSTALLATION

.1 Locate service entrance switchboard as indicated.

.2 Connect main secondary 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 one #3/0, bare copper, grounding conductor in 1" (25 mm) conduit from ground bus to the main building ground.

.6 Manufacturer to provide test equipment and field test overload, magnetic and ground fault tripping. Include test report in Maintenance Manuals.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Panelboards shall be provided as indicated and required for the systems served and supplied under electrical Divisions.

.2 Circuit breakers, switches and accessories shall be provided as indicated and required for a complete installation.

1.2 SUBMITTALS

.1 Shop drawings shall be submitted for approval for all panelboards.

.2 Voltage and amperage test results shall be submitted to the Contract Administrator, prior to the final site observation.

2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 Panelboards shall be as manufactured by Schneider Canada, Cutler Hammer, or Siemens.

.2 Panelboards and all of the related components shall be supplied by only one of the indicated manufacturers. Partial or split packages of equipment are not acceptable.

2.2 GENERAL

.1 Panel ratings, sizes, mounting, and components shall be as indicated on the drawings.

.2 Multiple circuit breakers shall be common trip type.

.3 All bussing shall be full height at the panelboard rated capacity.

.4 Provide lockable covers for all CDP's, panels, including suite panelboards.

.5 Covers shall be hinged, locking type with concealed trim clamps. Covers will not be required for distribution type panelboards.

.6 Main circuit breakers and disconnect switches shall not be branch-mounted unless explicitly indicated.

.7 Branch circuit breakers shall have a minimum interrupting capacity of 35,000 amps at 120/240 volts. Refer to single line drawing.

.8 Provide CDP type panels where indicated.

.9 All CDP's shall be sprinkler proof and CSA enclosure 3. Panels shall be sprinkler proof.

.10 Provide 3 spare 15 amp 1 Pole breakers for each panelboard and 1 spare 15 amp 2 Pole for each CDP.

.11 Provide GFCI and AFCI breakers as indicated.

3 EXECUTION

3.1 INSTALLATION

.1 Wall mounted panels shall be mounted with tops at 6'-0" and mounted to 3/4" plywood equipment mounting panels which are painted with a gray fire-retardant.

.2 Floor mounted panels shall be provided with a 4" concrete housekeeping pad.

.3 Typed circuit directories shall be provided for all circuit breaker panelboards. Include supply disconnect location and size of feeder.

.4 Laminated (black/white) plastic nameplates with 3/16" letters shall be provided for each panelboard and for each device in the distribution panelboard(s).

.5 Loads shall be evenly balanced on all phases.

.6 Every breaker feeding receptacles in suite bedrooms shall be AFCI type (arc fault circuit interrupter) with series and parallel protection, and meeting C.E.C. rule 26-722. Install in strict conformance with manufacturers instructions do not connect smoke alarms to AFCI protected circuits.

3.2 TESTING

.1 Voltage and amperage readings shall be taken on the incoming line side of each panelboard with the maximum possible number of systems operating to simulate peak operating conditions.

END OF SECTION

1 **GENERAL**

1.1 **RELATED WORK**

.1 Basic Electrical Materials and Methods — Section 26 05 01

.2 Outlet Boxes and Fittings — Section 26 05 32

1.2 **SUBMITTALS**

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

2 **PRODUCTS**

2.1 **SWITCHES**

.1 Toggle-operated general purpose AC switches 15A and 20A, 120V AC, 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 or white toggle as directed by the Contract Administrator.

.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	15AC1 Series
Arrow Hart	1891 Series
Woodhead	1890 Series

2.2 **RECEPTACLES**

.1 Duplex receptacles, NEMA No. 5-15R, 125V AC, 15A, U-ground, with the following features:

.1 Nylon face, red for emergency power or computer power. Other receptacles:

color to be determined by the Contract Administrator.

.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 riveted grounding contacts.

.5 Child tamper proof receptacles in accordance with Canadian Electrical Code requirement.

.6 GFCI receptacles in accordance with Canadian Electrical Code requirement.

.2 Single receptacles NEMA No. 5-15R, 125V AC, 15A, U-ground, with the following features:

.1 Nylon face, color as indicated above.

.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 for each isolated ground circuit.

.4 Receptacles to be of one manufacturer throughout project.

.5 Acceptable manufacturers: Hubbell, Arrow Hart, Bryant, Woodhead, Pass & Seymour. Catalogue No. 5252 (or equivalent) for all manufacturers.

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, 50A, black, complete with cord set.

.4 Dryer outlets to be NEMA #14-30, 125/250V, 30A, black, complete with cord set.

2.4 LIGHTING DIMMER CONTROLS

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

.2 Dimmers shall be Lutron Novs 'NT' Series or Prescolite 'HT' Series rated at 1500, 1000 or 600 watts, as indicated on drawings. Dimmers for low voltage lamp circuits to be rated for low voltage applications.

.3 Color or 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.

2.5 **TRANSIENT VOLTAGE SURGE PROTECTION RECEPTACLES**

.1 Transient voltage surge protection (TVSS) receptacles, NEMA No. S-15R, 125V AC, 15A, U-ground with the following features:

.1 Thermo-plastic face, duplex, ivory, hospital grade construction.

.2 Back and side wiring.

.3 80 joules of energy absorption in each of the three modes: line-to-neutral; line-to-ground; neutral-to-ground.

.4 6000 volts protection in each of the three modes.

.5 Two filtering capacitors for 7:1 RFI and EMI noise reduction.

.6 Varistor clamping voltage 150V RMS.

.7 Response time of less than 1 nanosecond.

.8 Built-in LED for surge protection indication.

.9 Electronic components potted for electrical, mechanical and thermal stability.

.2 TVSS receptacles to be orange face, isolated ground-type. Provide a separate insulated ground wire for each isolated ground circuit.

.3 Acceptable manufacturers: Pass & Seymour 6262-SP Series, or equivalent product by Hubbel or Leviton.

2.6 **COVERPLATES**

.1 Coverplates from one manufacturer throughout project.

.2 Stainless steel coverplates for wiring devices mounted in flush-mounted outlet boxes. Where indicated by the Contract Administrator, in-suite outlets may have nylon cover plates in white, off-white or brown. Confirm with shop drawings.

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

.4 Cast gazetted coverplates for wiring devices mounted in surface mounted FS or FD.

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

.6 Weatherproof coverplates, complete with gaskets for single receptacles or switches as indicated.

3 **EXECUTION**

3.1 **INSTALLATION - 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 26 05 01 or as indicated.

3.2 **INSTALLATION - 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 26 05 01, or as indicated.

.3 Install cord sets on ranges and dryers.

3.3 **INSTALLATION - COVERPLATES**

.1 Install suitable common coverplates where wiring devices are ganged.

.2 Do not use coverplates intended for flush outlet boxes on surface mounted boxes.

.3 Provide a coverplate on each outlet. Stainless steel, unless otherwise directed.

3.4 **IDENTIFICATION**

.1 Identify receptacles with size ~~0~~ nameplate indicating panel and circuit number. Nameplates to be pre-glued with peel-off paper backing.

.2 Where directed by the Contract Administrator, do not provide name plates on outlets in independent living suites (only).

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Basic Electrical Materials and Methods — Section 26 05 01

.2 Panelboards — Section 26 24 17

1.2 SUBMITTALS

.1 Submit product data in accordance with Section 26 05 01.

.2 Include with requests for equal time-current characteristic curves for breakers with ampacity of 800A and over, or with interrupting capacity of 35,000A symmetrical RMS and over at system voltage.

2 PRODUCTS

2.1 BREAKERS - GENERAL

.1 Bolt-on molded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C (104°F) ambient.

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

.3 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-10 times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

2.2 THERMAL MAGNETIC BREAKERS

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

2.3 GROUND FAULT CIRCUIT INTERRUPTERS

.1 Molded case circuit breakers as above with integral Class A Group 1 ground fault interrupter.

2.4 ARC FAULT CIRCUIT INTERRUPTERS

.1 Molded case circuit breakers as above with integral Arc Fault Circuit Interrupter to CSA-C22.2 No. 5.1.

.2 Series, parallel and ground protection.

2.5 MANUFACTURERS

.1 Acceptable manufacturers: Cutler Hammer, Schneider Canada or Seimens.

3 EXECUTION

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

1 GENERAL

1.1 SCOPE

.1 The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability, the AC surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway and/or motor control centers. Refer to related sections for surge requirements in:

1.2 RELATED SECTIONS

.1	Panelboards	Section 26 24 17
.2	Main distribution Switch board	Section 26 24 13

1.3 REFERENCES

.1 SPD units and all components shall be designed, manufactured and tested in accordance with the latest applicable UL Listed standards (ANSI/UL 1449, 3rd Edition), UL 1283 and CSA certified per CSA 22.2

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

.1 The following information shall be submitted to the Contract Administrator:

.1 Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (I_n).

.2 Provide actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41Category C3 & C1 (combination wave) and B3 (ringwave) tested in accordance with ANSI/IEEE C62.45.

.3 Provide spectrum analysis of each unit based on MIL-STD-220A test procedures between 50 kHz and 200 kHz verifying the devices noise attenuation equal or exceeds 50 dB at 100 kHz.

.4 For retrofit mounting applications, electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

.5 Provide test report in compliance with NEMA LS1 from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the IEEE C62.41, 8 x 20 microsecond current wave. Note that test data on individual module is not accepted.

.6 For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

.2 Where applicable the following additional information shall be submitted to the Contract Administrator:

.1 Descriptive bulletins

.2 Product sheets.

1.5 SUBMITTALS – FOR CONSTRUCTION

.1 The following information shall be submitted for record purposes:

.1 Final as-built drawings and information for items listed in section 1.04.

1.6 QUALIFICATIONS

.1 For the specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

.2 The manufacturer must have a 24-hour response capability with nationwide field engineering personnel. The field service organization must have fully accredited, power system Engineers located across the North America who are capable of performing complete grounding, Power Quality analysis, and coordination studies. Factory trained SPD sales personnel do not qualify as Power System Engineers.

.3 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Contract Administrator, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

.4 The manufacturer of the SPD equipment shall be the same manufacturer as the manufacturer of the low voltage distribution equipment in which the TVSS units are installed.

.5 The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE MANUALS

.1 Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

2 PRODUCTS

2.1 MANUFACTURERS

.1 Eaton/ Cutler-Hammer: Visor Series or approved equal.

.1 The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Contract Administrator ten (10) days prior to bid date.

2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

.1 Electrical Requirements

.1 Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.

.2 Maximum Continuous Operating Voltage (MCOV) – The MCOV shall not be less than 125% of the nominal system operating voltage.

.3 The suppression system shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge suppressor for the service entrance and other distribution level. The system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

.4 Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	●	●	●	●
Delta	N/A	●	●	N/A
Single Split Phase	●	●	●	●
High Leg Delta	●	●	●	●

.5 Nominal Discharge Current (I_n) – All SPDs applied to the distribution system shall have a 20kA I_n rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an I_n less than 20kA shall be rejected.

.6 ANSI/UL 1449 3rd^d Edition Voltage Protection Rating (VPR) – The maximum ANSI/UL 1449 3rd Edition VPR for the device must not exceed the following:

Modes	208Y/120	480Y/277	600Y/347
L-N; L-G; N-G	700V	1200V	1500V
L-L	1200V	2000V	3000V

.2 SPD Design

.1 Maintenance Free Design – The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

.2 Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating TVSS modules shall not be acceptable.

.3 Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method. Products not able to demonstrate noise attenuation of 50 dB @ 100 kHz shall be rejected.

.4 Extended Range Filter –The Surge Protective Device shall have a High Frequency Extended Range Tracking filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall have published high frequency attenuation rating in the attenuation frequencies.

Attenuation Frequency	50kHz	100kHz	500kHz	1MHz	10MHz	100MHz
Insertion Loss (ratio)	40	316	316	89	200	79
Insertion Loss (dB)	32	50	50	39	46	38

.5 Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.

.6 Standard Monitoring Diagnostics – Each SPD shall provide integral monitoring options:

.1 Each unit shall provide a green / red solid state indicator light shall be provided on each phase.

.1 For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and

circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted

.2 For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.

.3 The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

.2 Remote Status Monitor – The SPD device must include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.

.3 Audible Alarm and Silence Button – The SPD shall provide an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.

.4 Event Counter – The SPD shall be equipped with an LCD display system designed to indicate to the user how many surges, sags, swells and outages have occurred at the location. The event counter triggers each time under each respective categories after significant event occurs. A reset pushbutton shall also be standard allowing all counters to be zeroed. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the counter. The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.

.5 Push to Test – The SPD shall be equipped with push-to-test feature is designed to provide users with real time testing of the suppressor's monitoring and diagnostic system. By depressing the test button, the diagnostic system initiates a self test procedure. If the system is fully operational, the self test will activate all indicator lights.

.6 Voltage Monitoring – The SPD shall display true Root Mean Square (RMS) on three L-N voltage protection mode on Wye configuration and three L-L voltage on delta configuration.

.7 Optional Monitoring Diagnostics:

.1 Network Communication – The SPD shall have the ability to communicate via Ethernet 10BaseT port or Modbus to provide information to the network master drive.

.2 Security – The SPD monitoring diagnostics shall be password protected.

.3 Protection Remaining – The SPD shall indicate the level of protection remaining.

.4 Total Harmonic Distortion (%THD) – The SPD shall display Total Harmonic Distortion.

.8 Overcurrent Protection Fusing: In order to isolate the SPD under any fault condition, the manufacturer shall provide:

.1 Individual Fusing: MOV's shall be individually fused via Copper Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events.

.2 Thermal Protection: MOV's shall be equipped with Thermal Fuse Spring (TFS) Technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100mA to 30Amp, or if the occurrence is over a longer period of time, the TFS will disconnect first. Manufacturers that utilize fuse trace only shall not be approved since there is no fault current protection between 100mA to 30A.

.3 All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.

.9 Fully Integrated Component Design – All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.

.10 Safety Requirements

.1 The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

.2 SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

.3 Sidemount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Sidemount SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

2.3 SYSTEM APPLICATION

.1 The SPD applications covered under this section include distribution and branch panel locations, bus plugs, motor control centers (MCC), switchgear, and switchboard assemblies. The branch panel located TVSS shall be tested and demonstrate to be suitable for ANSI/IEEE C62.41 Category C, B and A environments.

.2 Surge Current Capacity -- The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as shown in the following

table:

Minimum total surge current and withstand Capability with compliance to ANSI/IEEE C62.41 AND NEMA LS1			
Application	Per Phase	Per Mode	Surge Withstand Capabilities ANSI/IEEE C3 Wave (10 kA)
Service Entrance Locations (Switchboards, Switchgear, MCC Main Entrance). Category C	250kA	125kA	12000
High Exposure Roof Top Locations (Distribution Panelboards) Category B	160kA	80kA	10000
Branch Locations (Panelboards, MCCs, Busway) Category A	120kA	60kA	9000

.3 Lighting and Distribution Panelboard Requirements

.1 The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested to demonstrate suitability for ANSI/IEEE C62.41 Category B environments.

.2 The SPD shall not limit the use of Through-feed lugs, Sub-feed lugs and Sub-feed breaker options.

.3 The SPD shall be immediately installed on the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.

.4 The panelboard shall be capable of re-energizing upon removal of the SPD.

.5 A direct bus bar connection shall be used to mount the TVSS component to the panelboard bus bar to reduce the impedance of the shunt path.

.6 The SPD panelboard shall be constructed using a direct bus bar connection (cable connection between bus bar and SPD device is not acceptable). SPD units that use a cable connection do not meet the intent of this specification.

.7 The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.

.8 The SPD shall be of the same manufacturer as the panelboard.

.9 The complete panelboard including the SPD shall be UL67 listed.

.4 Retrofit Installation (externally mounted suppressor). Maximum conductor lead length between breaker and suppressor shall not exceed 14 inches. Comply with the manufacturer's recommended installation and wiring practices.

.5 Switchgear, Switchboard, MCC and Busway/ Bus Plug Requirements

.1 The SPD application covered under this section is for switchgear, switchboard, MCC and Bus Plug locations. Service entrance located TVSS shall be tested and suitable for ANSI/IEEE C62.41 Category C environments.

.2 The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC and Busway.

.3 The SPD shall be factory installed inside the switchgear, switchboard, MCC and Bus Plug at the assembly point by the original equipment manufacturer.

.4 Locate SPD on load side of main disconnect device, as close as possible to the phase conductors and ground/neutral bar.

.5 The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.

.6 The SPD shall be integral to switchgear, switchboard, MCC and Bus Plug as factory standardized design.

.7 All monitoring diagnostics features shall be visible from the front of the equipment.

2.4 ENCLOSURES

.1 All enclosed equipment shall have NEMA 1/ 3R general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:

.1 NEMA 1/3R rainproof enclosures intended for outdoor use primarily to provide protection against rain, sleet and damage from external ice formation.

.2 NEMA 12 dust-tight enclosures intended for indoor use primarily to provide protection against circulating dust, falling dirt and dripping non-corrosive liquids. (Panelboards Only).

.3 NEMA 4 watertight stainless steel intended for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing rain, hose-directed water, and damage from external ice formation. (Side Mounted Units Only).

.4 NEMA 4X – Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only)

3 **EXECUTION**

3.1 EXAMINATION

3.2 FACTORY TESTING

.1 Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.3 INSTALLATION

.1 The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

3.4 WARRANTY

.1 The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any TVSS part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Fastenings and Supports	Section 26 05 29
.3	Outlet boxes	Section 26 05 32

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 26 05 01.

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

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

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 or THD within 12 months of takeover.

1.4 COORDINATION

.1 Coordinate luminaire locations with work of other trades.

.2 Coordinate luminaire types with ceiling finishes to ensure compatibility.

2 PRODUCTS

2.1 GENERAL

.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 minimum of .125" (3 mm) thick, and shall be mounted in a hinged frame.

.4 Include finishes to Section 26 05 01 and as indicated.

.5 Where soffits or ceilings have thermal insulation, and if recessed luminaire fixtures are used, they shall be fixtures type IC (intended for insulation contact) ,which are CSA approved for such use.

2.2 **LAMPS**

.1 Provide lamps as indicated on drawings.

.2 Manitoba Hydro lamps.

.3 Fluorescent lamps shall be T-8 rapid start, 3100 lumens, rated 20,000 hours, 4100K, CRI 82 (or greater).

.4 Fluorescent lamps shall be 13W (or as indicated on drawings) and match T8 lamps for color temperature.

.5 Metal Halide lamps shall be 200W, pulse start, and match T8 lamps for color temperature.

2.3 **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 Provide discreet electronic instant start fluorescent ballasts of 120 and 347V design, automatic reset thermal protected, 90% power factor, group A noise rating. Ballasts to have 4 watt/lamp or less loss. Only Manitoba Hydro Power Smart approved ballasts will be accepted.

2.4 **EXIT LIGHTS**

.1 Provide exit lights as indicated, complete with directional arrows, as shown on the drawings.

.2 Units to be provided with full panel LED's, English, meeting CSA-C860-01.

.3 Arrange exit lights as required, to allow exits to be visible from access to egress locations.

3 **EXECUTION**

3.1 **INSTALLATION (LUMINAIRES)**

.1 Install luminaires at locations indicated, complete with 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, complete with all fasteners, framing and hangers, as may be required. Do not secure luminaires to mechanical ductwork or other vibration producing apparatus.

.6 Where a luminaire is suspended from the ceiling using a self-aligning box cover, an additional ground wire from the outlet box to the luminaire shall be provided.

.7 Coordinate 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 The City.

.8 Do not handle specular lenses with bare hands. Use plastic gloves as recommended by supplier.

3.2 WIRING

.1 Connect luminaires to lighting circuits as indicated.

.2 Circuit breakers for exit light circuits shall be provided with lock-on devices.

.3 Wiring for exit and night light circuits shall be installed in a separate conduit system.

.4 Connect luminaires to contactor controlled circuits where indicated. In general corridor, alternating fixtures on separate contactors.

3.3 TESTS

.1 Perform tests in accordance with Section 26 05 01.

.2 Check luminaires and replace defective lamps, ballasts, lenses and accessories.

3.4 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.

.2 Do not handle specular lenses with bare hands. Use plastic gloves as recommended by supplier.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1	Basic Electrical Materials and Methods	Section 26 05 01
.2	Wire and Cable	Section 26 05 21
.3	Outlet Boxes and Fittings	Section 26 05 32
.4	Conduit	Section 26 05 34

1.2 SUBMITTALS

.1 Submit shop drawings in accordance with Section 26 05 01.

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

.3 Battery bank sizing criteria.

1.3 OPERATION AND MAINTENANCE DATA

.1 Provide data for incorporation into Maintenance Manual specified in Section 26 05 01.

.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 MANUALS

.1 Provide maintenance manuals in accordance with Section 26 05 01.

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 ten years, with a no-charge replacement during the first five years and a pro-rate charge on the second five years from the date of the Final Acceptance from the The City.

1.6 SYSTEM DESCRIPTION

.1 The system to include battery unit(s) 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.

.2 Unit equipment certified to CSA Standard C22.2 No. 141.

2 PRODUCTS

2.1 BATTERY BANK

.1 Supply voltage: 120 volt.

.2 Output voltage: 24DC.

.3 Battery: long life sealed lead, maintenance-free.

.4 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected, modular constructed.

.5 Solid state transfer.

.6 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

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

.8 Lamp heads: integral on unit and remote as indicated. Adjustable mounting, swivel type, complete with quartz halogen lamp. Minimum twin heads required per location.

.9 Cabinet: suitable for shelf mounting to wall and complete with knockouts for conduit.

.10 Auxiliary equipment:

.1 test switch

.2 battery disconnect device

.3 AC input and DC output terminal blocks inside cabinet

.4 shelf

.5 cord and plug connection for AC

.6 RFI suppressors

2.2 REMOTE HEADS

.1 Double adjustable heads, as indicated.

2.3 MANUFACTURERS

.1 Acceptable Manufacturers: Lumacell, Beghelli, Emergi-Lite and Readylite.

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 as indicated.

.6 Mount double remote heads on outlet box such that two heads will be horizontal with the building lines.

.7 Provide “dark test” at the end of the project to direct heads as indicated and required to provide adequate egress lighting. Confirm test complete before requesting substantial performance and/or final on-site review by the Contract Administrator.

.8 Charge the batteries and test the system for proper operation (minimum of 35 minutes discharge time).

END OF SECTION

EMERGENCY LIGHTING VERIFICATION

The following document shall be dated and signed by E.C. and G.C. upon final completion, witnessing and verification of installed, fully operational emergency lighting systems (including installation and testing of all exit lights and emergency lights) as outlined in drawings and electrical specifications.

This **Emergency Lighting Verification** document must be submitted to Tower Engineering **PRIOR** to submitting request for 'Substantial Completion'.

Company Name: _____ Date: _____
(Electrical Contractor)

Printed Name: _____ Signature: _____

I hereby verify that all emergency lighting systems as noted above are complete and have been commissioned on above noted date.

Company Name: _____ Date: _____
(General Contractor)

Printed Name: _____ Signature: _____

I hereby verify that all emergency lighting systems as noted above are complete and have been commissioned on above noted date.

Witness (circle one):

Engineer - Tower representative Date: _____

Printed Name: _____ Signature: _____

I hereby verify that all emergency lighting systems as noted above are complete and have been commissioned on above noted date.

The above does not constitute a waiver of any of the contract document requirements.

1 **GENERAL**

1.1 **RELATED WORK**

.1	Concrete	Section 03 10 00
.2	Basic Electrical Materials and Methods	Section 26 05 01
.3	Conduit	Section 26 05 34
.4	Wire and Cable	Section 26 05 21
.5	Underground Conduit and Cables	Section 26 05 43

1.2 **COORDINATION WITH HYDRO SUPPLY AUTHORITY**

.1 Make all arrangements and coordinate with Electrical supply authority to ensure availability of service when required.

.2 Submit all required drawings to supply authority for their approval.

.3 Refer to Section 26 05 01 for cash allowance requirements associated with electrical service by the supply authority.

1.3 **COORDINATION WITH TELEPHONE AUTHORITY**

.1 Make all arrangements and coordinate with telephone utility to ensure availability of service when required.

.2 Refer to Section 26 05 01 for cash allowance requirements associated with telephone service by the telephone utility.

1.4 **COORDINATION WITH CABLE TV PROVIDER**

.1 Make all arrangements and coordinate with Cable TV utility to ensure availability of service when required.

.2 Refer to Section 26 05 01 for cash allowance requirements associated with cable TV by the cable utility.

1 PRODUCTS

1.1 EQUIPMENT

.1 Underground conduit in accordance with Section 26 05 43.

.2 Conduit and fittings to Section 26 05 34.

2 EXECUTION

2.1 PRIMARY CABLES

.1 Primary cables to the utility supplied pad mounted transformer to be provided by the Hydro utility.

.2 Coordinate shut down and re-servicing with utility.

2.2 SECONDARY CABLES

.1 Install secondary cables from pad mounted transformer to main distribution, via a trench as indicated. Allow adequate conductor length for termination. Backfill trench and restore surface to original condition.

.2 Arrange for inspection of cables in trench by The Contract Administrator BEFORE backfill, or provide and pay for Certificate of Inspection by Utility.

END OFSECTION

1 **GENERAL**

1.1 **RELATED WORK**

.1 Plywood backboard as drawings indicated.

.2 Conduit systems to Section 26 05 34.

1.2 **DESCRIPTION OF SYSTEM**

.1 Incoming telephone service to be underground. Coordination with Contractor to coordinate with telephone authority, to ensure telephone authority availability of service.

1.3 **PAYMENT**

.1 Arrange and pay for all Utility services charges.

2 **PRODUCTS**

2.1 **MATERIALS**

.1 Grounding: To Section 26 05 28, Grounding - Secondary.

.2 Telephone Raceway System: To Section 27 05 14.

.3 Conduits, conduit fastenings, and conduit fittings to Section 26 05 34, 26 05 29 and 26 05 32.

3 **EXECUTION**

3.1 **INSTALLATION**

.1 Install telephone conduit and service entrance. Support as per Canadian Electrical Code and utility requirements.

.2 Install plywood backboard for main telephone distribution. Paint backboard with two coats of fire retardant paint.

.3 Install grounding facilities, and make connections.

END OF SECTION

1 GENERAL

1.1 RELATED WORK

.1 Plywood backboard as drawings indicate.

.2 Conduit systems to Section 26 05 34.

1.2 DESCRIPTION OF SYSTEM

.1 Incoming CATV service underground.

1.3 COORDINATION WITH CATV AUTHORITY

.1 Contractor to coordinate with CATV authority to ensure availability of service.

1.4 PAYMENT

.1 Arrange and pay for all Utility service charges from local CATV utility.

2 PRODUCTS

.1 MATERIALS

.2 Grounding: To Section 26 05 28, Grounding.

.3 Underground Service Conduit: To Section 26 05 34, Conduits, Conduit Fastenings and Conduit Fittings.

.4 CATV utility to install utility grade amplifier(s).

3 EXECUTION

3.1 INSTALLATION

.1 Install underground CATV service conduit. Support as per Canadian Electrical Code, and utility requirements.

.2 Install plywood backboard for main telephone distribution. Paint backboard with two coats of fire retardant paint.

.3 Install grounding facilities, and make connections.

.4 Provide a circuit(s) as required for connection of all amplifiers as provided by CATV installer.

END OF SECTION