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Toronto, Ontario  
M5J 1A7

## **ELECTRICAL SPECIFICATIONS**

**FOR  
WEST SCARBOROUGH  
NEIGHBOURHOOD COMMUNITY  
CENTRE (WSNCC)  
313 PHARMACY AVENUE,  
TORONTO, ON  
MECHANICAL & LIGHTING SYSTEM  
UPGRADE**

**TO**

**CITY OF TORONTO  
CORPORATE REAL ESTATE  
MANAGEMENT**

**DATED**

**AUGUST 7, 2025**

**ISSUED FOR TENDER**

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**MCW Project No: 22241M**

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END OF SECTION

**PART 1 - GENERAL**

**1.01 GENERAL REQUIREMENTS**

- .1 Comply with Division 1 - General Conditions and all documents referred to therein.

**1.02 APPLICATION**

- .1 This Section applies to and is a part of all Sections of Division 26.

**1.03 DEFINITIONS**

- .1 "Manufactured in accordance with" is not equivalent to UL listing and does not meet the intent of this specification.
- .2 Wherever the term "This Sub-Contractor" is used in the Division 26 Drawings and Specifications, it means the firm having a subcontract with the "Contractor" to perform, supervise and co-ordinate all work of this Division.
- .3 Wherever the term "install" (and tenses of "install") is used in the Division 26 Drawings and Specifications, it means install and connect complete.
- .4 Wherever the term "supply" is used in the Division 26 Drawings and Specifications, it means supply only.
- .5 Wherever the term "Provide" or "Provision of" are used in relationship to equipment and other materials specified for the Work of Division 26 it means "Supply, Install and Connect". Wherever the terms "Provide" or "Provision of" are used in connection with services such as testing, start-up and commissioning for any part of the Work of Division 26, it means procure, supervise, take responsibility and pay for these services.
- .6 Whenever "Drawings and Specifications" are referred to herein, it means "the Contract Documents".
- .7 Wherever the terms "Authorities" or "Authorities having jurisdiction" are used in the Division 26, Drawings and Specifications, it shall mean any and all current laws and/or by-laws of any federal, provincial] or local authorized agencies having jurisdiction over the sum total or parts of the work including, but not restricted to the Municipal Planning and Building Department, Municipal Fire Department, The Construction Safety Act, Municipal Public Works Department, Federal and/or Provincial Fire Marshall, the Ontario Electrical Safety Code and the Ontario Building Code.
- .8 Wherever the term "Work" is used in the Division 26 Drawings and Specifications, it means all equipment, permits, materials and labour to provide a complete electrical installation as required and detailed in the Drawings and Specifications.

- .9 Wherever the term "Acceptable" is used in the Division 26 Drawings and Specifications it means acceptable to the Consultant.

#### 1.04 WORK INCLUDED

- .1 Sections of Division 26 are not intended to delegate functions nor to delegate work and supply to any specific trade and the Work shall include all labour, materials, equipment and tools required for a complete and working installation as described, but not necessarily limited to items in the following Sections:

Section 26 05 00	Electrical General Requirements
Section 26 05 01	Shop Drawings, Product Data and Samples
Section 26 05 05	Basic Materials and Methods
Section 26 05 10	Electrical Identification
Section 26 05 14	Work in Existing Building
Section 26 05 21	Wire and Cable Up To 600 Volts
Section 26 05 27	Grounding and Bonding
Section 26 05 29	Hangers and Supports
Section 26 05 33	Raceways and Boxes
Section 26 24 16	Panelboards
Section 26 28 13	Fuses
Section 26 28 23	Safety Switches
Section 26 50 00	Lighting Retrofit and New Luminaire

#### 1.05 PERMITS, FEES AND INSPECTIONS

- .1 Apply for, obtain, and pay for all permits, licenses, inspections, examinations and fees required for Work of Division 26.
- .2 If the municipality is structured as a "single permit jurisdiction", the Contractor will apply, pay for and obtain the municipal building permit. In this case, the Division 26 contractor has no financial obligation for permit application except for permits not covered in the "single permit".
- .3 Arrange for inspection of all Work by the Authorities having jurisdiction over the Work. On completion of the Work, present to the Consultant the final unconditional certificate of approval of the inspecting Authorities.
- .4 Comply with the requirements of the latest edition of the applicable CSA standards, the requirements of the Authorities, Federal, Provincial and Municipal Codes, the applicable standards of the Underwriters' Association and all other Authorities having jurisdiction. These codes and regulations constitute an integral part of these specifications.
- .5 In case of conflict, the codes take precedence over the Contract Documents. In no instance reduce the standard or intent established by the drawings and specifications by applying any of the codes referred to herein.

- .6 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 Consultant immediately of such changes. Prepare and furnish any additional drawings, details or information as may be required.

#### **1.06 CONTRACT DRAWINGS**

- .1 The Drawings for Electrical work are performance drawings, diagrammatic, intended to convey and indicate general arrangement and approximate location of apparatus, fixtures and conduit runs. The Drawings do not intend to show architectural and structural details.
- .2 Do not scale Drawings. Obtain information involving accurate dimensions from dimensions shown on Architectural and Structural drawings, and by site measurement.
- .3 Make, at no additional cost, any changes or additions to materials, and/or equipment necessary to accommodate structural conditions (conduits around beams, columns, etc.)
- .4 Alter, at no additional cost, the locations of materials and/or equipment as directed that do not necessitate additional material.
- .5 Install ceiling mounted components (e.g., light fixtures, speakers, heat or smoke detectors) in accordance with reflected ceiling drawings.
- .6 Confirm on the site the exact location and mounting elevation of outlets and fixtures as related to Architectural and Structural details.

#### **1.07 EXAMINATION OF SITE AND DOCUMENTATIONS**

- .1 Prior to submitting tender, carefully examine conditions at the site which could affect the Work. Refer to and examine all contract documents.
- .2 Be responsible for any damage done to existing underground services caused by neglect to determine and mark out the location of such services prior to excavation work commencing.
- .3 Refer to room finish schedules to determine finished, partially finished and unfinished areas of the building.
- .4 Ensure that materials and equipment are delivered to the site at the proper time and in such assemblies and sizes so as to enter into the building and to be moved into the spaces where they are to be located without difficulty. Be responsible for any cutting and patching involved in getting assemblies into place.

#### **1.08 CO-ORDINATION DRAWINGS**

- .1 Prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structure, and all inserts, equipment bases, and supports, and relate these to suitable grid lines and elevation datum.
- .2 When requested, provide weights of major items of equipment.
- .3 Prepare interference and co-ordination drawings for all areas where the work of this Division could conflict with and/or obstruct the work of other trades and/or other Sections of this Division. Submit drawings for review by the Consultant.

#### 1.09 RECORD DRAWINGS

- .1 The drawings for this Project have been prepared using REVIT. For the purpose of producing record (as-built), the consultant will provide a BIM Model to the subcontractor at no cost.
- .2 In the event cad files are required, copies of contract drawings may be purchased from the Consultant based on the following rates plus GST:

For 1 to 10 files	\$550.00
For 11 to 20 files	\$650.00
For 21 to 50 files	\$850.00
For 51 to 100 files	\$1,350.00
For greater than 100 files, charge \$10.00 per file + \$350.00.	

In using the drawings from the Consultant to produce record drawings, the Contractor is deemed to have agreed to take full responsibility for any and all information on the drawings.

- .3 Obtain a set of white prints as the job progresses, mark this set to accurately indicate installed work. Show location by dimension from walls or columns for all buried services as well as invert depths. Have these white prints available for inspection at the site at all times, and present for scrutiny at each job meeting.
- .4 At completion of the project, transfer all information from the white prints to the REVIT files, and provide one USB Flash Drive with updated files to the Client as part of the close out documents.
- .5 The Division 26 contractor is responsible for all cost associated with the production and services required, such as recreating, plotting and printing to produce "as-built" drawings.

#### 1.10 PRODUCT STANDARDS AND ALTERNATIVES

- .1 Provide new material and equipment as specified and to the acceptance of the Consultant. Manufacturer's names are listed to set a standard of quality, performance, capacity, appearance and serviceability. Other acceptable manufacturers are also listed, and their names may be used in the submission of the Electrical List of Manufacturers, Subtrades and Separate and Unit Prices Tender subject to conditions stipulated in paragraph .3 of this article.

- .2 Where no other acceptable manufacturers are indicated, provide the exact make specified. Requests for acceptance of manufacturers not listed must be submitted not less than seven working days prior to closing date of the tender and submissions must bear proof of acceptance by the Consultant if used in the tender.
- .3 Assume full responsibility for ensuring that when providing other acceptable manufacturers all space, weight, connections, power and wiring requirements, etc., are considered, and costs therefore included in the tender. Equipment requiring greater than specified energy requirements or unduly limiting service space requirements will not be accepted.
- .4 All electrical equipment, material, wiring and devices to conform to the Canadian Electrical Code for the purpose for which they are to be used and bear the approval of the CSA or have special approval of the inspection authority. All equipments to be designed and manufactured in accordance with applicable EEMAC and ANSI specifications.

#### **1.11 PATENTS**

- .1 Pay all royalties and licence fees, and defend all suits or claims for infringement of any patent rights, and save the Owner and Consultant 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 Subcontractor 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 or such letters, patent or rights.

#### **1.12 RIGHTS RESERVED**

- .1 Rights are reserved to furnish any additional detail drawings, which in the judgement of the Consultant may be necessary to clarify the work, and such drawings shall form a part of this contract.

#### **1.13 EQUIPMENT NAMEPLATES**

- .1 Provide apparatus with proper nameplates affixed thereto, showing the size, name of equipment, serial number and all information usually provided, which also includes voltage, cycle, phase, horsepower of motors and the name and address of the manufacturer.

#### **1.14 EXPEDITING AND DELIVERY**

- .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 Consultant in case information is required from him.
- .4 Provide delivery records updated monthly.

**1.15 SUPERINTENDENCE**

- .1 Maintain at the job site, at all times, qualified personnel and supporting staff, with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.
- .2 The supervising personnel and their qualifications are subject to the approval of the Consultant.

**1.16 WORKMANSHIP**

- .1 Install equipment, conduit and cables in a workmanlike manner to present a neat appearance to function properly to the satisfaction of the Consultant. Install 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 to present a tidy appearance.
- .2 Install equipment and apparatus requiring maintenance, adjustment or eventual replacement with due allowance therefore.
- .3 Include in the work all requirements of manufacturers shown on the shop drawings or manufacturers installation instructions.
- .4 Replace work unsatisfactory to the Consultant without extra cost.
- .5 Make provision to accommodate future plant and equipment indicated on drawings.
- .6 Protect from damage all equipment delivered to the site and during installation. Any damage or marking of finished surfaces shall be made good to the satisfaction of the Consultant.

**1.17 TRIAL USAGE AND TESTS**

- .1 The Owner has the privilege of the trial usage of Electrical Systems or parts thereof for the purpose of testing and learning the operational procedures.
- .2 Assist in trial usage over a length of time as deemed reasonable by the Consultant at no extra cost and do not waive any responsibility because of trial usage.
- .3 Trial usage shall not be construed as Substantial Completion of the Work, or acceptance by the Owner.
- .4 Provide and pay for all testing required on the system components where, in the opinion of the Consultant, manufacturer's ratings or specified performance is not being achieved.

**1.18 CLEANING**



- .1 Before energizing any systems, inspect and clean the inside of panel boards, switchgear and cabinets to ensure that they are completely free from dust and debris.
- .2 Clean all polished, painted and plated work bright. Clean all lighting fixtures.
- .3 Remove all debris, surplus material and all tools.
- .4 Carry out additional cleaning operating of systems as specified in other sections of the specification.

#### 1.19 COMPLETION

- .1 Leave electrical work in specified working order.

#### 1.20 WARRANTIES

- .1 Provide 2 year warranty certificates for all services.
- .2 Wherever given or required, in excess of the normal warranty period, provide certificate showing the name of the firm giving the warranty, dated and acknowledged, on specific equipment and systems.

#### 1.21 INSTRUCTION TO OWNERS

- .1 Instruct the Owner's representatives in all aspects of the operation of systems and equipment.
- .2 Arrange for and pay for services of service engineers and other manufacturers' representatives required for instruction on specialized portions of the installation.
- .3 Submit to the Consultant at the time of final inspection a complete list of systems stating for each system:
  - .1 Date instructions were given to the Owner's staff.
  - .2 Duration of instruction.
  - .3 Name of persons instructed.
  - .4 Other parties present (manufacturer's representative, consultants, etc.).
- .4 Signatures of the Owner's staff stating that they properly understood the system installation, operation and maintenance requirements.

#### 1.22 DOCUMENTATION AND SYSTEMS ACCEPTANCE

- .1 Assemble three (3) copies of operating and instruction manuals in three ring binders with index tabs each containing this subcontractor's and suppliers names and telephone numbers.
- .2 Each manual shall contain the following data:

- .1 A set of as-built prints.
  - .2 Letters of Owner's Instructions
  - .3 Final Hydro certificate.
  - .4 A copy of each "reviewed" shop drawing.
  - .5 Complete explanation of operation principles and sequences.
  - .6 Complete part lists with numbers.
  - .7 Recommended maintenance practices and precautions.
  - .8 Complete wiring and connections diagrams.
  - .9 Certificate of warranty.
  - .10 Representative certificates for:
    - .1 Fire Alarm System
    - .2 Security System
    - .3 Generator Assemblies
- .3 Ensure that operating and maintenance instructions are specific and apply to the models and types of equipment provided.

#### **1.23 OWNER'S RIGHT TO RELOCATE ELECTRICAL ITEMS**

- .1 The Owner reserves the right to relocate electrical outlets at a later date, but prior to installation, without cost, assuming that the relocation per outlet does not exceed 3000 mm from the original location. No credits shall be anticipated where relocation per outlet of up to and including 3000 mm reduces materials, products and labour.
- .2 Necessary changes, due to lack of co-ordination, and as required and when approved, shall be made at no additional cost, to accommodate structural and building conditions. The location of conduits and other equipment shall be altered without charge to the Owner, if approved, provided the change is made before installation.

#### **1.24 MUNICIPAL AND UTILITY SERVICES**

- .1 Co-ordinate, arrange, and pay for (provide cost to owner) all utility connections and fees as required and shown on the drawings, complete with all required metering. Install all metering equipment in accordance with municipal or utility requirements.

#### **1.25 PHASING AND SCHEDULING OF WORK**

- .1 Refer to front end documentation for a detailed description of the phasing and scheduling of the work. Execute work in accordance with the phasing and construction schedule. Provide all necessary temporary connections and equipment to provide functional, operational systems during construction period when part of the building will be occupied and construction is still continuing in other portions.

#### **1.26 MATERIALS FURNISHED BY OTHERS**

- .1 Where materials are furnished by others for installation under this Division, the Sub-Contractor shall notify the supplier of dates he will be ready for delivery as specified in the General Conditions. The Sub-Contractor shall receive, unload, handle, store, protect and insure the material until ready for actual installation. Upon receipt of material furnished by others, the Sub-Contractor shall spot-check or check the entire shipment and promptly advise the Consultant in writing of any damage and/or missing components. Any material which is subsequently lost or damaged due to negligence on the part of the Sub-Contractor shall be promptly replaced (or repaired to the satisfaction of the Owner) at the Sub-Contractor's expense.

**1.27 CONNECTIONS TO EQUIPMENT FURNISHED BY OTHERS.**

- .1 Where the Drawings indicated equipment to be furnished by others, provide Electrical rough-in for each unit pursuant to its shop drawings, and make final connections, disconnect switches and other electrical facilities for a complete installation.

**1.28 ELECTRICAL LEGEND & SCHEDULES**

- .1 Refer to Electrical Drawings for Legend and Schedules

**PART 2 - PRODUCTS**

2.01 NIL

**PART 3 - EXECUTION**

3.01 NIL

END OF SECTION 26 05 00

## PART 1 - GENERAL

### 1.01 GENERAL

- .1 Submit Shop Drawings, Product Data and Samples as specified herein.
- .2 Designate in the Construction Schedule, or in a separate coordination schedule, dates for submission and dates that reviewed Shop Drawings, Product Data and Sample will be required. Give due consideration for review time required by the Consultant, with a minimum of fifteen (15) working days required. The submission of Appendix 'B' will be considered an acceptable submittal schedule.
- .3 All data and dimensions on shop drawings, product data and sample information to be based on units (Imperial or Metric) as shown on the contract documents.
- .4 Shop Drawings with errors or omissions and deviations will be returned "Not Reviewed".
- .5 The Contractor's responsibility for deviations in submission from the requirements of Contract Documents is not relieved by the Consultant's review of submittals, unless a deviation on the submittal is noted as such in writing and has been accepted by the Consultant.
- .1 Keep one (1) reviewed copy of each submission on site.

### 1.02 SHOP DRAWINGS

- .1 Review and stamp Shop Drawings, Product Data and Samples prior to submission to the Consultant. Confirm that necessary requirements have been determined and verified and that each submittal has been checked and coordinated with requirements of the Work and the Contract Documents. Submittals not stamped, signed, dated and identified as to the specific project, will be returned without being examined and shall be re-submitted when completed.
- .2 In the event expedited shop drawings reviews are required, be prepared to attend and participate at the request of the project manager with the appropriate shop drawings in hand.
- .3 Submit drawings in a clear and thorough manner:
  - .1 Identify details by reference to drawing No. and detail, schedule or room numbers as shown on Contract Documents.
  - .2 Minimum sheet size and larger sheets to be multiples of 8½" x 11".
  - .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated. Indicate cross references to design drawings and specification.
  - .4 Adjustments to shop drawings by the Consultant do not change the cost of the work. If adjustments affect the cost of Work, advise through normal channels in writing prior to proceeding with the Work.
  - .5 Make changes in shop drawings as directed by the Consultant. Resubmit and note any revisions other than those requested.
  - .6 If only minor adjustments are made, shop drawings to be returned and fabrication and installation of work to proceed.
- .4 Determine and verify:

- .1 Field measurements.
- .2 Field construction criteria.
- .3 Catalogue numbers and similar data.
- .4 Conformance with Specifications.
- .5 Co-ordinate each submittal with requirements of the Contract documents.
- .6 Each Shop Drawing will be stamped by the Consultant in the following format:
  - ☐ NOT REVIEWED ☐ REVIEWED
  - ☐ RESUBMIT ☐ REVIEWED AS MODIFIED
  - ☐ NOT SPECIFIED BY MCW, REVIEWED FOR MEP ONLY
- .7 This review by the Consultant is for the sole purpose of ascertaining conformance with the general design concept. This review shall not mean that the Consultant approved the detail design inherent in the shop drawings, responsibility for which shall remain with this Subcontractor submitting same, and such review shall not relieve this Subcontractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the contract documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication.
- .8 Products not specified by MCW are reviewed to confirm compliance with services provided only. Any changes required between provided services and shop drawing requirements will be identified for coordination between trades.
- .9 Shop drawings shall be accompanied by a complete copy of the attached "Shop Drawing Submittal Sheet" Section 26 05 01, Appendix 'A'.
- .10 Begin no fabrication or work which requires submittals until return of submittals reviewed by Consultant.

### 1.03 PRODUCT DATA

- .1 Where specified, Manufacturer's standard schematic drawings, catalogue sheets, diagrams, schedules, performance charts, illustrations and other standard descriptive data is acceptable provided there is conformance with the following:
  - .1 Clearly identify pertinent products or models.
  - .2 Show performance characteristics and capacities.
  - .3 Show dimensions and clearances required.
  - .4 Show wiring or piping diagrams and controls.
- .2 Manufacturer's standard schematic drawings and diagrams may require modifications to drawings and diagrams to provide information applicable to the Work.
- .3 Provide information specifically applicable to the Work.

### 1.04 SAMPLES

- .1 Samples to be labelled, of sufficient size and quantity to clearly illustrate:
  - .1 Functional characteristics integrally related parts and attachment devices.
  - .2 Full range of colour, texture and pattern.
- .2 Field Samples and mock-ups:

- .1 Erect, at the project site and in location acceptable to the Consultant.
- .2 Fabricate each sample and mock-up complete and finished.
- .3 Remove mock-ups at conclusion of Work or as specified by the Consultant.

#### **1.05 SUBMISSION REQUIREMENTS**

- .1 Submit promptly to approved schedule and in sequence to prevent submission delay in the Work.
- .2 Submission requirements:
  - .1 Shop Drawings: Submit shop drawings electronically. Coordinate submission with the construction team and the start of the project.
  - .2 Product Data: Submit a copy for each O & M Manual.
  - .3 Samples: Submit as specified, or as requested during the shop drawing review period.

#### **1.06 RESUBMISSION REQUIREMENTS**

- .1 Make corrections or changes to the submittals noted by the Consultant and resubmit.
- .2 Shop Drawings and Product Data:
  - .1 Revise drawings or data, and resubmit as noted on the initial submittal.
  - .2 Indicate any changes which have been made other than those noted by the Consultant.
- .3 Samples: Submit new samples as required for initial submittal as soon as possible after notification of the rejection of the original submission and mark "resubmitted samples".

#### **1.07 DISTRIBUTION**

- .1 Distribute reproductions of Shop Drawings and copies of Product Data which carry the Consultant's stamp to all parties as specified by Division One General Requirements.
  - .1 Job site file
  - .2 Project record document file
  - .3 Other affected contractors
  - .4 Subcontractors
  - .5 Supplier or fabricator (as applicable)
  - .6 Operations Manual.

### **PART 2 - PRODUCTS**

#### **2.01 NIL**

### **PART 3 - EXECUTION**

#### **3.01 NIL**

END OF SECTION 26 05 01

**SHOP DRAWING SUBMITTAL SHEET**

Project: West Scarborough Neighbourhood Community Centre  
313 Pharmacy Avenue, Toronto, On  
Mechanical And Lighting System Upgrade

Date: \_\_\_\_\_

Project No. 22241M Submittal No. \_\_\_\_\_

Section: \_\_\_\_\_

Equipment Description

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Contractor: \_\_\_\_\_

Sub-Contractor: \_\_\_\_\_

Suppliers Name: \_\_\_\_\_

Manufacturer: \_\_\_\_\_

Catalogue No.: \_\_\_\_\_

Variations From Tender Documents

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Engineer: MCW Consultants Ltd.  
207 Queen's Quay West, Suite 615  
Toronto, Ontario  
M5J 1A7

ELECTRICAL GENERAL REQUIREMENTS SECTION 26 05 01 – APPENDIX 'B' PROJECT: <u>West Scarborough Neighbourhood Community Centre</u> <u>313 Pharmacy Avenue, Toronto, On</u> <u>Mechanical And Lighting System Upgrade</u>  PROJECT No: 22241M			SHOP DRAWING SUBMITTAL SCHEDULE DIVISION 26						Date: July 23, 2025	
SECTION	DESCRIPTION	MANUFACTURER	SHOP DRAWING				DELIVERY		COMMENTS	
			SUBMITTED		RETURNED					
			SCHED	ACTUAL	SCHED	ACTUAL	SCHED	ACTUAL		
26 05 21	Wire and cable up to 600V									
26 24 16	Breakers									
26 28 13	Fuses									
26 28 23	Safety Switches									
26 50 00	Lighting Retrofit & New Luminaire									



## **PART 1 - GENERAL**

### **1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Requirements, and all documents referred to therein.

### **1.02 WORK INCLUDED**

- .1 Provide materials as specified herein to complete the work as required by the contract documents.

### **1.03 SUBMITTALS**

- .1 Submit Shop drawings as required.

## **PART 2 - PRODUCTS**

### **2.01 SLEEVES**

- .1 In concrete slabs, except as noted below, sleeves shall be #24 gauge galvanized steel or factory fabricated plastic sleeves, each with an integral flange to secure the sleeve to form work construction. Sleeves to extend 50mm (2") above finished slab to prevent water infiltration into or through the sleeve.
- .2 In waterproof concrete slabs and in other slabs where waterproof sleeves are required, provide Schedule 40 mild galvanized steel.

### **2.02 INSERTS AND BEAM CLAMPS**

- .1 Inserts for concrete form work shall be Crane Canada Ltd., #4-M Unistrut Ltd., or approved equal cast iron inserts, multiple type where required.
- .2 Inserts for precast concrete and existing concrete shall be lead cinch anchors of "WEJ-IT" or self-drilling "STARR" or "PHILLIPS" anchors.
- .3 Beam clamps for hanging and support to structural steel shall be Crane Canada Ltd., or equal.

### **2.03 ACCESS DOORS**

- .1 Minimum #12 gauge prime coat painted steel flush access doors, each complete with a heavy frame and anchor, heavy duty rust-resistant concealed hinges, a positive locking screwdriver lock, and mounting and finishing provisions to suit the particular construction in which it is installed. Access door sizes shall suit the concealed work for which they are supplied. Access doors in fire rated ceilings, walls, partitions, structures, etc., shall be ULC listed and labelled and of a rating to maintain the fire separation integrity.

- .2 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.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION OF SLEEVES**

- .1 Where conduits, raceways and conductors pass through structural poured concrete, supply sleeves, unless otherwise noted.
- .2 Size sleeves, unless otherwise noted, to leave 12mm clearance around the conduit, raceway, etc. Pack and seal the void between the sleeves and the conduit, raceway, conductor etc. for the length of the sleeves.
- .3 Pack all sleeves with a ULC and CSA approved one part intumescent elastomer as manufactured by 3M. The installation shall be formed for each specific application using the manufacturers recommended combination of the following:
  - .1 P25 caulk, Puty 303, penetration sealing system 7902 or 7904, composite sheet CS195 or wrap strip FS-195.
- .4 In poured concrete construction, accurately locate sleeves, and turn these sleeves over to the Division performing the concrete work for placement in the concrete form work. Sleeves shall be sufficiently rigid to prevent sleeve deformation when the concrete is poured, and shall be suitably plugged to prevent concrete from entering the sleeve.
- .5 Submit to the concrete reinforcement detailer at the proper times, drawings, indicating all required sleeves, recesses and formed openings in poured concrete work. Such drawings shall be completely and accurately dimensioned and shall relate sleeves, recesses and formed openings to suitable grid lines and elevation datum.
- .6 Supply sleeves of a water protecting type for installation in the following locations:
  - .1 In Mechanical and Fan Room floor slabs except where on grade;
  - .2 In slabs over Mechanical, Fan, Electrical and Telephone equipment rooms or closets;
  - .3 In all floors equipped with waterproof membranes;
  - .4 In the roof.
- .7 "Gang" type sleeving will be permitted only with the Consultant's approval.
- .8 Terminate sleeves for work which will be exposed so that the sleeve is flush at both ends with the wall, partition or slab surface so that the sleeves may be completely covered by escutcheon plates.
- .9 Openings for multiple conduit or conductor runs, etc., will be provided by the Division responsible for the particular construction in which the opening is required. Carefully co-ordinate the opening locations with the particular Division and ensure that openings are suitably sized and located. Seal the space between the opening and the conduit, conductors, etc., for the length of the opening as for sleeves above.

- .10 Where a round or formed opening is required, where placement of a sleeve has been missed, or where provision of an opening has not been properly co-ordinated with the Concrete Division, neatly cut a suitably sized hole or opening using proper tools to the approval of the Consultant. Prior to cutting any such holes or openings, determine whether or not any reinforcing steel or services, are concealed behind the surface where the hole or opening is to be cut and be responsible for all costs incurred for correcting any damage caused to the structure or services due to cutting holes or openings without prior study and approval.

### **3.02 INSTALLATION OF INSERTS AND BEAM CLAMPS**

- .1 Provide all inserts, beam clamps, fasteners, and similar hardware required for conduit, duct, raceway, conductor, etc., and equipment hanger and/or support materials unless otherwise noted.
- .2 Accurately and properly set concrete inserts in the concrete framework.
- .3 For runs of three (3) or more conduits, raceways, or conductors in concrete form work, use multiple type inserts used for the smallest conduit in the group.
- .4 Where inserts are required in pre-cast concrete and in concrete work where concrete inserts have not been installed, drill a neat hole of the proper diameter and depth in the concrete and insert an anchor to accept the hanger rod, bolt, etc. or where concrete mass permits, use self-drilling concrete anchors.
- .5 Fasten hangers and support provisions to brick or masonry with expansion shields and machine bolts, or for light loads, use plugs and screws.
- .6 In cavity walls and/or ceilings, use two (2) wing toggles and for heavy loads, provide steel anchor plates with two (2) or more toggles to spread the load.
- .7 Provide beam clamps for attaching, hanging and/or support provisions to structural steel, or where approved by the Consultant, weld the hanging and support provisions to the structural steel.
- .8 Explosive power actuated fasteners will not be permitted unless specific approval for their use has been obtained from the Consultant.
- .9 Use fibre or lead screw anchors for anchoring screws.

### **3.03 SUPPLY OF ACCESS DOORS**

- .1 Supply access doors to give access to all junction boxes, pullboxes, conductor joints and other similar electrical work which may need maintenance or repair but which is concealed in inaccessible construction except as otherwise specified herein or on the drawings.

- .2 Before commencing installation of electrical work, prepare on a set of reflected ceiling plans with complete layouts of all ceiling access door which will be required. Submit these layouts to the Architect for approval and show the exact sizes and locations of such ceiling access doors. Locate access doors in walls and partitions to the Consultant's approval, and arrange electrical work to suit.
- .3 Supply the respective trade with panels, doors or the frames therefore complete with all pertinent information and pay their trade for installation.
- .4 Access doors shall be, wherever possible, of a standard size, for all applications. Confirm exact dimensions with the Consultant, prior to ordering.
- .5 Submit a sample of each proposed type of access door to the Consultant for approval.

#### **3.04 PLYWOOD**

- .1 Provide all plywood indicated on the drawings required for the work of Division 26. The backboards shall be 19mm thick, good one side and shall be impregnated with fire retardant material.

#### **3.05 EQUIPMENT CURBS, BASES AND SUPPORTS**

- .1 Set all floor mounted equipment on 100mm high concrete housekeeping pads 100mm wider and longer than the equipment base dimensions.
- .2 Furnish dimensioned drawings, templates and anchor bolts for proper setting of equipment on bases and pads. Provide all structural steel frames, brackets, etc., for equipment bases and supports unless otherwise noted, and be responsible for all required levelling, alignment and grouting of the equipment.
- .3 Provide structural steel stands for equipment where indicated or specified. Flange bolt stands to housekeeping pads.
- .4 Where equipment is suspended above floor level it shall be, unless otherwise noted, supported on a suitable structural steel angles or channels bracketed to the wall or secured by hanger rods to slab construction, or where loading is excessive, from separate structural steel members carried to either the floor or ceiling, or both as required.

#### **3.06 EXCAVATION AND BACKFILL**

- .1 Do all excavating bedding backfill and related work for the work of Division 26 as specified therein.
- .2 For all electrical excavation, excavate to 150mm below and a minimum of 200mm to either side of the cable or duct run. Fill back with a bedding of granular 'A' gravel or sand. Minimum coverage shall be 750mm.

- .3 Refer to details on the drawings and to utility company requirements for concrete encased duct installation.
- .4 Where excavation is necessary in proximity to and below the level of any footings, bed with concrete to the level of the highest adjacent footing. Concrete strength shall be as directed by the Consultant.
- .5 Carry out pavement cutting and repair of the Owners and Public Property as may be required for excavation and backfill work.

### **3.07 CONCRETE**

- .1 Do all concrete or related work required for the work of Division 26 as specified herein.
- .2 Division 26 shall be responsible for all co-ordination to meet authority having jurisdiction requirements for ducts, provision of ducts and fittings as specified.

### **3.08 CUTTING AND PATCHING**

- .1 Inform other trades in time concerning required openings. In work already finished, cutting and patching shall be done by the trades installing the affected work, at the expense of Division 26. Obtain the approval of the Consultant, before doing any cutting.

### **3.09 PROVISION FOR SERVICES CROSSING BUILDING EXPANSION JOINTS**

- .1 Wherever services (conduit, cables etc.) cross building expansion joints, install the services in such a manner to permit free movement without imposing additional stress or loading upon the support system, and to prevent excessive movement at joints and connections.

### **3.10 SPRINKLER PROTECTION**

- .1 Weatherproof equipment where noted in the specifications and/or drawings shall have EEMAC Type 3 enclosure in accordance with the requirements of CSA C22.2 No. 94 Standard.

### **3.11 FLASHING**

- .1 Flash all electrical parts passing through or built into an outside wall, or a waterproof floor.
- .2 Provide copper flashing for sleeves passing through exterior walls or water proof floors.
- .3 Provide counter flashing on conduits passing through roofs to fit over flashing or curb. Supply flashing to appropriate division for installation.

### **3.12 METALS**

- .1 Steel construction required solely for the work of electrical trades and not shown on architectural or structural drawings shall be provided by Division 26 to the acceptance of the Consultant.

**3.13 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to center line of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not indicated verify before proceeding with installation.
- .3 Install electrical equipment at the following heights unless indicated otherwise.
- .4 Prior to rough-in, co-ordinate and have approved by the Consultant all mounting heights of devices.
- .5 Mounting heights shall meet the requirements of the "Barrier Free" section of OBC.
  - .1 Local switches: 1100mm
  - .2 Local switches in suites: 950mm
  - .3 Wall receptacles:
    - .1 General: 400mm
    - .2 Above top of continuous baseboard heater: 200mm
    - .3 Above top of counters or splash back: 175mm
    - .4 In mechanical room: 1200mm
  - .4 Panelboards (to top of panel trim): 1850mm
  - .5 Telephone and interphone outlets: 400mm
  - .6 Wall mounted telephone and interphone outlets: 1100mm
  - .7 Fire alarm stations: 1100mm
  - .8 Fire alarm Signalling Devices: 2300mm or 150mm below Ceiling, to top of device
  - .9 Television outlets: 400mm
  - .10 Pay Telephones: 1100mm

END OF SECTION 26 05 05

## **PART 1 - GENERAL**

### **1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Requirements, and all documents referred to therein.

### **1.02 WORK INCLUDED**

- .1 Provide lamacoid nameplates and other identification means for a complete installation.

### **1.03 SUBMITTALS**

- .1 Submit a list of proposed labels for review prior to manufacturing.

## **PART 2 - PRODUCTS**

### **2.01 NIL**

## **PART 3 - EXECUTION**

### **3.01 STANDARD IDENTIFICATION**

- .1 Identify electrical work as specified herein:
  - .1 For each piece of electrical distribution equipment from the electrical source of supply up to and including panelboards and motor systems, for special control panels and cabinets, and for any other piece of equipment where specified in this Section, provide engraved lamacoid identification nameplates.
  - .2 Nameplates shall generally be black-white-black with bevelled edges, secured to apparatus with stainless steel screws. Generally lettering shall be 6mm high but equipment in the main electrical room shall be provided with lettering 13mm high.
  - .3 Warning signs, if and when required, shall be red with white lettering.
  - .4 Equip large multiple cell or component apparatus such as switchboards and distribution panels with main nameplates identifying the equipment, voltage characteristics and capacity and with sub-nameplates clearly identifying each cell or component and its service.
  - .5 Panelboard nameplates shall identify the panelboard numbers designated on the drawings, unless otherwise instructed. Nameplates for disconnect switches, control panels and cabinets shall outline their service.
  - .6 Motor starters, magnetic and manual, shall identify the piece of motorized equipment being serviced.
  - .7 Exact nameplate wording and sizes must be approved by and confirmed by the Consultant prior to manufacture.
  - .8 Directories for branch circuit panelboards shall be clearly and neatly typewritten, accurately identifying the type, location and wattage of the connected load for each circuit breaker. Directories shall be secured to the rear of the cabinet door under protective plastic. Incorporate copies of all panel board directories in each copy of operating and instruction manuals.

- .9 Clearly identify each branch circuit breaker in a permanent manner to correspond with directories. Glued paper identification will not be acceptable.
- .10 Clearly identify main pull or junction boxes (excluding obvious outlet boxes) by painting the outside of the covers. Paint colours shall be in accordance with the following schedule:
  - .1 Lighting - Yellow
  - .2 Power - Blue
  - .3 Emergency Power - Orange
  - .4 Fire Alarm - Red
  - .5 Telephone - Cream
  - .6 Miscellaneous Signals - Brown
- .11 In addition to painting miscellaneous signal boxes clearly identify the specific system in which the box is installed.
- .12 Colour code empty conduit capped and terminated for future use as specified above and clearly identify its intended use by means of securely attached tags.
- .13 Colour code conductors throughout to identify phases, neutrals and grounds, by means of coloured conductor insulation. Colours shall be as follows:
  - .1 Phase A Red
  - .2 Phase B Black
  - .3 Phase C Blue
  - .4 Ground Green
  - .5 Neutral White
- .14 Control conductors, in addition, shall be numbered with Brady Ltd., or Electrovert Ltd., Z-type markers. Colour code conductors, for special component per manufacturer's recommendations.

### 3.02 PAINTING AND FINISHES

- .1 Painting of exposed electrical work will be done as part of the work of Section 09900. Equipment to be located in finished areas shall be provided to site prime coated.
- .2 All exposed electrical fittings, supports, hangers, frames conduit, racks, boxes, raceways and similar material and apparatus shall be galvanized or finished with corrosion resistant primer ready to accept paint. Take special care when priming work exposed to the elements or in wet areas to prevent rust or corrosion from damaging adjacent surfaces.
- .3 All large switchgear, transformers, distribution centres, panelboard, starters, disconnects or similar apparatus shall be factory finished in gloss air dry enamel over corrosion resistant sealer primer. Unless specified to the contrary, this finish shall be ASA #61 grey.
- .4 Touch-up and/or repaint any factory finished equipment not scheduled to be painted by Section 09900 that has been scratched or otherwise damaged during installation.

END OF SECTION 26 05 10



## **PART 1 - GENERAL**

### **1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Requirements and all documents referred to therein.

### **1.02 WORK INCLUDED**

- .1 Demolition and restoration of areas as identified on the contract documents.

### **1.03 WORK IN EXISTING BUILDING**

- .1 The building shall remain open and in operation during the construction period.
- .2 All lighting scope shall occur after hours.
- .3 Where existing services such as electrical power, fire alarm system, television system etc., are required to be disrupted and/or shut-down, co-ordinate the shut-downs with the Owner and carry out the work at a time and in a manner acceptable to them. Carefully schedule all disruption and/or shut-downs and ensure that the duration of same is kept to the absolute minimum. Submit for approval a written, concise schedule of each disruption at least 72 hours in advance of performing work and obtain Owner's written consent prior to implementing.
- .4 Where disruption to life safety systems are required, comply with paragraph above and provide continuous monitoring during shut down period and ensure that all systems are reactivated prior to leaving site at the end of each working day.
- .5 Should any temporary connections be required to maintain services during work in the existing building, supply and install all necessary material and equipment and provide all labour at no extra cost. Should any existing system be damaged, make full repairs without extra cost, and to the satisfaction of the Consultant.
- .6 Refer to Division 1 for phasing and staging of work and adhere to that program. Comply with instructions regarding working hours necessary to maintain the building in operation.
- .7 The drawings indicating items of equipment to be deleted or relocated have been prepared as a guideline for this subcontractor, but shall not be construed as indicating every item of equipment or conduit. Be responsible for determining site conditions by personal examination.
- .8 Where existing services (conduits, receptacles, switches, etc.) presently mounted on and/or concealed behind existing finishes become exposed during the renovation work and where these services will not be concealed behind or mounted on new finishes, include for relocating the service so as to be concealed behind or on new or existing finishes. Co-ordinate new locations with the Consultant.

## **PART 2 - PRODUCTS**

### **2.01 NIL**

## **PART 3 - EXECUTION**

3.01 NIL

END OF SECTION 26 05 14

**PART 1 - GENERAL**

**1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Requirements, and all documents referred to therein.

**1.02 WORK INCLUDED**

- .1 Provide all wiring as specified herein for a complete installation, as required by the contract documents.

**1.03 SUBMITTALS**

- .1 Submit shop drawings of building wire and cables.
- .2 Submit a list of feeders used on the project, indicating cable type and size.

**1.04 ACCEPTABLE MANUFACTURERS**

- .1 Acceptable manufacturers are; Canada Wire, Pirelli, Alcan NuAl and Pyrotenax MI Cable where specified.

**PART 2 - PRODUCTS**

**2.01 BRANCH CIRCUIT CONDUCTORS**

- .1 "RW90" single conductor to CSA C22.2 No. 38-95, colour coded 90°C rated, with approved manufactured connectors at joints.
- .2 "RWU90" (-40°C) single conductor to CSA C22.2 No. 38-95, colour coded, 90°C rated, with joints soldered and taped to the Consultant's approval.
- .3 Flexible armoured cable, CSA type "AC-90" to CSA C22.2 □ 51-95.
- .4 "TWH" single conductor to CSA C22.2 No. 75-M1983 (R1992), colour coded, 90°C, rated with approved manufactured connectors at joints.
- .5 Single conductor colour-coded, rubber insulated wire to CSA type "R90" 90°C rated.
- .6 NuAl conductors where shown to be used, shall be provided with compression terminations, applied with corrosion preventing compound, and hydraulic or power activated tools shall be used for all connections.

- .7 Branch circuit conductors up to and including #12 AWG shall be solid. Branch circuit conductors in sizes larger than #12 AWG shall be stranded. All branch circuit conductors shall be constructed of 98% conductive copper, unless otherwise noted, and shall be approved for 600 volts.
- .8 Electric service, distribution and special conductors are specified in this Section and/or on the drawings.
- .9 Lubricant shall be Ideal "Yellow 77" or approved equal.

## **2.02 LOW VOLTAGE (24 VOLT) CONDUCTORS**

- .1 Colour-coded #18 AWG TFF thermoplastic insulated wire for 600 volt service, complete with the number of copper conductors required.

## **2.03 MICC CABLE**

- .1 Pyrotenax of Canada Ltd. two hour rated mineral insulated cables and accessories to CSA standard C22.2 No. 124 (R1981).
- .2 Conductors shall be solid bare soft annealed copper.
- .3 Insulation shall be compressed powdered magnesium oxide to form compact homogeneous mass throughout the entire length of the cable.
- .4 The overall covering shall be an annealed seamless copper sheath type MI rated 600V, 250°C.
- .5 Terminations shall be factory pre-packaged kits.
  - .1 (1850°F with hose stream).
  - .2 Low toxicity index per NES-713.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION OF BRANCH CIRCUIT CONDUCTORS**

- .1 Provide all required branch circuit conductors.
- .2 Conductors for branch circuit work inside the building and above ground, except as noted below, shall be as specified in Article #2.01 Item .1 above.
- .3 Conductors for branch circuit work underground as specified in Article #2.01, Item .2 above.
- .4 Conductors for branch circuit lighting work (fixture tails) in accessible ceiling spaces, maximum length 1500mm, and branch circuit work in cavity wall construction from wiring devices to ceiling spaces, maximum length 6m, shall be as specified in Article #2.01, Item 3 above.

- .5 Conductors for branch circuit work to electric heating coils and/or units shall be as specified in Article #2.01, Items .4 and .5 above.
- .6 Branch circuit conductor sizes are scheduled and/or specified on the drawings. Such sizes are minimum requirements and must be increased, where required, to suit the length of run and voltage drop.
- .7 Do not use conductors smaller than #12 AWG in systems over 30 volts, unless otherwise noted.
- .8 Use lubricant when pulling wires into conduit. Ensure that wires are kept straight and are not twisted or abraded.
- .9 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.
- .10 Splicing of all conductors shall be done with Ideal Wing nut #450 Series for conductors from #14 Awg to #8 Awg.
- .11 For all conductors larger than #8 AWG, splicing shall be done with Burndy Serut connectors wrapped with 3 m #33 scotch tape.
- .12 Provide a dedicated neutral for each branch circuit conductor unless noted otherwise.
- .13 Joints in all conductors shall be kept to a minimum and all conductors shall be installed in continuous unbroken runs.

### 3.02 INSTALLATION OF LOW VOLTAGE (24) VOLT CONDUCTORS

- .1 Install all low voltage wiring in conduit.
- .2 Refer to manufacturer's shop drawings for special requirements pertaining to low voltage wiring.
- .3 Refer to individual specification section and the drawings for additional wiring requirements.

### 3.03 INSTALLATION OF MICC CABLE

- .1 For feeders and branch circuit conductors which are used in connection with fire alarm systems and all life safety systems connected to a standby generator power source, and where such feeders and conductors are not embedded in concrete, utilize Pyrotenax MICC cables as specified. Adjust all conductor sizes as required to suit load as per the schedule on the drawings.
- .2 MICC cables shall be clipped and fastened on maximum 12" centres and shall be fastened within 6" of each bend.
- .3 All MICC cables shall be meggered out using a 1000 volt megger upon completion of terminations.

END OF SECTION 26 05 21

## **PART 1 - GENERAL**

### **1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Requirements, and all documents referred to therein.

### **1.02 WORK INCLUDED**

- .1 Provide a complete system of electric service grounding as outlined herein and as specified and detailed on the drawings. Grounding shall comply with the requirements of all grounding work, which is required but not specified herein or shown on the drawings.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- .1 All grounding conductors shall be stranded copper, bare or insulated as indicated on Drawings or in Specifications.
- .2 Use Cadweld or Burndy Thermoweld process for all weld connections. AMP of Canada Ltd. Wrench-Lok grounding connectors are an acceptable equivalent to welded connections.
- .3 All ground connectors to be designed and approved for grounding purposes.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- .1 Bond all interior non-electrical metallic piping systems to the electrical system ground
- .2 Ground the neutral point of each secondary wye connected transformer.
- .3 Ground all conduit, and all non-current carrying metal parts, equipment cases, frames etc.
- .4 Where conduit systems are used for grounds, provide all necessary bushings, studs and jumpers as may be required to maintain effective continuity of ground. Provide separate ground conductors in all non-metallic conduits and EMT conduit.
- .5 Ground each piece of fixed equipment back to the switchboard or panel feeding that equipment, by one of the following methods:

- .1 Install a separate bare soft drawn copper ground inside each feeder conduit. At the switchboard or distribution panel, provide a grounding bushing, loop the ground conductor through the bushing, and connect to the switchboard ground bus. At the fixed equipment, connect to an internal ground bus, or connect to the inside of the metal enclosure utilizing approved screws and connectors (remove all paint).
- .2 For branch circuits, the conduits may be used for grounding, provided seamless steel fittings are used on EMT and threaded fittings are used on rigid conduit. At each receptacle connect a stranded copper ground wire from the outlet box to the grounding terminal on the receptacle. Install a separate grounding conductor in all PVC conduits.
- .3 Where equipment is fed by a multi-conductor power cable, provide a ground conductor in the cable. At the switchboard or panel, connect to the ground bus. Use a grounding connector on the cable for positive grounding of the metallic sheath. Loop the ground wire to the grounding connector.
- .6 Where equipment is fed by single conductor flexible armoured cables, provide separate ground conductor and non-ferrous metallic plate and grounding connectors at the switchboard or panel for terminating cables. Run grounding conductor inside fixed equipment and terminate at the grounding connection. At the load end provide an insulating plate for terminating cables, the outer sheaths to be ungrounded.
- .7 Run a separate ground wire in all flexible conduits. Connect each end to ground bus or lug or connector.
- .8 Where mechanical protection is required for insulated grounding conductors install in rigid conduit. Use rigid PVC conduit in concrete or below grade slab and aluminium conduit in other locations.
- .9 Provide weld connection or wrench type grounding connectors for:
  - .1 All connections between grounding conductors.
  - .2 All connections between grounding conductors and cable lugs.
- .10 Arrange grounding to provide the minimum impedance paths for ground fault currents. Provide any additional grounding required for approval by the inspecting authorities.
- .11 Ground uninsulated metallic materials, which are located below surfaces heated by electric heating cable.

END OF SECTION 26 05 27



## **PART 1 - GENERAL**

### **1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Requirements, and all documents referred to therein.

### **1.02 WORK INCLUDED**

- .1 Provide all hangers and supports as required to provide a complete and operational system as required by the contract documents.

## **PART 2 - PRODUCTS**

### **2.01 SUPPORT CHANNELS**

- .1 U-shape, size 41 x 41 x 2.5mm thick, surface mounted, suspended or set in poured concrete walls and ceilings, as required for the specific application.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- .1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
  - .1 One-hole steel straps to secure surface conduits and cables 50mm and smaller.
  - .2 Two-hole steel straps for conduits and cables larger than 50mm.
  - .3 Beam clamps to secure conduit to exposed steel work.
- .6 Suspended support systems
  - .1 Support individual cable or conduit runs with 6mm dia. threaded rods and spring clips.
  - .2 Support 2 or more cables or conduits on channels supported by 6mm dia. threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface-mounting of two or more conduits, use channels at 1.5m o.c. spacing.

- .8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.
- .12 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 26 05 29

**PART 1 - SPART 1 – GENERAL**

**1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Requirements, and all documents referred to therein.

**1.02 WORK INCLUDED**

- .1 Provide all conduits, fastenings, fittings and boxes for a complete installation, as required by the contract documents.

**PART 2 - PRODUCTS**

**2.01 CONDUITS**

- .1 Rigid galvanized steel, CSA C22.2 No. 45, with exterior zinc and interior enamel coatings, galvanized threads where factory cut, red lead coated threads where site cut, factory made bends where site bending is not possible, factory made and threaded fittings and “tomic” joints and terminations made with rigid galvanized steel couplings, concrete tight where required.
- .2 EMT (Thinwall), to CSA C22.2 No. 83, complete with factory made bends where site bending is not possible and joints and terminations made with set screw steel type connectors, concrete tight where required, maximum allowable size shall be 50mm diameter.
- .3 Galvanized steel flexible liquid-tight metallic conduit, to CSA C22.2 No. 56, complete with proper and suitable liquid-tight flexible galvanized steel conduit connectors at terminations.
- .4 Galvanized steel flexible metallic conduit to CSA C22.2 No. 56, complete with suitable type steel connectors at terminations.
- .5 Rigid plastic (PVC) conduit to CSA C22.2 No. 211.1 complete with site made heat gun bends to 50mm diameter, factory made bends for conduit larger than 50mm, solvent weld joints with socket couplings and proper connectors and adaptors at terminations.
- .6 Electrical non-metallic tubing to CSA C22.2 No. 211.0 – M1984 complete with suitable type connections and couplings.
- .7 Conduit racks shall be Unistrut Ltd. Electrovert Ltd., “Cantruss”, Burndy Ltd., “Flexible” or equivalent.

**2.02 STANDARD OUTLET BOXES**

- .1 Sheet Steel outlet boxes:
  - .1 Electro galvanized steel single and multi-gang flush device boxes for flush installation.

- .2 Electro galvanized steel utility boxes for outlets connected to surface mounted EMT conduit in interior application.
- .3 102mm galvanized steel octagonal boxes for lighting fixture outlets
- .4 102mm galvanized square outlet boxes with extension and plaster ring for flush mounting in finished plaster walls.
- .2 Masonry boxes: Electro galvanized steel masonry single and multi-gang boxes for devices flush-mounted in exposed block walls.
- .3 Concrete boxes: Non-metallic concrete boxes with matching extension and plaster rings as required for flush-mounting in concrete.
- .4 Conduit boxes: Type FS and FD ferralloy boxes with factory threaded hubs and mounting feet for exterior surface wiring of switches and receptacles.
- .5 Each outlet box must be suitable in all respects for the application, and complete with securing lugs, knock-outs, and where necessary, suitable plaster rings, concrete rings, covers and any other required accessory.
- .6 Outlet boxes for special wiring devices, for special equipment and for special applications, if and where required, are specified hereinafter in this Section or on the drawings.
- .7 347 volt outlet boxes for 347 volt switching devices.
- .8 Provide blank cover plates for all boxes without wiring devices.

### **2.03 PULLBOXES AND JUNCTION BOXES**

- .1 Pullboxes and junction boxes shall be constructed of galvanized or prime coated steel. Each shall be suitable in all respects for the applications, and complete with screw-on hinged covers as required.
- .2 The physical size of pullboxes shall be as required by the "Ontario Electrical Safety Code" to suit the number and size of conduits and conductors.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION OF CONDUITS**

- .1 Install conduit concealed in all finished areas, and concealed to the degree made possible by finishes in partially finished and unfinished areas. Conduit may be exposed in unfinished areas such as Electrical Rooms and Mechanical Rooms, unless otherwise noted on the drawings or specified herein. Refer to and examine the architectural drawings and on the drawings or specified herein. Refer to and examine the architectural drawings and room finish schedules to determine finished, partially finished and unfinished areas of the building.

- .2 Where conduits are exposed, arrange same to avoid interference with other work and parallel to the building lines. Where horizontal conduits are exposed, install as high as possible. Do not install conduit within 150mm of "hot" pipes or equipment unless the conduit is associated with the equipment.
- .3 Provide conduit for all electric service distribution and branch circuit conductors except armoured cable, and bus duct and except for applications where duct, cable tray and similar raceway material is provided.
- .4 Conduit for branch circuit and distribution conductors, except as noted hereinafter, shall be as specified in Article #2.01, Item .1 above.
- .5 From 1200mm above the ground floor slab.
  - .1 Conduit for branch circuit conductors concealed in masonry work in drywall, in shafts and furring's above ground;
  - .2 For branch circuit conductors exposed inside the building; and
  - .3 For distribution and branch circuit conductors concealed in poured concrete work above ground (not on grade); shall be as specified in Article #2.01 Item .2 above.
- .6 Conduit for short branch circuit connections to motorized equipment (minimum length 450mm; maximum length 600mm with 180 degree loop where possible) shall be as specified in Article #2.01, Item .3 above.
- .7 Conduit for short branch circuit connections to electric heating units where 90°C rated conductors are required (minimum length 450mm - maximum length 600mm with 180 degree loop where possible) and at points where distribution and/or branch circuit conductors cross building expansion joints shall be as specified in Article #2.01, Item .4 above.
- .8 Conduit for distribution and branch circuit conductors underground and for distribution and branch circuit conductors in special corrosive areas as defined herein shall be as specified in Article #2.01, Item .5 above.
- .9 Conduit for branch circuit conductors where concealed in walls or encased in concrete shall be as specified in Article #2.01 Item 6 above.
- .10 Conduits supplying equipment classified as explosion proof (i.e., fuel pumps and associated and adjacent equipment) shall be rigid galvanized steel for their entire length from their power source. Provide all required seals as specified in OESC.
- .11 Provide a separate ground conductor in all conduits.
- .12 Secure conduit located in poured concrete work in place in a manner such that conduit will not float or move when concrete is poured. Protect conduit from concrete and water penetration during the concrete pour.

- .13 Support and secure surface mounted and suspended single or double runs of metal conduit at support spacing in accordance with "Ontario Electrical Safety Code" requirements by means of galvanized pipe straps, conduit clips, ring bolt type hangers, or by other manufactured devices. Support multiple mixed size metal conduit runs with conduit racks spaced to suit spacing requirements of the smallest conduit in the group.
- .14 Install conduit parallel or perpendicular to building lines.
- .15 Generally, conduit is sized on the drawings. Conduit not sized on the drawings shall be sized in accordance with the latest edition of the Ontario Electrical Safety Code. 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 the Ontario Electrical Safety Code. Where conductor sizes are increased to suit voltage drop requirements, increase the scheduled or specified conduit size to suit.
- .16 Increase conduit sizes for heavily insulated conductors (i.e., "TWU"), a minimum of one (1) conduit size, regardless of the size indicated or required.
- .17 The maximum allowable size of conduit for installation in poured concrete work must be determined in consultation with the Consultant prior to installation. The placement of reinforcing steel in structural concrete work will take precedence over the placement of conduit. Multiple runs of conduit in poured concrete work must be adequately spaced as directed by the Consultant.
- .18 Do not install horizontal runs of conduit in masonry walls.
- .19 Ensure that all conduit systems which are left empty are clean, clear, capped and properly identified. Provide suitable fish wires in all such conduit.
- .20 Provide a minimum of two (2) 25mm diameter spare conduits up to and into ceiling spaces from flush mounted panelboards located below and/or near a hung ceiling.
- .21 Support and secure surface mounted and suspended rigid PVC plastic conduit with hangers and supports as specified above for metal conduit but at support spacing in accordance with the conduit manufacturer's published recommendations.
- .22 Support all conduit installed underground on well tamped flat bed of earth, free from rocks or protrusions of any kind.
- .23 Conduit fittings shall be, unless otherwise noted, constructed of the same material as the conduit and suitable in all respects for the application.
- .24 Provide proper adaptors for joining conduits of different materials.
- .25 Ends of all site cut conduit must be square and properly reamed.

- .26 All conduits for high voltage cable installation shall be rigid galvanized steel.
- .27 Electrical conductors supplying all equipment connected to a source of emergency supply shall be installed in service spaces that do not contain other combustible material or shall be protected against exposure to fire as allowed by the Building Code. Provide fire rated enclosures to ensure continued operation for a minimum period of 2 hours from the source of power supply to the branch circuit supplying the equipment.
- .28 Use of Pyrotenax or approved equal Mineral Insulated copper sheathed cables is an acceptable alternative to providing a fire rating around conduit and cable.

### **3.02 INSTALLATION OF OUTLET BOXES**

- .1 Provide an outlet box for each lighting fixture, wiring device, telephone outlet and any other outlet specified herein or shown or specified on the drawings, unless otherwise noted.
- .2 Generally, mounting heights and locations for outlets are shown on the drawings and/or specified herein, however, confirm the exact location and arrangement of all outlets with the Consultant prior to roughing-in. Architectural drawings and the Consultant's instructions have precedence over electrical drawing diagrammatic layouts and specified mounting heights and locations.
- .3 Do not install outlet boxes "back-to-back" in walls and partitions. Such outlets must be staggered and sealed against noise transmission. "Thru-Wall" type outlet boxes will not be permitted for any application.
- .4 Support and secure boxes independent of the conduit or cable connected thereto.
- .5 All recessed outlet boxes for surface mounted devices or lighting fixtures must be totally concealed by the device or fixture.

### **3.03 INSTALLATION OF PULLBOXES AND JUNCTION BOXES**

- .1 Provide pullboxes in conduit systems wherever necessary to facilitate conductor installations. Generally, conduit runs exceeding 30m in length, or with more than two (2) 90 degree bends shall be equipped with a pullbox installed at a convenient and suitable intermediate location.
- .2 Provide a junction box wherever required and where shown and/or specified on the drawings.
- .3 All pullboxes and junction boxes must be accessible after the building is completed.
- .4 Accurately locate and identify all concealed pullboxes and junction boxes on "as-built" record drawings.
- .5 Support and secure all boxes independent of the conduit or cable connected thereto.

- .6 Install identification labels indicating system name on all pullboxes and junction boxes.

END OF SECTION 26 05 33



## **PART 1 - GENERAL**

### **1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Requirements and all documents referred to therein.
- .2 The panelboards and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of EEMAC and CSA.

### **1.02 WORK INCLUDED**

- .1 Provide all panelboards as specified and shown for a complete installation, as required by the contract documents.

### **1.03 SUBMITTALS**

- .1 Submit shop drawings showing the following information:
  - .1 Breaker layout drawing with dimensions indicated and nameplate designation.
  - .2 Component list.
  - .3 Conduit entry/exit locations.
  - .4 Assembly ratings including:
    - .1 Short circuit rating.
    - .2 Voltage
    - .3 Continuous current
  - .5 Cable terminal sizes.
- .2 Where applicable, the following additional information shall be submitted:
  - .1 Key interlock scheme drawing and sequence of operations.

### **1.04 QUALIFICATIONS**

- .1 The manufacturer of the panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers and fusible switches.
- .2 The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Consultant, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

### **1.05 ACCEPTABLE MANUFACTURERS**

- .1 Schneider Canada, Cutler Hammer, ABB, and Siemens.

## **PART 2 - PRODUCTS**

## **2.01 RATINGS**

- .1 Panelboards shall have short circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes RMS symmetrical.
- .2 Panelboards shall be labelled with a CSA short circuit rating. When series ratings are applied with integral or remote upstream devices, a label shall be provided. Series ratings shall cover all trip ratings of installed frames. It shall state the conditions of the CSA series ratings including:
  - .1 Size and type of upstream device.
  - .2 Branch devices that can be used.
  - .3 CSA series short circuit rating.
- .3 Circuit breakers shall have a minimum interrupting rating of 10,000 amperes symmetrical at 240 volts and 14,000 amperes symmetrical at 600 volts.

## **2.02 CONSTRUCTION**

- .1 Interiors shall be completely factory assembled with bolt-on devices. They shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
- .2 Trims for lighting and appliance panelboards shall have doors with concealed hinges over all circuit breaker handles. Doors in panelboard trims shall not uncover any live parts. Doors shall have a semi-flush cylinder lock and catch assembly. Trim fastening screws shall not be visible.
- .3 Distribution panelboard trims shall cover all live parts. Switching device handles shall be accessible.
- .4 Surface trims shall be same height and width as box. Flush trims shall overlap the box by one (1) inch on all sides.
- .5 A directory card with a clear plastic cover shall be supplied and mounted on the inside of each door.
- .6 All locks shall be keyed alike.

## **2.03 BUS**

- .1 Main bus bars shall be plated aluminium sized in accordance with CSA standards to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum.
- .2 Full-size insulated neutral bars shall be included for panelboards shown with neutral. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

**2.04 POWER DISTRIBUTION PANELBOARDS – CIRCUIT BREAKER TYPE**

- .1 Power distribution panelboards and the devices contained therein shall have series interrupting ratings as indicated on the drawings. Panelboards shall have molded case circuit breakers as indicated below.
- .2 Molded case circuit breakers shall provide circuit overcurrent protection with inverse time and instantaneous tripping characteristics. Ground fault protection shall be provided where indicated.
- .3 Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-centre switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.
- .4 Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.
- .5 Where indicated, circuit breakers shall be CSA listed for series rating.
- .6 Where indicated, circuit breakers shall be current limiting.
- .7 Circuit breakers 400 ampere frame and below shall be thermal-magnetic trip units and inverse time-current characteristics.
- .8 Circuit breakers 600 ampere through 1200 ampere frame shall be microprocessor-based RMS sensing electronic trip units and the following features:
  - .1 Each molded case circuit breaker microprocessor-based tripping system shall consist of three current sensors, a trip unit, and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. True RMS sensing circuit protection shall be achieved by analyzing the secondary current signals received from the circuit breaker current sensors and initiating trip signals to the circuit breaker trip actuators when pre-determined trip levels and time delay settings are reached.
  - .2 Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed or adjustable as indicated. Rating plugs shall be interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.
  - .3 The microprocessor-based trip unit shall have thermal memory capabilities to prevent the breaker from being reset following an overload condition until after a preset time delay.
  - .4 When the adjustable instantaneous setting is omitted, the trip unit shall be provided with an instantaneous override. Internal ground fault protection adjustable pick-up ratings shall not exceed 1200 amperes. Provide neutral ground fault current sensor for four wire loads.
  - .5 System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:
    - .1 Adjustable long time pick-up and delay
    - .2 Adjustable short time pick-up and delay, with selective curve shaping
    - .3 Adjustable instantaneous pick-up

- .4 Adjustable ground fault pick-up and delay, with selective curve shaping.
- .9 Where indicated, provide circuit breakers CSA listed for application at 100% of their continuous ampere rating in their intended enclosure.
- .10 Provide shunt trips, bell alarms, and auxiliary switches as shown on the contract drawings.

#### **2.05 BRANCH CIRCUIT PANELBOARDS**

- .1 The Minimum Integrated Short Circuit Rating for branch circuit panelboards shall be indicated on the drawings. Panelboards shall be similar and approved equal to Square D type NF or NQOD. Panelboards shall have circuit breakers as indicated below.
- .2 Bolt-in type, heavy-duty, quick-make, quick-break, single- and multi-pole circuit breakers of the types specified herein, shall be provided for each circuit with toggle handles that indicate when unit has tripped.
- .3 Circuit breakers shall be thermal magnetic type with common type handle for all multiple pole circuit breakers. Circuit breakers shall be minimum 100 ampere frame and through 100 ampere trip sizes shall take up the same pole spacing. Circuit breakers shall be CSA listed as type SWD for lighting circuits.
  - .1 Circuit breaker handle locks shall be provided for all circuits that supply exit signs, emergency lights, energy management and control system (EMCS) panels and fire alarm panels.

#### **2.06 ENCLOSURE**

- .1 Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the Canadian Electric Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
- .2 Enclosures shall be provided with one (1) blank end and one end with knock-outs.
- .3 All enclosures shall be EEMAC 1 – NEMA 3R c/w drip shield for surface-mounted enclosure unless otherwise noted.

#### **2.07 NAMEPLATES**

- .1 Provide an engraved nameplate for each panel section.

#### **2.08 FINISH**

- .1 Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of grey ANSI 49 paint applied.

**PART 3 - PART 3 – EXECUTION**

**3.01 FACTORY TESTING**

- .1 The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of EEMAC and CSA standards.

**3.02 INSTALLATION**

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

**3.03 FIELD SETTINGS**

- .1 The Electrical Trade Contractor shall perform field adjustments of the circuit breakers as required to place the equipment in final operation condition. The settings shall be in accordance with the approved protective device co-ordination study or as directed by the Consultant.

END OF SECTION 26 24 16

**PART 1 - GENERAL**

**1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Requirements and all documents referred to therein.

**1.02 WORK INCLUDED**

- .1 Provide all fuses for a complete installation, as required by the contract documents.

**1.03 SUBMITTALS**

- .1 Submit shop drawings of all fuses required.

**1.04 ACCEPTABLE MANUFACTURERS**

- .1 Ferraz Shawmut, Bussman and Little Fuse.

**PART 2 - PRODUCTS**

**2.01 FUSES**

- .1 For services up to 600 volts and up to and including 600 amps, provide HRCI-J (AJT) time delay fuses for motor and transformer circuits.
- .2 All remaining fuses up to 600 volts and up to and including 600 amps, shall be HRCI-J (CJ) fast acting fuses.
- .3 For services up to 600 volts and over 600 amps, provide class L-HRC (CL) fuses.

**PART 3 - EXECUTION**

**3.01 INSTALLATION OF FUSES**

- .1 Install fuses in all fuse holders to suit design requirements.
- .2 Provide three (3) spare fuses of each type and size used above 600 amp and six (6) spare fuses for each type and size up to and including 600 amps. Mount the spare fuses in clips neatly arranged and labelled in a suitably sized type "D" cabinet in the main electrical room.

END OF SECTION 26 28 13

**PART 1 - GENERAL**

**1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Provision, and all documents referred to therein.

**1.02 WORK INCLUDED**

- .1 Provide enclosed switches, fused and/or unfused, for a complete installation, as required by the contract documents.

**1.03 SUBMITTALS**

- .1 Submit shop drawings of enclosed switches.

**1.04 ACCEPTABLE MANUFACTURERS**

- .1 Schneider Canada, Cutler Hammer, ABB, and Siemens.

**PART 2 - PRODUCTS**

**2.01 ENCLOSED SWITCHES (DISCONNECTS)**

- .1 Provide heavy duty, CSA approved enclosed switches.
- .2 Each enclosed switch shall be front operated with a handle suitable for padlocking in the "OFF" position and arranged so that the enclosure cover cannot be opened while the handle is in the "ON" position. Operating mechanisms shall be quick-make, quick-break, positive acting with visible blades and a line terminal shield.
- .3 Fusible units shall be complete with fuse clips suitable for HRC, Class "J" fuses unless otherwise noted. Each unit shall also be equipped with solderless lugs and a front cover nameplate identifying the catalogue number and electrical characteristics.
- .4 Enclosures shall be, unless otherwise noted, NEMA 1 general purpose enclosures and NEMA 3 weatherproof enclosures. Provide NEMA 4X around the cooling towers.
- .5 The ampere rating, number of poles and fuse requirements for enclosed switches shall be as specified on the documents.
- .6 Where the enclosed switch is for use on a hydraulic elevator application, such switches shall be provided with auxiliary contacts. These contacts shall be Commander positive action switches or equivalent.

- .7 Where the enclosed switch is for use on a variable frequency drive application, such switches shall be heavy duty type complete with auxiliary contacts, to wire remote stop to variable frequency drive.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION OF ENCLOSED SWITCHES (DISCONNECTS)**

- .1 Provide disconnects:
  - .1 Wherever shown on the drawings and/or specified herein.
  - .2 Wherever required by starter schedule drawings:
  - .3 For motorized equipment which cannot be seen from the motor starter location or is more than 10m away from the starter location.
  - .4 For all "packaged" equipment supplied by other Divisions and fed from a motor starter panel.
- .2 Enclosures mounted indoors and not exposed to the weather shall be NEMA 1 type.
- .3 Enclosures mounted outdoors or in locations exposed to the weather shall be NEMA 3 type.
- .4 Where the enclosed switch is for use on a variable frequency drive application, wire the normally closed contact on the switch to the stop circuit on the variable frequency drive.

END OF SECTION 26 28 23



**PART 1 – GENERAL**

**1.01 WORK INCLUDED**

- .1 Comply with the Bidding Instructions and all documents referred to therein.
- .2 Comply with requirements of Section 26 05 00 Common Work Results Electrical and Section 26 05 34 Conduit Fastenings Fittings.
- .3 Supply all labour, tools, services and equipment and provide all the materials required to complete this section of the work.
- .4 Refer to Appendices for Scope of Work.

**1.02 REFERENCES**

- .1 American National Standards Institute (ANSI)
  - .1 ANSI C82.1-2004, Electric Lamp Ballasts-Line Frequency Fluorescent Lamp Ballast
- .2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
  - .1 ANSI/IEEE C62.41-1991, IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
    - .1 Illuminating Engineering Society of North America (IESNA)
- .3 IESNA LM-79-08.
- .4 LM-80-08 (or latest) - IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.
- .5 TM-21-11 (or latest) - IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.
- .6 RoHS - Restriction of Hazardous Substances
- .7 NEMA SSL 1-2010 (or latest) - Electronic Drivers for LED Devices, Arrays, or Systems.
- .8 ANSI/NFPA 70 National Electrical Code
- .9 ANSI/IES RP 6 Recommended Practice for Sports Lighting
- .10 Tempo-24 – Comprehensive suite of Thermal, Electrical, Mechanical, Photometric and Optical tests (TEMPO) for LED luminaires
- .11 All LED Luminaires shall be Design Lights Consortium® (DLC) listed (DesignLights.org)
- .12 All components shall be CSA and/or ULC approved/listed and labelled
- .13 All fixtures cables shall comply with CSA standard- C22.2 #127-1981
- .14 Tempo-24 – Comprehensive suite of Thermal, Electrical, Mechanical, Photometric and Optical tests (TEMPO) for LED luminaires

**1.03 SUBMITTALS**

- .1 Submit shop drawings for the following:
  - .1 New LED Fixtures and Luminaires
  - .2 LED Lamps
  - .3 LED Tubes and Linear Fluorescent Ballasts
  - .4 LED Retrofit Kits
  - .5 Drivers
- .2 Shop drawings shall indicate:
  - .1 Housing construction, driver type, LED type, lumen output, wattage, CCT, CRI, rating/life expectancy, reflector type, lens type and photo metrics.
    - .1 Power factor and THD at full load
    - .2 Transient Analysis
    - .3 Driver and Optical efficiency
    - .4 Chromaticity/Spectral distribution
    - .5 Visible flicker analysis
    - .6 Polar candela distribution
    - .7 Cut off classification
    - .8 Zonal lumen Analysis
    - .9 VF/Current balance
    - .10 Chemical compatibility analysis
- .3 The new and/or retrofit light levels shall meet existing light levels in all areas. Maintain Records of existing light levels prior to retrofit, provide instrumentation calibration records. Readings are to be taken where the task occurs (on working surfaces). For example, readings to be taken at desk height for offices and workshops and then at floor level for corridors and gymnasiums. Readings to be taken between fixtures either after hours or ensuring that natural daylight does not adversely affect the readings.
- .4 State the light levels in the numeric values obtained during the initial hours (after 100 hours of burn in time) of the operation of the lighting system.
- .5 Wiring requirements, including required conductors, cables and wiring methods.

#### 1.04 DEFINITIONS

- .1 Driver - the power supply used to power LED fixtures, modules, or arrays.
- .2 L70, or L70% - The reported life of an LED component or system to reach 70% lumen maintenance, or 70% of the LED's original light output. This test is being developed by the IES and is currently described by TM-21-11.
- .3 LED's - Broadly defined as complete light fixture with light emitting diode (LED) packages, modules, light bars or arrays, complete with optical assembly and driver
- .4 LED luminaire failure - Negligible light output of more than 10 percent of the LED's initial light output value constitutes luminaire failure.

#### 1.05 QUALITY ASSURANCE

- .1 All components shall be CSA and/or ULC approved/listed and labelled.

- .2 Manufacturer's Warranty: Refer to section 01 99 00 for warranties and extended warranties
- .3 Replace and install at no cost to the project any led driver or led lamp array, which fails during the warranty period.

#### 1.06 SAFETY

- .1 Under NO circumstances shall work occur on energized circuits.

### PART 2 – PRODUCTS

#### 2.01 LUMINAIRES

- .1 Provide luminaires as indicated on the luminaire schedule and/or as specified under this section. These shall be complete with all necessary hangers, supports, brackets, and required hardware for a complete and finished installation, luminaires in schedule and legend are intended to set a standard below which equipment will not be accepted
- .2 All luminaires shall be complete with luminance disconnects.
- .3 Luminaire shall be certified by a Nationally Recognized Testing Laboratory (UL, ETL, or IEC).
- .4 Trade Contractor as part of the Bid Submission to submit detailing manufacturer catalogue numbers etc. of fixtures proposed for this project.
- .5 All new fixtures to have a means of disconnect at each fixture.

#### 2.02 LED LUMINAIRES

- .1 All LED Luminaires shall be Design Lights Consortium® (DLC) listed (DesignLights.org) or meet all DLC Product Qualification Criteria with independent third party testing and verification for each data point. The technical data points the luminaire shall meet for each Application Category are:
  - .1 Minimum Light Output
    - .1 Zonal Lumen Requirements
    - .2 Minimum Luminaire Efficacy
    - .3 Minimum CRI of 80.
    - .4 L70 Lumen Maintenance
    - .5 Minimum Efficacy of 90 lumens/watt
  - .2 Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.
    - .1 Additional Requirements:
    - .2 Luminaire shall be mercury-free, lead-free, and RoHS compliant.
  - .3 Luminaire shall maintain 70% lumen output (L70) for a minimum of 70,000 hours. L70 calculations shall be performed using the IES TM-21-11 calculation methodology.
  - .4 Driver shall have a minimum rated life of 100,000 hours at 25°C.
  - .5 Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility and warranty compliance.
  - .6 LED luminaire shall have an operating temperature range of -20°C to +55°C. Fixtures must be thermally designed as to not exceed the maximum allowable junction temperature of the LED for the ambient temperature of the location the fixture is to be installed.

- .7 LED driver shall have a minimum power factor (pf) of 0.92 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
- .8 Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
- .9 Luminaire shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
- .10 Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
- .11 All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
- .12 Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
- .13 All luminaires shall be provided with knockouts for conduit and/or cord connections.
- .14 The LED lighting fixture shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).
- .15 The LED heat sink must be constructed of 6063 extruded aluminum for maximum thermal management and resistance to corrosion

## **2.03 BALLASTS**

- .1 All fixtures shall be provided with ballasts suitable for the fixture type and application. All ballasts shall comply with CSA standard C22.2 No. 74. Ballasts shall be suitable for use with LED Tubes on 120 volt or 347 volt application as required. The Trade Contractor shall be responsible to ensure that suitable ballasts for the intended retrofit are ordered to site.
- .2 All ballasts must have a local means of disconnect such as the Sta-Kon Luminaire Disconnect by Thomas & Betts; Ideal Luminaire disconnect or Wago luminaire disconnect connector (yellow).
  - .1 Premium Linear Electronic Fluorescent Ballasts
    - .1 Frequency of operation shall be 42 kHz or greater. The ballast shall operate without visible flicker
    - .2 Ballasts shall have an A sound rating.
    - .3 Ballasts shall be CSA approved and ULC listed.
    - .4 Ballasts shall comply with NEMA limits governing electromagnetic and radio frequency interference and shall not interfere with operation of other normal electrical equipment.
    - .5 Ballasts shall meet ANSI Spec C62.41 and IEEE standards regarding all applicable transient protection.
    - .6 Total harmonic distortion will be less than 10%.
    - .7 Minimum ballast factor will be 0.88 for normal light output ballasts. Minimum ballast factor will be 0.78 for reduced light output ballasts. Minimum ballast factor will be 1.20 for high light output ballasts.
    - .8 Lamp current crest factor shall average 1.4 and shall not exceed 1.7.
    - .9 Ballasts shall have a power factor of 98% or above.
    - .10 Ballasts shall be instant start type unless otherwise specified.

## **2.04 LED T8 LAMPS**

- .1 T8 LED lamps shall be 10-15W with a minimum CRI of 83 and colour temperature of 4000K, average life to be 70,000 hours when used with an instant start ballast and an activation time of three hours. Initial lumen output no less than 1,900 lumens. Lamps from the following manufacturers are

acceptable:

- .1 LEDVance
- .2 Philips
- .3 GE

## **2.05 LED LAMPS**

- .1 LED lamps shall contain integrated drivers.
- .2 All LED lamps must be Energy Star Rated.

## **PART 3 – EXECUTION**

### **3.01 DESCRIPTION OF WORK**

#### **.1 Installation**

- .1 All materials required for the intended retrofit will be provided and installed by the Trade Contractor.
- .2 The Trade Contractor will be responsible for co-ordinating the delivery of materials to site, unloading the materials at site, and arranging for storage and insurance of such materials upon arrival. It is the responsibility of the Trade Contractor to ensure that all required materials for performing the intended retrofit are delivered to site such that work can be completed expeditiously, and according to the schedule provided by the Trade Contractor.
  - .1 The Trade Contractor shall warranty the retrofit of materials as specified in Section 01 99 00.
  - .2 Verify ceiling types of existing ceilings, identify optical obstructions, inspect luminaire mounting surfaces and verify specified fixtures are compatible prior to ordering fixtures.
  - .3 If existing fixtures are on dimmers, Trade Contractor to ensure existing dimmers will be compatible with new fixtures. If new dimmers are proposed by Consultant, Trade Contractor to ensure compatibility.
  - .4 Install in accordance with manufacturer's instructions.
  - .5 Install suspended luminaires using existing pendants/brackets where possible. All pendant/bracket supported luminaires shall have an independent safety support chain or cable appropriately rated for the connected load. Chain or cable shall be solidly connected to the structure at all pendant/bracket support locations.
  - .6 The Contractor shall install fixture supports as required. Fixture installations with fixtures supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all lighting fixtures adequately, providing extra steel work for the support of fixtures if required. Any components necessary for mounting fixtures shall be provided by the Contractor. No plastic, composition or wood type anchors or supports shall be used.
  - .7 Install all accessories furnished with each luminaire according to manufacturer's installation instructions.
  - .8 Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
  - .9 Bond fixtures and metal accessories to branch circuit equipment grounding conductor.
  - .10 Dimmed fixture circuits shall have separate neutrals.
  - .11 Dimmed LED fixtures shall have a positive OFF, which requires turning off the circuit to the fixture so that the fixtures don't "glow" at the lowest dimmed setting.

**.3 General Lighting Retrofit**

- .1 The retrofit of lighting fixtures will vary with each room and fixture type.**
  - .1** Generally the work will comprise the removal of fluorescent lamps and the removal of the ballasts within the light fixtures. Replace the ballasts with new electronic ballasts and interconnect the wiring in the light fixture. Clean the interior surfaces of fixture and diffusers/lens as detailed in the specifications. Provide new lamps to the fixture and leave in working order.
  - .2** The primary intended retrofit includes the use of a four lamp ballast inter-wired between fixtures when fixtures are located end to end. The Trade Contractor shall endeavour to perform this retrofit where otherwise possible thus maximising the number of four lamp ballasts, minimizing the total number of ballasts used on the job, and minimizing energy consumption of lighting systems. In circumstances where a four-lamp ballast cannot be used, the Trade Contractor will endeavour to use a three lamp ballast, a two lamp ballast and then a single lamp ballast, in this order.
  - .3** When ballasts are used to regulate lamps in multiple fixtures, fixtures shall be marked as described in Section 3.3.1.4.
  - .4** In circumstances where the proposed retrofit cannot be performed exactly as specified, the Trade Contractor shall immediately make this known to the Consultant
  - .5** Contractor to verify the compatibility of existing dimmer to ensure the new lamp or luminaire will be in working condition upon completion of lamp or luminaire installation. Verification shall be completed during Trade Contractor re-audit assessment.

**3.02 SCOPE AND GENERAL GUIDE TO THE WORK**

- .1 This following description is intended to be a general guide of the work that comprises each retrofit. The exact retrofit must be compatible with each specific fixture type. Perform the Pre Construction Audit as outlined in Section 01 32 00.**
  - .1 Work Included for Retrofit of Fluorescent Fixtures:**
    - .1** Remove the lens and cover plate exposing the ballast interior of the fixture. Remove the existing ballast and check if the ballast is suspect to containing PCBs.
    - .2** If PCBs are present treat materials in accordance with the guidelines of Section 26 05 00..
    - .3** Clean the interior surfaces of fixtures using a damp cloth, and clean the diffuser/lens to remove dust and residue.
    - .4** Replace cover and lens.
    - .5** Provide LED tubes as detailed in each retrofit fixture description.
    - .6** Test the fixture to ensure proper working order.
  - .2 Work Included for Installation of New Interior LED Fixtures:**
    - .1** New LED fixtures will be installed in certain areas to improve appearance, maintenance, and light levels.
    - .2** Removal of existing fixtures shall be performed such as to minimise impact on existing space.
    - .3** Repair, patch, and repaint surfaces exposed by the removal of fixtures, associated wiring, junction boxes. Where new fixtures are to be installed, adjust opening as required. Paints and finishes to match existing space.
    - .4** Provide or modify existing wiring and fixture mounting equipment to accommodate intended installation.

- .5 Provide and install new fixtures c/w lamps, ballasts, reflectors, lenses, wire guards etc. according to specifications of Part 2 of this Section.
- .6 Provide power to fixtures. Reuse existing lighting circuits where possible. Provide lighting control to permit optimum switching capability as per instructions from Consultant.
- .7 Clean the fixture and lens as required to remove dirt and dust acquired during installation.
- .8 Test the fixture to ensure proper working order.
- .3 Work Included for Installation of New Exterior LED Fixtures:
  - .1 New exterior LED fixtures will be installed in certain areas to improve appearance, maintenance, and light levels.
  - .2 Decommission and remove existing fixtures
  - .3 Where fixtures are mounted on a pole, existing pole shall be utilized.
  - .4 Removal of existing fixtures shall be performed such as to minimise impact on existing space.
  - .5 Repair, patch, and repaint surfaces exposed by the removal of fixtures, associated wiring, junction boxes. Where new fixtures are to be installed, adjust opening as required. Paints and finishes to match existing space.
  - .6 Provide or modify existing wiring and fixture mounting equipment to accommodate intended installation.
  - .7 Provide and install new fixtures c/w lamps, ballasts, reflectors, lenses, wire guards etc. according to specifications of Part 2 of this Section.
  - .8 Provide power to fixtures. Reuse existing lighting circuits where possible. Provide lighting control to permit optimum switching capability as per instructions from Consultant.
  - .9 Clean the fixture and lens as required to remove dirt and dust acquired during installation.
  - .10 Test the fixture to ensure proper working order.

END OF SECTION 26 50 00

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## **PART 1 - GENERAL**

### **1.01 REFERENCES**

- .1 Comply with Section 26 05 00, Electrical General Requirements and all documents referred to therein.

### **1.02 WORK INCLUDED**

- .1 Provide sensors including multi-technology, ultrasonic, and passive infrared (PIR) technologies. This includes self-contained PIR sensors that are switch-mounted and ceiling-mounted, as well as a low voltage line, which works with a power pack and add-a-relay units as specified herein.

### **1.03 SYSTEM DESCRIPTION**

- .1 Performance Requirements: Provide occupancy sensor lighting controls and power packs that have been manufactured, assembled and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.
- .2 Performance Testing Requirements - Manufacturer shall 100% test all equipment prior to shipment. Sample testing is not acceptable.
- .3 Code Requirements
  - .1 All occupancy sensor lighting controls and power packs shall be UL listed and either CSA or CUL/US listed.
  - .2 All sensors shall be FCC compliant where applicable.
  - .3 Building Codes: All units shall comply with applicable, local building codes.

### **1.04 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 25 05 01.
- .2 Submit product data, including catalog cut sheets for specified products.
- .3 Submit drawings detailing all mechanical and electrical equipment including one-line diagrams, wire counts, coverage patterns and physical dimensions of each item.
- .4 List of ballasts and lamp combinations compatible with occupancy sensors, by manufacturer and catalog number.
- .5 Submit samples for finish, color and texture.
- .6 Maintenance Instructions: To remove dust and grime, wipe down units with damp cloth and mild detergent solution. Do not touch the surface of the lens.

### **1.05 QUALITY ASSURANCE**

- .1 Source Limitations: To assure compatibility, obtain occupancy sensors from a single source with complete responsibility over all lighting controls, including accessory products. The use of subcontracted component assemblers is not acceptable.

- .2 Manufacturer Requirements: The manufacturer will be one who has been continuously engaged in the manufacture of commercial lighting controls and occupancy sensors for no less than ten (10) years.

#### 1.06 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in manufacturer's original, unopened, undamaged packages with intact identification labels.
- .2 Store materials away from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

#### 1.07 WARRANTY

- .1 All equipment shall be warranted free of defects in materials and workmanship.
  - .1 Warranty Period: Five (5) years from date of purchase.
  - .2 Owner Rights: Manufacturer's warranty is in addition to, not a limitation of other rights the Owner may have under contract documents.

#### 1.08 ACCEPTABLE MANUFACTURERS

- .1 Acceptable manufacturers are Leviton Manufacturing Inc. of Canada or approved equal.

### PART 2 - PRODUCTS

#### 2.01 SELF-CONTAINED UNITS

- .1 General to Wall Switches with Infrared: ODSXX-ID and OSSXX-ID
  - .1 Shall use passive infrared motion detection.
  - .2 Shall be compatible with incandescent, magnetic or electronic low voltage, and magnetic or electronic fluorescent, as well as motor loads.
  - .3 Switch shall be microprocessor controlled.
  - .4 Shall be capable of detecting occupancy with true, 180° field of view.
  - .5 Shall utilize zero crossing circuitry, which increases relay life, protects from the effects of inrush current, and increases sensor longevity.
  - .6 Wall switch shall have integral shutters that narrow the field of view from 180°.
  - .7 Shall feature pushbutton for manual on and off, which times out based upon occupancy detection.
  - .8 An LED shall indicate occupancy status.
  - .9 Manual range, photocell and time settings shall be user-configurable.
  - .10 Switch shall be rated at 120/277V in one unit.
  - .11 Unit shall fit in a standard box and use a standard wall plate, which is gangable.
  - .12 Wall switch shall not protrude more than .4 inches from box.
  - .13 Shall be a Decora style unit with a matching wall plate available.
  - .14 Wall switch must be available in white, ivory, almond and gray (or equivalent colors).
- .2 ODS15-ID
  - .1 Shall use microprocessor for motion signal analysis and internal, adaptive self-adjustment.
  - .2 No manual adjustment shall be required at the time of installation or during operation.

- .3 Shall automatically adapt to changing room conditions—with the ability to disable adaptive features.
  - .4 Shall save learned and adjusted settings in non-volatile memory that retains all settings during power outages.
  - .5 Shall recognize motion detected within 20 seconds of turning off lighting as a false off. In response to a false off, the microprocessor shall increase the time-off setting.
  - .6 Maximum adapted time-out shall not exceed 30 minutes.
  - .7 Walk through feature shall shut off lights within 2.5 minutes after momentary occupancy.
  - .8 Shall beep before load is automatically switched off.
  - .9 Shall have a 3-position service switch: off, auto, and on.
  - .10 Four, selectable manual timer settings shall be available from 30sec to 20min.
  - .11 Rating: 1800W/VA @ 120V, 4000VA @ 277V, and ¼HP @ 120VAC.
- .3 ODS10-ID
- .1 Sensor shall have four, selectable manual timer settings from 30sec to 30min.
  - .2 Rating: 800W @ 120V, 1200VA @120V, 2700VA @ 277V and ¼HP @ 120VAC
- .4 ODS0D-ID and ODS0D-T
- .1 Shall provide switching for 2 separate banks from a single unit.
  - .2 Shall use microprocessor for motion signal analysis and internal, adaptive self-adjustment.
  - .3 Shall save learned and adjusted settings in non-volatile memory that retains all settings during power outages.
  - .4 No manual adjustment shall be required at the time of installation or during operation.
  - .5 Shall automatically adapt to changing room conditions—with the ability to disable adaptive features.
  - .6 Maximum adapted time-out shall not exceed 30 minutes.
  - .7 Walk through feature shall shut off lights within 2.5 minutes after momentary occupancy.
  - .8 Shall offer two modes of operation:
    - .1 Only one relay responds to photocell.
    - .2 Both relays respond to photocell and lights return to the previous state on the next cycle. (not available on ODS0D-T)
  - .9 Shall beep before load is automatically switched off.
  - .10 Shall have a 3-position service switch: off, auto and on. (not available on ODS0D-T)
  - .11 Four, selectable manual timer settings shall be available from 30sec to 20min.
  - .12 ODS0D-T secondary relay shall be manual-on/automatic-off.
  - .13 Ratings: Primary Relay - 800W @ 120V, 1200VA @120V, 2700VA @ 277V @ 120VAC; Secondary Relay - 800W @ 120V, 800VA @120V, 1200VA @ 277V.
- .5 General to wall switches with multi-technology OSSMx-Xd
- .1 Shall incorporate Doppler shift ultrasonic and passive infrared motion detection technologies.
  - .2 Shall use passive infrared to turn on and either technology to keep on.
  - .3 Shall be compatible with incandescent, magnetic or electronic low voltage, and magnetic or electronic fluorescent, as well as motor loads.
  - .4 Switch shall be microprocessor controlled.
  - .5 Shall be capable of detecting occupancy with true, 180° field of view.
  - .6 Shall utilize zero crossing circuitry, which increases relay life, protects from the effects of inrush current, and increases sensor longevity.
  - .7 Wall switch shall have integral shutters that narrow the field of view from 180°.

- .8 Shall feature pushbutton for manual on and off, which times out based upon occupancy detection.
  - .9 An LED shall indicate occupancy status.
  - .10 Manual range, ultrasonic sensitivity, photocell, and time settings shall be user-configurable.
  - .11 Switch shall be rated at 120/277V in one unit.
  - .12 Unit shall fit in a standard box and use a standard wall plate, which is gangable.
  - .13 Wall switch shall not protrude more than .4 inches from box.
  - .14 Shall be a Decora style unit with a matching wall plate available.
  - .15 Wall switch must be available in white, ivory, almond, and gray (or equivalent colors).
  - .16 Shall be available in 40 kHz ultrasonic frequencies.
  - .17 Shall have "vacancy confirmation" where if a false off occurs, the sensor shall wait for 45 seconds to determine if space is vacant or not. If occupancy is detected within the 45 second period, either ultrasonic or passive infrared technology can immediately turn the lights back on. If no occupancy is detected within the 45 second period, the sensor will turn off and reset to normal operation of passive infrared on only.
- .6 OSSMT-ID
- .1 Shall use microprocessor for motion signal analysis and internal, adaptive self-adjustment.
  - .2 No manual adjustment shall be required at the time of installation or during operation.
  - .3 Shall automatically adapt to changing room conditions—with the ability to disable adaptive features.
  - .4 Shall save learned and adjusted settings in non-volatile memory that retains all settings during power outages.
  - .5 Maximum adapted time-out shall not exceed 30 minutes.
  - .6 Walk through feature shall shut off lights within 2.5 minutes after momentary occupancy.
  - .7 Sensor shall have four, selectable manual timer settings from 30sec to 30min.
  - .8 Rating: 800W @ 120V, 1200VA @120V, 2700VA @ 277V, and ¼HP @ 120VAC

## **2.02 LOW VOLTAGE SENSORS AND ACCESSORIES**

### **.1 General to Low Voltage Sensors**

- .1 Shall use microprocessor for motion signal analysis and internal, adaptive self-adjustment.
- .2 No manual adjustment shall be required at the time of installation or during operation.
- .3 Shall automatically adapt to changing room conditions.
- .4 Shall identify, record and learn a room's normal occupancy cycles to automatically adjust the sensitivity threshold.
- .5 Shall save learned and adjusted settings in non-volatile memory that retains all settings during power outages.
- .6 Shall recognize motion detected within 20 seconds of turning off lighting, as a false off. In response to a false off, the microprocessor shall increase sensitivity, and increase the time-off setting.
- .7 Sensor shall recognize as a false on the failure. The sensor shall decrease the sensitivity in response to a false on.
- .8 Sensor shall feature a 6-second time-out install test mode, which will automatically revert to standard time-out no longer than one hour after test mode is initiated. Sensor shall have manual controls and override switches to force manual adjustments.
- .9 Shall provide a concealed bypass switch to force on lighting.
- .10 Sensitivity shall be adjustable from 0% to 100%.
- .11 Control knobs shall set the initial settings for automatic sensitivity adjustments.
- .12 Shall have a switch for restoring factory settings.
- .13 Timer shall be manually selectable between 30 sec. and 30 minutes.

- .14 Photocell shall be available. Photocell shall prevent lighting from coming on when the ambient light levels are above the set point.
- .15 Shall be equipped with tamper resistant cover.
- .16 All controls shall be accessible from front of unit.
- .17 Rugged, plastic housing shall be available white
- .18 Shall accept Class 2 wiring.
- .2 Low-Voltage Multi-Technology Ceiling-Mount: OSC05-MOW, OSC10-MOW, OSC20-MOW
  - .1 Shall incorporate Doppler shift ultrasonic and passive infrared motion detection technologies.
  - .2 Shall mount on the ceiling.
  - .3 Shall be available in 180° and 360° coverage patterns.
  - .4 Infrared lenses shall have a 360° field of view.
  - .5 Shall be available in 40 kHz ultrasonic frequencies.
  - .6 Shall automatically adapt to changing room conditions—including background PIR levels and continuous airflow.
  - .7 Sensor shall have two modes of operation:
    - .1 Multi-technology mode: Where the sensors send infrared signal to the microprocessor, which makes the decision to turn on lighting based on the level of the signal.
    - .2 Single technology mode: Where the user chooses technology that will turn on lighting.
  - .8 Shall incorporate a real-time motion indicator LED, which is visible from the front of unit.
  - .9 Shall have mask inserts for PIR rejection to prevent false tripping.
- .3 Low-Voltage Ultrasonic Ceiling-Mount: OSC05-UOW, OSC10-UOW, OSC20-UOW
  - .1 Shall utilize Doppler shift ultrasonic detection technology.
  - .2 Shall mount on the ceiling.
  - .3 Shall be available in 180° and 360° coverage patterns.
  - .4 Shall be available in 40 kHz ultrasonic frequencies.
  - .5 Shall automatically adapt to continuous airflow conditions.
  - .6 Shall incorporate a real-time motion indicator LED, which is visible from the front of unit.
  - .7 Operating status and setting confirmation shall be available via LED motion indicators.
- .4 Low-Voltage Infrared Ceiling-Mount: OSC04-I, OSC15-I
  - .1 Shall utilize passive infrared motion detection.
  - .2 Shall mount on the ceiling.
  - .3 Shall automatically adapt to changing background PIR levels.
  - .4 Shall incorporate a real-time motion indicator LED, which is visible from the front of unit.
  - .5 Infrared lenses shall have 360° field of view.
  - .6 Shall have mask inserts for PIR rejection to prevent false tripping.
- .5 Low-Voltage Infrared Ceiling-Mount: OSW12-MOW
  - .1 Shall incorporate Doppler shift ultrasonic and passive infrared motion detection technologies.
  - .2 Shall mount on ceiling or wall via supplied mounting bracket. Mounting bracket shall have a place to conceal the wiring connections.
  - .3 Shall automatically adapt to changing room conditions—including background PIR levels and continuous airflow.

- .4 Sensor shall have two modes of operation:
  - .1 Multi-technology mode: where the sensors send infrared and ultrasonic signals to the microprocessor, which makes the decision to turn on lighting based on the level of each signal.
  - .2 Single tech mode: where the user chooses technology which will turn on lighting.
- .5 Shall incorporate a real-time motion indicator LED, which is visible from the front of unit.
- .6 Shall have at least a 110° coverage pattern.
- .7 Shall utilize 40 kHz ultrasonic frequency.
- .6 Low-Voltage Infrared Wall/Corner Sensors: OSWWV-IOW, OSWLR-IOW
  - .1 Shall utilize passive infrared motion detection.
  - .2 Shall be available in wide view, long range and high bay infrared lenses.
  - .3 Shall mount on ceiling or wall via supplied mounting bracket. Mounting bracket shall have a place to conceal the wiring connections and provide knock-out for surface wire raceway.
  - .4 Shall automatically adapt to changing background PIR levels.
  - .5 Shall incorporate a real-time motion indicator LED, which is visible from the front of unit.
- .7 Power Pack: OSP20-ODO, OSP20-RDO, OSP15-R30
  - .1 Shall be compatible with incandescent, magnetic or electronic low voltage and magnetic or electronic fluorescent, as well as motor loads.
  - .2 Ratings: OSP20-ODO – 20A incandescent, 20A fluorescent; OSP20-RDO – 20A fluorescent @ 50Hz or 60Hz; OSP20-070 – 20A fluorescent; and ODP15-030/OPB15-0DW – 15A fluorescent. Shall utilize normally open, silver alloy dry contacts rated for a 20A-ballast load at 120V, 230V, 277V, and 15A at 347V.
  - .3 Relay function shall not require more than 5-ma control current to operate.
  - .4 Power Pack shall allow for separation of Class 1 and Class 2 wiring.
  - .5 Power Pack Mounting Specifications (OSPXX-XXX)
    - .1 Shall fit inside the ballast cavity of a fluorescent fixture and shall be qualified for installation in a ballast cavity.
    - .2 Shall be sized to fit inside a standard, 4" x 4" junction box.
    - .3 Shall be mountable to a ½ in. knock-out within a ballast cavity on the line voltage end, such that it may be mounted to the outside of a junction box with the line voltage wiring internal to the box and the low voltage wiring external.
    - .4 Shall be mountable to a ½ in. knock-out within a ballast cavity on the low voltage end, such that it may be mounted to the inside of a ballast cavity with the box and line voltage wiring internal to the cavity and the low voltage wiring external.
  - .6 Power Pack Mounting Specifications (OP15-0DW) - Shall fit inside a 4" x 2.125" deep octagon or a 4" x 2.125" deep square with mud ring electrical junction box.
  - .7 Models OSP20-RDO– The 1st R after dash indicates HVAC Relay included in power pack.
  - .8 HVAC Relay – SPDT 500ma@24VDC three-wire isolated. Ratings: .5A, 125VAC; 1A, 30VDC
- .8 Add-A-Relay: OSA-R00
  - .1 Relay shall be compatible with incandescent, magnetic or electronic low voltage, and magnetic or electronic fluorescent, as well as motor loads.
  - .2 Control module shall interface with and control two- and three-wire relays from GE, Reliant and Douglas.
  - .3 Add-A-Relay shall accept 24VAC full-wave or half-wave rectified power.
  - .4 Control module Output:
    - .1 Output for relay control shall be dry contact closure, not solid state switching.

- .2 Shall be an "ON" dry contact closure of at least 150ms when blue wire transitions from low to high.
- .3 Shall be an "OFF" dry contract closure of at least 150ms when blue wire transitions from high to low.
- .5 Add-A-Relay Mounting Specifications
  - .1 Shall fit inside the ballast cavity of a fluorescent fixture and shall be qualified for installation in a ballast cavity.
  - .2 Shall be sized to fit inside a standard, 4" x 4" junction box.
  - .3 Shall be mountable to a ½ in. knock-out within a ballast cavity on the line voltage end, such that it may be mounted to the outside of a junction box with the line voltage wiring internal to the box and the low voltage wiring external.
  - .4 Shall be mountable to a ½ in. knock-out within a ballast cavity on the low voltage end, such that it may be mounted to the inside of a ballast cavity with the box and line voltage wiring internal to the cavity and the low voltage wiring external.
- .6 Models OSPXX-RXX – The 1st R after dash indicates HVAC Relay included in power pack.
- .7 HVAC Relay – SPDT 500ma@24VDC three-wire isolated. Ratings: .5A, 125VAC; 1A, 30VDC
- .9 Expanded 12-Pole Lighting Contactor Box, 120-600Vm 60Hz, 3 x 4PST Outdoor Enclosure
  - .1 Intermatic Model # ETCB284512PCR or approved equal.
  - .2 The ETCB284512PCR Expanded 12-Pole lighting Contractor Box provides an easy-to-install solution for a variety of application needs. The Contractor Box comes with a pre-installed Astronomic timer with 7-day, holiday/exception period scheduling, USB for Schedule transfer and Backup, (3) electrically held 40 A contactors, as well as inputs for overrides and surge protective device
  - .3 7-Day/365 Day Astronomic Scheduling.
  - .4 Up to 96 Scheduling set points.
  - .5 Up to 50 Holiday/Exception Period set points.
  - .6 USB port for backing up or transferring schedules.
  - .7 Built-in (3)40 A 4-Pole contactor for more robust loads.
  - .8 Input for optional "Timed" photo control override.
  - .9 Input for other types of switches/sensors.
  - .10 Terminals for adding Surge Protection.
  - .11 100-hour supercapacitor eliminates the need for battery replacement.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- .1 Verify that wiring conditions, which have been previously installed under other sections or at a previous time are acceptable for product installation in accordance with manufacturer's instructions.
- .2 Inspect all material included in this contract prior to installation. Manufacturer shall be notified of unacceptable material prior to installation.

### **3.02 INSTALLATION**

- .1 Coordinate, receive, mount, connect and place into operation all equipment.

- .2 Provide all conduit, wire, connectors, hardware and other incidental items necessary for properly functioning lighting control and occupancy sensors as described herein and shown on the plans. Maintain performance criteria stated by manufacturer without defects, damage, or failure.
- .3 Comply with manufacturer's product data, including shop drawings, technical bulletins, product catalog installation instructions and product carton instructions for installation.
- .4 Test that all branch load circuits are operational before connecting loads to sensor system load terminals and then de-energize all circuits before installation.

### **3.03 TESTING**

- .1 Upon completion of all line, load and interconnection wiring, and after all fixtures are installed and lamped, a qualified factory representative shall completely check the installation prior to energizing the system. Each installed occupancy sensor shall be tested in the test mode to see that lights turn off and on based on occupancy.
- .2 At the time of check-out and testing, the Owner's representative shall be thoroughly instructed in the proper operation of the system.

### **3.04 PROTECTION**

- .1 Contractor shall protect installed product and finished surfaces from damage during all phases of installation including preparation, testing and clean-up.

END OF SECTION 26 50 10